Please note that this version contains corrections to pages 214, 218, 219 and 303 which do not figure on the paper version.

WORLD TRADE ORGANIZATION

WORLD TRADE REPORT 2005

Exploring the links between trade, standards and the WTO

FOREWORD

The World Trade Report 2005 follows the pattern established in previous years and takes up a number of key trade policy issues facing the international trading system for analysis and discussion. The underlying objective of the Report is to contribute to a deeper understanding of trade policy issues facing governments. The core topic in this year's report is standards and international trade. Shorter essays have been prepared on three other topics – the use of quantitative economic analysis in WTO dispute settlement, international trade in air transport services, and offshoring services.

First, however, the Report examines recent trends in international trade. The year 2004 saw impressive growth in trade, against a background of strong output growth. At 9 per cent in real terms export growth was twice as fast in 2004 as in 2003, and the third highest over the last decade. All regions shared in this expansion to a degree, but 2004 was a particularly good year for some commodity-exporting developing countries, including Africa. Other regions that enjoyed strong trade performance were South and Central America, Asia and the Commonwealth of Independent States.

Prospects for trade growth in 2005 are not as promising as in 2004, but at a predicted real rate of 6.5 per cent, trade would still expand faster than the average rate since 1994. Downside risks in the world economy include the dampening effect on economic activity of high oil prices, as well as persistent sluggishness in some economies, and interest rate and exchange rate volatility arising from imbalances in others. I urge governments to address these challenges in a timely and decisive fashion.

Last year was a good year for the WTO. After the disappointing Fifth Ministerial Conference in Cancún in September 2003, Members worked hard in the first half of 2004 to put the Doha negotiations back on track. This they succeeded in doing with the "July package", which embodied a set of clear mandates for bringing the negotiations to successful completion. But much work remains to be done. The present Report is being launched on the eve of a significant milepost in the negotiating process. By the time of the August break in Geneva, we need to see the shape of a set of clear results emerging from the Sixth Ministerial Conference in Hong Kong, China that will set the scene for completing the Doha negotiations in 2006. This is a shared responsibility of the entire WTO membership, requiring constructive engagement and a willingness to act in the collective interest despite sometimes difficult trade-offs.

An interesting debate has taken place over the years about the relationship, at different points in time, between the health of the world economy and progress in building a stronger international trading system. Some have argued, perhaps with certain justification, that governments need to be faced with bad economic news and the threat of worse to come before they can muster the political momentum for difficult decisions on trade – decisions whose benefits may not always be immediate. If bad times are needed for good decisions and good times induce complacency, we surely miss valuable opportunities to make real progress in strengthening the world economy and addressing the core challenges of our time – development and poverty alleviation. Let us not permit today's good economic news to blind us to the pressing need for action to bolster and advance international cooperation in matters of trade policy. Let us mark ten years of the existence of the WTO with decisive action that will set the scene for real progress in the year ahead.

Turning to the specific topics covered in WTR 2005, a stable and mutually supportive relationship between standards regimes and international trade rules is central to the effective functioning of the trading system. The Report thoroughly explores this relationship and seeks to extend our understanding of the issues involved. At its core, the policy challenge is to shape and maintain arrangements that allow governments to pursue multiple objectives in a consistent and effective manner. Standards are essential for addressing market failures such as imperfect information and negative externalities such as environmental degradation. They are also important in facilitating well-functioning markets where technical compatibility (network externalities) is important. But the design and operation of standards must also be such as to avoid the misappropriation or capture of public policy in these areas to construct unwarranted obstacles to competition and trade.

The underlying issues can be complex. Among the questions to be considered are whether standards should be harmonized, whether they should be voluntary or mandatory, how far standard-setting should be a public or a private activity, whether production processes as well as product standards should be the subject of international obligations, and who should be responsible for ensuring that producers and suppliers conform with established standards. Many of these questions do not have straightforward answers. Trade-offs must be made and desirable outcomes are often sensitive to the specificity of circumstances. Not all governments share the same public policy preferences or priorities.

A particular challenge for the WTO is to ensure that everything possible is done to enable developing countries to participate effectively in the trading system. This is as important in the field of standards as anywhere else. Among the challenges here are those which ensure that developing countries possess the requisite infrastructure to meet standards and to shape their own standards regimes, that they are not disadvantaged in the area of conformity assessment and that they can participate effectively in international standard-setting activities. A good deal is being done in these areas, but many developing countries still face formidable challenges.

The first of the three shorter essays, on the use of quantitative economic analysis in WTO dispute settlement, deals with a fascinating issue of increasing importance in the trading system. Broadly, we have seen growing interest in using quantitative analysis to address questions about the trade effects of policy measures and the effects of imports on the markets of domestic products and producers. Resort to arbitration has continued to grow and arbitrators have found it useful to supplement their reasoning and final decisions with quantitative analysis. And parties to a number of disputes have done the same in recent years. This essay explores these various episodes, after taking the reader through a careful explanation of the technical aspects of quantification.

The paper is at pains to point out two important aspects of the use of quantitative analysis in disputes. One is that the techniques used can only produce estimates and not unique, authoritative numbers. The second is that quantification cannot settle disputes, but only assist in their resolution. This is because numbers do not decide points of law – that is the role of legal reasoning. So quantitative analysis is not a panacea, but rather an aid that can become increasingly useful in disputes where complex factual information is of the essence.

The second essay deals with a vital and complex industry – air transport services. Like other network service industries, air transport is both a traded product and a vital producer service for trade in other products. Whether traders enjoy efficient, reliable and well priced air transport services is an important determinant of competitiveness in a whole range of economic activities.

Given the importance of this industry to the economy as a whole, it is gratifying to see the progress made in recent years in improving the quality and reducing the price of air transport services. This has been achieved through a combination of technical advances and deregulation and liberalization, giving rise to more intense competition among suppliers. The air transport industry nevertheless remains a complex one where profitability is a constant challenge and where adequate access will continue to be an issue for smaller and more remote developing countries. Attempts to apply a multilateral approach to rule-making and liberalization have not been successful, and the question remains whether more could be offered at the multilateral level to supplement what has been achieved bilaterally and regionally in recent years.

The third and final essay in this Report deals with offshoring services, an issue that has been the subject of considerable public debate recently. The essay explores the concept of offshoring as a sub-category of outsourcing, considers the economic rationale for this kind of trade, and attempts to estimate its magnitude. This paper provides us with a timely reminder that there is nothing special about offshoring in terms of a trading activity. It is simply one more example of how countries can benefit from specialization. The benefits are shared by both exporting and importing countries, as the paper explains in some detail.

An important finding is that the extent of the effect of offshoring on aggregate employment, output and trade is far more modest than the public debate and recent press coverage of the issue would have us believe. This means that public perceptions of adjustment challenges associated with offshoring have been exaggerated, but it also means we cannot claim as much in terms of gains from trade. The General Agreement on Trade in Services (GATS) offers potential for mutually beneficial liberalization commitments, although certain clarifications and improvements in the Agreement could make the GATS more attractive still as an instrument of liberalization. But we must not fall for the fallacy that we should make a special case of offshoring. Progress in opening this market is no more or less valuable than that which can be achieved in any other market. A broad-based and ambitious approach to the realization of new trading opportunities is the challenge and the promise of the Doha negotiations.

Supachai Panitchpakdi

Director-General

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SUMMARY OF CONTENTS

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II TRADE, STANDARDS AND THE WTO

ABBREVIATIONS AND SYMBOLS

3G	Third Generation
AACC	American Association of Cereal Chemists
AB	Appellate Body
ACIL	American Council of Independent Laboratories
ACP	African, Caribbean and Pacific Group of States
AECMA-STAN	European Association of Aerospace Industries
AEQ	European Association of Manufacturers of Quality Metal Expansion Joints, Metal Bellow and Metal Hoses
AFNOR	Association Française de Normalisation
ALOP	Appropriate Level of Protection
AMPS	Advanced Mobile Phone Service
APEC	Asia Pacific Economic Co-operation
APLAC	Asia Pacific Laboratory Accreditation Co-operation
ARSO	African Regional Organization for Standardization
ASEAN	Association of South East Asian Nations
ATP	Airline Tariff Publishing Company
BIPM	Bureau International des Poids et Mesures
BIS	Bureau of Indian Standards
BOP	Balance of payment
BP	Business process
BPO	Business process outsourcing
BPOM	Agency for Drug and Food Control
BSE	Bovine Spongiform Encephalpathy
BSI	British Standard Institute
CAC	Codex Alimentarius Commission
CAFTA	Central American Free Trade Agreement
CAP	Common Agricultural Policy
CASCO	Committee on Conformity Assessment
CB	Certification Bodies
CD	Compact disc
CDI	Centre for the Development of Industry
CDMA	Code-division multiple access
CE	Conformité Européenne
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CES	Constant elasticity of substitution
CFIA	Canadian Food Inspection Agency
CIS	Computer and information services
CIS	Commonwealth of Independent States
CO_2	Carbon dioxide
COMTRADE	Commodity Trade Statistics Database of the United Nations
COPOLCO	Committee on Consumer Policy
CPC	Central product classification of the United Nations
CPE	Cross price elasticity
CRS	Computer reservation system
DIN	Deutsches Institut für Normung
DOJ	Department of Justice
DOT	Department of Transportation
DSB	Dispute Settlement Body
DSU	Dispute Settlement Understanding

EA	European co-operation for Accreditation
EAC	European co-operation for Accreditation of Certification
EAL	European co-operation for Accreditation of Laboratories
EAR	European Authorized Representative
EBO	Edible beef offal
EC	European Communities
ECLAC	Economic Commission for Latin America and the Caribbean
EEA	European Economic Area
EFTA	European Fair Trade Association
EITO	European Information Technology Observatory
EMA	Mexican Accreditaiton Entity
EMC	Electromagnetic compatibility
ENGO	Environmental NGO
ETSI	European Telecommunication Standards Institute
FAO	Food and Agriculture Organization of the United Nations
FAPRI	Food and Agricultural Policy Research Institute
FCC	Federal Communication Commission
FDA	US Food and Drug Administration
FDI	Foreign direct investment
FINE	FLO, IFAT, NEWS and EFTA
FLO	Fairtrade Labelling Organizations
FMD	Foot and Mouth Disease
FSC	Forest Stewardship Council (chapter 2)
FSC/ETI	FSC Repeal and Extraterritorial Income Exclusion Act (chapter 3a)
FSCs	Foreign Sales Corporations (chapter 3a)
FY	Fiscal year
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GE	General equilibrium
GMP	Good Manufacturing Practices
GSM	Global System Mobile
HACCP	Hazard Analysis and Critical Control Points
H-1B	H-1B temporary worker: an alien admitted to the United States to perform services in "speciality occupations"
HKAS	Hong Kong Accreditation Service
HQB	High quality beef
HSDC	High speed data communication
IAAC	Inter-American Accreditation Cooperation
IAF	International Accreditation Forum
IANZ	Internal Accreditation New Zealand
IATA	International Air Transport Association
IBM	International Business Machines
ICAO	International Civil Aviation Organization
ICPM	Interim Commission on Phytosanitary Measures
ICRIER	Indian Council on International Economic Relations
ICS	International Classification for Standards
ICT	Information communications technology
IDA	Industrial Development Agency of Ireland
IDB	Integrated Database
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IECEE	IEC System for Conformity Testing and Certification of Electrical Equipment
IECEE-CB Scheme	Scheme of the IECEE for Mutual Recognition of Test Certificates for Electrical Equipment

IF	Integrated Framework
IFOAM	International Federation of Organic Agriculture Movements
ILAC	International Laboratory Accreditation Co-operation
ILO	International Labour Organization
IMF	International Monetary Fund
INMETRO	International Relations National Institute of Metrology, Brazil
IPPC	International Plant Protection Convention
IRA	Import risk assessment
ISEAL	International Social and Environmental Accreditation and Labelling
ISIC	International Standard Industrial Classification
ISO	International Standardization Organization
ISPM	International Standards for Phytosanitary Measures
ISRAC	The Israel Laboratory Accreditation Authority
IT	Information technology
ITC	International Trade Centre
ITES	IT-enabled services
ITS	International Trade Statistics
ITU	International Telecommunications Union
JAS-ANZ	Joint Accreditation System of Australia and New Zealand
JITAP	Joint Integrated Technical Assistance Program
LCA	Large civil aircraft
LCC	Low cost carriers
LDCs	Least-Developed Countries
LPG	Liquid Petrolium Gas
MERCOSUR	Southern Common Market
MFN	Most-Favoured-Nation
MLA	Multilateral Mutual Recognition Agreement/Arrangement
MNC	Multi-national corporations
MRA	Mutual Recognition Agreement/Arrangement
NADCAP	National Aerospace and Defense Contractors Accreditation Programme
NAFTA	North American Free Trade Agreement
NAICS	North American Industry Classification System
NASSCOM	National Association of Software and Services Companies
NATA	National Association of Testing Authorities
NBC	National Certification Bodies
NEISS	National Electronic Injury Surveillance System
NGO	Non-Governmental Organization
NHTSA	National Highway Traffic Safety Administration
NICs	Newly industrialized Asian countries
NIST	National Institute of Standards and Technology
NMI	National Measurement Institute
NMT	Nordic Mobile Telephone
NTB	Non-tariff barrier
NTE	National trade estimate
NTSC	National Television Standards Committee
NVCASE	National Voluntary Conformity Assessment Systems Evaluation
NVLAP	National Voluntary Laboratory Accreditation Programme
OAS	Organization of American States
OECD	Organization for Economic Co-operation and Development
OIE	Office International des Epizooties
OIML	International Organization of Legal Metrology
OPS	Other professional services
OSHA	Occupational Safety and Health Administration
PAC	Pacific Accreditation Co-operation

PAL	Phase alternate lines
PC	Personal computer
PCE	Phytosanitary capacity evaluation
PE	Partial equilibrium
PKP	Passenger kilometers performed
PPMs	Processes and production methods
PVC	Polyvinyl choride
R&D	Research and Development
RBI	Reserve Bank of India
RTA	Regional Trading Arrangement
S&D	Special and Differential Treatment
SAC	Singapore Accreditation Council
SADC	Southern African Development Community
SADCA	Southern African Development Cooperation for Accreditation
SANAS	South African National Accreditation System
SARS	Severe Acute Respiratory Syndrome
SCC	Standards Council of Canada
SCM	Subsidies and Countervailing Measures
SDoC	Supplier's Declaration of Conformity
SECAM	Sequential Couleur Avec Memoire
SGS	Société Générale de Surveillance
SIC	Standard Industrial Classification
SIM	Inter-American Metrology System
SITC	Standard International Trade Classification
SLSI	Sri Lanka Standards Institution
SO_2	Sulphur dioxide
SPS	Sanitary and Phytosanitary Measures
STDF	Standards and Trade Development Facility
STPI	Software Technology Park of India
TACS	Total Access Communication System
TBT	Technical Barriers to Trade
TC	Technical Committee
TCBDB	Trade-Related Technical Assistance Capacity Building Database
TED	Turtle Excluder Devices
TISI	Industrial Standards Institute
TKP	Tonne kilometres performed
TRAINS	Trade Analysis and Information Systems
TRIPS	Trade-Related Intellectual Property Rights
TTE	Telecommunication terminal attachment equipment
UL	Underwriters Laboratories
UMTS	Universal Mobile Telecommunication System
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
US	United States
USITC	US International Trade Commission
USTR	US Trade Representative
VAR	Vector autoregression
WHO	World Health Organization
WIPO	World Intellectual Property Organization

The following symbols are used in this publication:

...	not available
0	figure is zero or became zero due to rounding
-	not applicable
$	United States dollars
€	euro
Q1,Q2,Q3,Q4	first quarter, second quarter, third quarter, fourth quarter
–	break in comparability of data series. Data after the symbol do not form a consistent series with those from earlier years.

EXECUTIVE SUMMARY

The World Trade Report 2005 begins with a brief review of salient trends in international trade, focusing firstly on recent developments and then examining medium-term developments in the oil sector and the pharmaceutical sector. Section II of WTR 2005 contains the core topic of this year's Report, which is standards and trade in the context of the WTO. The Section looks first at the economics of standards and trade, and then at a range of institutional and policy issues. This is followed by a discussion of standards in the multilateral trading system. Section III of the Report takes up three discrete and topical issues of relevance to international trade. The three thematic essays in this Section are on the use of quantitative economics in WTO dispute settlement, trade in air transport services and offshoring services. The essay on the use of quantitative economic analysis in WTO dispute settlement procedures explains the kinds of quantitative techniques and econometric models that have been applied in various WTO legal disputes and discusses the use that was made of such analysis in a selected range of cases. The essay on trade in air transport services takes a close look at key characteristics of the industry and examines how it has evolved over time. The analysis also considers the economics of this sector, and a number of issues relating to competition, regulation, governance and trade in air transport services. Finally, the essay on offshoring services considers the economic characteristics of the activity, its scope and implications, and how it is relevant to the General Agreement on Trade in Services.

I. RECENT AND SELECTED MEDIUM-TERM TRADE DEVELOPMENTS

Global output and trade grew more strongly in 2004 than in the previous three years.

Global GDP growth amounted to 4 per cent in 2004, providing a solid basis for strong trade growth. For some regions, notably Central and South America and the Commonwealth of Independent States (CIS), this represented the best growth for more than a decade. In all seven regions defined in this Report, output and export growth were higher than the average annual rates for the 1990s.

Real merchandise trade grew by 9 per cent, the best performance since 2000 and the third highest rate over the last decade. In line with the prevailing post-war pattern, trade growth outstripped GDP growth by a significant margin – on this occasion by 5 percentage points. As this pattern continues, trade becomes an ever more crucial component of global economic activity. The most dynamic traders in 2004 were in Asia, South and Central America, and the CIS. Average trade growth in all of these regions was in double digits. Africa's trade grew strongly on average in 2004, buoyed in part by firmer commodity prices, particularly for oil and metals. Oil prices also had a strong influence on trade growth in the Middle East. North America's exports gained further momentum in 2004 compared to previous years, but growth was below the global average. Similarly, improved merchandise trade growth in Europe in 2004 was also very important for world trade growth, but Europe's trade and output growth remained well below the global average.

Price movements and exchange rates exerted a significant influence on trade flows measured in current dollar terms. Prices of primary commodities increased faster than prices for manufactured goods. The most notable exchange rate development in 2004 was the weakening of the dollar, resulting in a marked appreciation of European currencies against the dollar. World merchandise exports increased by 21 per cent in 2004, amounting to $8.88 trillion. This compares with growth in commercial services trade of 16 per cent in 2004, reaching $2.1 trillion. In current price terms, both merchandise and services trade grew more strongly for the third successive year, amounting to the strongest rise since 2000. Fuels in the case of merchandise, and transport in the case of services, were the sectors that showed the strongest nominal growth performance in 2004.

Looking at the regional picture in relation to merchandise export growth measured in current prices, the highest rates were recorded by the CIS, Africa and the Middle East, where fuel prices were a key factor. Central and South America also recorded strong export gains owing to a combination of economic recovery and higher commodity prices. At 25 per cent, Asia's nominal export growth rate was also above the global average in 2004. North America and Europe reported below average nominal export and import growth in 2004.

Some but not all developing countries have benefited from higher oil prices in the last two years.

Developing countries as a group are large net exporters of fuels, while the developed countries aggregate are net importers. As a result of higher oil prices, developing countries taken together have enjoyed higher export earnings, improved external balances and terms of trade gains. However, higher oil prices also mean production cost increases in many industries, such as petrochemicals, plastics, aluminium and transport services. The oil intensity of output tends to be higher in developing than developed countries, and has been increasing in recent decades while that of developed countries has been falling.

Increasingly, the destination of developing country fuel exports is other developing countries. In 2002-2003, 40 per cent of developing country oil exports went to other developing countries, up from less than 30 per cent in the 1990s. Higher energy prices affect individual developing countries and regions in quite different ways. Among the four developing country regions identified in this report, only the Middle East and Africa are large net exporters of fuel. Developing Asia, in particular, has become a large net-fuel importer.

Trade in pharmaceutical products has grown with great rapidity in recent years.

Since 2000, growth in world exports of pharmaceutical products has been four times stronger on average than the equivalent figures for other chemical products and manufactures as a whole. The share of pharmaceuticals in world trade has risen to some $200 billion, or 3 per cent of total trade. This share exceeds those of textiles and iron and steel.

Trade in pharmaceuticals takes place largely among developed countries, who account for 90 per cent of world exports and more than 80 per cent of world imports. The developed countries dominate research and development (R&D) activity, enjoy a high level of intra-industry and intra-firm trade, and high levels of health expenditures compared to developing countries. A number of factors explain the expansion of the pharmaceutical industry. One is strong demand growth in rich countries, stimulated by an aging population and increased use of "lifestyle" drugs. Another is corporate consolidation (mergers and acquisitions) resulting in more specialization and more intra-industry and intra-firm trade. Trade liberalization may also have played a part, as many industrialized countries eliminated tariffs on pharmaceutical products in the Uruguay Round from an average of 6.2 per cent.

II. TRADE, STANDARDS AND THE WTO

We live in a world profoundly reliant on product standards. They affect our lives in ways we sometimes do not even notice, but they can have far-reaching implications for economic activity, including trade.

Examples abound of how standards affect our world. Safety norms allow us to consume with a confidence that would be impossible if we had to make our own judgements about safety at every turn. Rules of conduct and product standards in numerous areas of activity help us avoid inefficiency, harmful surprises, and high costs. In the case of product standards, for example, faxes can be sent around the world because fax machines obey a common protocol. Computer files can be shared because computers employ various standardized hardware and software formats. The need for product standards is not a new phenomenon. In biblical times, the lack of a common (standardized) language wreaked havoc at the Tower of Babel. In more recent times, during the great Baltimore fire of 1904, fire fighters called in from neighbouring cities were unable to fight the blaze effectively because their hoses would not fit the hydrants in Baltimore.

The specific functions that standards fulfil are very diverse. Two of the most important are providing compatibility and information. It is through sharing a common standard that anonymous partners in a market can communicate, can have common expectations on the performance of each other's product, and can trust the compatibility of their joint production. Thus, standards are necessary for the smooth functioning of anonymous exchanges – and therefore, for the efficient functioning of the market. Although standardization is necessary, it does not follow that all variety is undesirable. The question therefore arises, what type of standards and how many of them are desirable in an increasingly globalized world.

By the end of 2004, the International Organization for Standardization (ISO) had published some 14,900 international standards. Perinorm, a consortium of European standards organizations, maintains a database of around 650,000 standards (national, regional and international) from about 21 countries. The bulk of these standards have been set by the private sector and many of them are international in scope. Non-governmental organizations (NGOs) have also been involved in standard-setting, working with industry and international organizations to develop standards in such areas as environment and corporate social responsibility. Among the factors accounting for heightened standardization activity are demand by consumers for safer and higher quality products, technological innovations, the expansion of global commerce and increased concern over social issues and the environment.

International standards help ensure technical compatibility across countries and convey information to consumers about products that have been produced abroad or processes that took place in another country. International standards thus reduce transaction costs and facilitate international trade. Yet harmonization to international standards is not always desirable, as it reduces product variety. Besides, it may not always be easy to agree on a global standard as local standards are often the outcome of specific technical requirements of domestic producers as well as a reflection of the social values in a society. Local standards may also have the effect of protecting local producers against foreign competition and producers may be interested in maintaining this protection.

The World Trade Organization deals with the rules of international trade and inevitably has to deal with the role of standards in international trade. Indeed, several WTO Agreements make reference to national and/or international standards. The Dispute Settlement System has had to decide on a number of cases involving standards, some of which received a lot of public attention, like *EC-Asbestos, EC-Hormones* and *US-Shrimps*. This Report discusses the WTO's role with respect to standards, the content of key provisions of WTO agreements relating to standards, and the resulting WTO jurisprudence. It also examines the link between the WTO and national and international standard setting bodies.

The economics of standards and trade

Standards may be public or private, mandatory or voluntary, and they may focus on products or processes.

Standards can be classified into private and public standards, although the line separating these two is not always well demarcated. Many standards adopted by governments have their origin in industry. The distinction between public and private standards matters when considering in whose interests standards might be set. In the case of public standards, it is assumed that the interests of all actors in society are taken into account, while in the case of privately-set standards, the standard is chosen to maximize firms' profits. While firms' choice of standards are likely to be optimal for society in many instances (e.g., when technical compatibility among related products is assured by a standard), there may be a divergence between private and social interests in standards when externalities and less than full information about products is available to all interested parties.

Private standards are by definition voluntary, but public standards can be either voluntary or mandatory. In the case of mandatory standards, only standardized products are allowed to circulate in the market. Where standards are voluntary, non-conforming products can also be supplied. In WTO terminology mandatory standards are referred to as technical regulations under the Agreement on Technical Barriers to Trade and may be sanitary or phytosanitary measures under the Agreement on the Application of Sanitary and Phytosanitary Measures.

It is important to distinguish between product and process standards. Process standards pin down the characteristics of a production process. Processes are typically not traded. But the goods produced through the process may be traded and process standards are therefore relevant to the multilateral trading system. This "indirect" relevance of process standards explains to a large extent why multilateral trade law, which traditionally deals with goods and not their process of production, finds it difficult to deal with process standards.

Process standards are introduced for different reasons – because they affect the goods that are produced (e.g. hygiene standards), because they affect the efficiency of the production process (e.g., in the case of network externalities) or because they affect the environment (e.g., pollution standards). In the first case, process standards are reflected in the final good and thus have a direct impact on trade. WTO terminology would refer to such standards as "incorporated process and production methods (PPMs)". In the other two cases, the process standards are not reflected or incorporated in the final product. Yet at the same time, consumers or governments in an importing country may care about the way in which an imported good is produced – for instance, because they care about the environmental impact of the production process.

Standards fulfil diverse functions. They can improve welfare in markets where compatibility standards capture network externalities.

Compatibility standards play an important role in increasing economic efficiency in the case of network externalities. There are circumstances where the value of a product for a consumer does not depend only on the quantity or the quality of the product itself, but also on the availability and variety of complementary goods and/or the number of people using the same product. A mobile phone, for example, is more valuable for a consumer the higher the total number of people using the same or a compatible mobile phone network. A computer is more valuable the more compatible software is available in the market. It may happen, however, that lack of information about the size of the network, different preferences and firms' marketing actions may generate a non-optimal outcome: markets may oversupply varieties and the size of the network may be too small, or it may happen that users delay the adoption of a new technology or rush to an inferior technology for fear of becoming stranded. In all these cases, by setting a standard, the industry is able to solve the problem of coordination among consumers.

There is little scope for government intervention in network industries, as compatibility standards are likely to result from the interaction of market forces. Network industries have a tendency to tipping – that is, when a certain technology has reached a critical mass it tends to dominate the whole market. Therefore, firms owning different technologies will either cooperate and agree on a standard or engage in fierce competition in the attempt to reach the critical mass.

Compatibility standards can create problems through their anti-competitive effects. This will happen if a dominant firm imposes its own standard (e.g. the de facto proprietary standard of Microsoft) and pursues anticompetitive behaviour. The role of the government would then be to ensure competitive behaviour through the pursuit of competition policy.

The argument that compatibility standards solve a coordination problem in network industries, thus increasing market efficiency and consumers' welfare, also holds in global markets. Several network industries are global in scope, such as telecommunications and transport systems. A natural tendency exists in global network industries to ensure that compatibility is extended across countries. In the case of industries where the final product is assembled from parts and modules, shared standards will thicken the market for suppliers of components. It will allow firms to diversify the sources of their inputs, creating a more competitive market and lower prices for intermediate products or components.

In practice, international compatibility may be more difficult to achieve than compatibility at the national level, as there are more consumers to coordinate and they are spread across different jurisdictions. International compatibility can also be impeded by strategic trade and market power considerations. To the extent that compatibility standards capture global network externalities, allow producers to coordinate their activity more efficiently and embody information about consumer preferences in foreign markets, compatibility standards are likely to enhance international trade and welfare.

Standards can also increase welfare by removing information asymmetries in markets...

Information asymmetries occur when producers have information about the characteristics of goods they produce which users do not possess. Whether as end consumers or as producing firms acquiring inputs, buyers may be at a significant disadvantage compared to sellers because the latter possess information

about the good or service not available to the buyer. This asymmetry can significantly hamper the efficient functioning of markets, and standards can help solve the problem and increase efficiency.

Product safety is an important area where standards are used to address information asymmetry problems. A wide range of consumer goods – food, drugs, vehicles, electrical appliances, safety equipment – face many types of requirements, from design (e.g., toys), to ingredients (e.g., chemicals), to the process of manufacture or production (e.g., pasteurisation of milk), and to performance (e.g., helmets). The economic cost from accidental injuries and deaths can be large. In the United States for example, there were more than 12 million accidents in 2003 from the use of consumer products that required patients to be treated in hospitals. The US Consumer Product Safety Commission estimates the economic costs of these accidental deaths and injuries at $700 billion annually. The potential gains from safety standards are therefore significant.

...but while national welfare in the standard-imposing country will increase if a standard is well designed, global welfare may not necessarily be improved as a consequence of the trade effects of the standard.

If mandatory safety standards differ across countries, they may increase trade, decrease it, or leave it unaltered. The outcome will depend to a large extent on the effect of a standard on the relative costs of domestic and foreign producers. But it also depends on many other factors, like the level of competition in exporting and importing countries and the willingness of consumers in different countries to pay higher prices for safer products.

Welfare effects are even more difficult to predict than trade flows. When trade flows decrease as a result of a standard in the importing country, the reduction in imports represents a welfare loss for the country setting the standard. On the other hand, the standard increases product safety, i.e. it corrects an existing market failure. This has a positive effect on domestic welfare. The optimal standard from the point of view of the country setting the standard is the one that leads to the best trade-off between a negative trade effect and a positive welfare effect due to increased product safety. In other words, safety standards may increase national welfare even if they decrease imports. The effect on exporters' welfare may be positive or negative. If consumers in the exporting countries have the same preferences as those in the importing country (they prefer the higher standard product), their welfare may also increase. In this case global welfare increases despite a fall in trade volume. But a decrease in the exporting countries' welfare cannot be excluded. In theory at least, standards may create conflicts of interest between trading partners even if they are not set with the intention of protecting domestic producers.

Standards increase welfare by reducing negative environmental externalities...

An important area where governments around the world have increased regulatory activity in recent decades is in relation to the environment. Government intervention aims in this case to create incentives for consumers and producers to take into account the effects of their actions on the environment.

Economic theory recommends the use of price-based policy instruments (e.g. taxes or charges) to manage environmental externalities. However, there is a strand in the literature in which price-based and quantity-based instruments are compared and in which one does better than the other in different circumstances. For instance, distributional concerns, the uncertainty of the costs and benefits of pollution abatement and the costs of monitoring and enforcement have led many governments to resort to environmental regulations rather than price-based instruments.

Preferences for different environmental policy instruments are likely to differ across countries. Some governments are more able than others to absorb the costs of environmental policies. Producers and consumers with lower average incomes are also less able and willing to incur such costs. Members of lower-income societies often face greater uncertainty about the future and therefore are more reluctant to invest in it, which after all is what much environmental policy is about. These are all reasons why industrialized countries tend to have more stringent environmental standards than developing countries.

...but once again the trade and global welfare effects are ambiguous. The effects depend on whether externalities are local or global, whether they are production- or consumption-related, and whether standards are mandatory or voluntary.

The trade effects of environmental standards depend on the nature of the environmental externality – whether it originates in production or consumption and whether it is local or global – and the nature (mandatory or voluntary) of the standard applied to products or processes. In the case of standards relating to production externalities, they also depend on whether standards are applied to both foreign and domestic producers or only to domestic producers.

In the case of local production externalities, it makes sense to apply mandatory standards only to domestic producers while applying voluntary standards to foreign producers.

In practice, applying mandatory standards only to domestic producers raises fears about the possible relocation of domestic producers to countries with less stringent standards and maybe even a "race-to-the-bottom" if governments compete to lower environmental standards so as to keep or attract jobs and investments. While theoretically plausible, it is much harder to find empirical evidence for these effects.

Imposing mandatory process standards on foreign producers raises two major concerns. First, the domestic process standards imposed on foreign producers may not be efficient from a global point of view, as the costs of production techniques differ across countries. Second, the question arises as to who controls and enforces the standards applied in the production of imported goods, given that production takes place abroad.

Voluntary process standards accompanied by a labelling policy give foreign producers the option of which production process to apply. But independent of their decision, they may be affected in any case if the labelling policy has an effect on the relative price of labelled and unlabelled products. If foreign producers decide to sell in an environmentally friendly market, problems of control and enforcement of process standards arise, as discussed above.

Product standards targeting a consumption externality affect both domestic production and imports. It could be argued that a priori there is no reason to expect that the regulation will favour domestic firms relative to foreigners. However, to the extent that the appreciation for the environment differs across countries and results in differing standards, foreign firms could be penalized more, as discussed in the case of safety standards.

In the case of global environmental externalities, it is likely that no standard will ever be fully optimal since individual countries will not take into account the effect of their actions on other countries.

When environmental externalities are of a global nature individual countries are unlikely to develop optimal policy instruments because they will not take into account the impact the deterioration of the environment has on other countries. International collaboration is therefore desirable.

To sum up, standards that aim at increasing market efficiency have complex trade effects.

The effects of standards on the direction and size of trade flows tend to be complex and need to be analysed on a case-by-case basis. Standards typically have an effect on both consumers and producers. They may affect the willingness of consumers to pay for product varieties meeting the standard, because they change consumers' perceptions or appreciation of these varieties. Standards may affect the costs of producing varieties to meet the standard and thus the prices at which producers are willing to supply them. Standards will affect trade flows if they have a different effect on the demand for and supply of varieties produced abroad and varieties produced domestically. This may be the case if foreign and domestic producers supply different varieties of the relevant good, or if standards affect their production costs differently.

In order to design standards, governments need information from both consumers and producers. Producers, however, may have an interest in influencing the design of standards in order to obtain an artificial advantage over foreign competitors. If they succeed, the resulting standards will tend to lower both trade and welfare...

The trade consequences of standards will affect the welfare of countries, including the welfare of the country introducing a standard. Governments need information from both producers and consumers in order to design optimal standards. Producers may have incentives to influence the design of standards in such a way that the relevant standards do not only target the environmental externality or product safety but also give them an artificial competitive advantage over foreign producers. If the design of a standard reflects protectionist interests, it will reduce trade flows as well as domestic and global welfare.

...on the other hand, if standards do not reflect protectionist interests, they increase welfare, even in cases where they reduce trade flows.

Standards that reduce trade flows are not necessarily welfare reducing, in particular if they are designed in order to reduce the negative welfare effects of a market imperfection. Standards that improve information available to consumers, that increase consumer safety or that reduce the negative effects of environmental externalities, for instance, may well increase domestic welfare even if they have a negative effect on trade. As a consequence it may be in the interest of individual countries to set standards in order to raise their own welfare but which, as a by-product, reduce trade flows.

Harmonization and mutual recognition are alternative approaches to standard-setting in international markets and are likely to have quite different consequences...

Different standards across countries, although optimal from the national point of view to pursue a certain policy objective, might hinder trade. They may reduce the scope for international arbitrage and they may increase costs for foreign companies relatively more than for domestic firms. When countries open up to trade, previous standards may become suboptimal as they can result in some forgone trade. Policy makers have various ways to deal with technical barriers to trade – full harmonization, harmonization of essential requirements, equivalence and mutual recognition of product standards.

Full harmonization implies that both policy objective and detailed technical provisions required to achieve the objective be commonly defined. Mutual recognition implies that countries simply accept each other's standards. Equivalence implies unilateral recognition. As mutual recognition entails the risk of a race to the bottom, in practice, it will therefore only be observed among countries with equivalent policy objectives. If countries prefer to control the risk of variation of policy objectives among partners, they can harmonize some essential requirements and accept (mutually recognize) each other's design/specific technical details.

As to voluntary standards in markets with network externalities, economic theory suggests that opening up to trade is likely to lead to a process of harmonization of standards initiated by industry groups, as coalitions of firms will reorganize internationally and exploit economies of scale at a more disaggregated level of economic activity. The role of the government would be confined to preventing anti-competitive outcomes.

...and we have no a priori *way of knowing the welfare implications of the alternatives.*

There is no a priori answer to the question of whether harmonization is more desirable than mutual recognition from a national or a global welfare point of view. When standards addressing global externalities (environmental or network externalities) are set at the national level they are likely to be inefficient. International collaboration would be beneficial in these circumstances, though the optimal solution would not necessary mean harmonization.

Economic theory does not provide a clear-cut answer even to the question whether harmonization of product standards is more trade enhancing than mutual recognition. The advantage of harmonization is that products produced in different countries are homogeneous and therefore better substitutes from the point of view of producers and consumers. This, in turn, may facilitate trade by improving confidence in the importing country

about product quality, enhancing compatibility with domestically produced goods and intensifying competition. On the other hand, harmonization imposes a cost in terms of reduced variety. Insofar as demand for foreign goods is driven by a love of variety, a reduced degree of product differentiation would hamper trade. Another potential advantage of mutual recognition is that it allows any firm to pick a standard and to sell its products in the whole regional market. So, unless consumer preferences are biased toward domestic specification, a firm located in the region can freely access the whole regional market without the additional costs of complying with a specific harmonized standard. Harmonization to a specific standard, by contrast, may imply a higher cost of compliance for firms in certain countries, thus effectively erecting a barrier to trade.

Multiple tests to determine conformity with technical requirements increase transaction costs and can hinder trade.

Independently of whether standards are harmonized or not, exporters may be faced with having to test or certify their products in each of the countries to which they are exporting. This can substantially increase the costs of exports. In order to reduce such costs, a number of regional agreements on mutual recognition of conformity assessment procedures have been negotiated. Although these agreements unambiguously foster trade among participating countries, they can divert trade from excluded countries.

Empirical evidence on the impact of standards on trade embodies certain limitations, but still provides interesting insights.

The empirical literature has tended to rely upon a rather short list of databases from which to measure standardization activity. But the data are not usually classified in a way that reflects the various economic functions of standards. Information on whether these are voluntary or mandatory, national or international, can be found in some databases but not in others. While it may be possible to identify the sector to which a standard applies, it will not always be clear whether all products in that sector are covered or only a subset of them. Most of the available databases also depend on the willingness of countries to provide accurate and prompt responses to questionnaires or surveys. The number of empirical studies has also been limited. These limitations have to be taken into account in assessing the results of the empirical survey on standards and trade.

Industries characterized by network externalities are standards-intensive while technical regulations are primarily focused on problems of information asymmetry.

Standard-setting activity is pronounced in industries characterized by network externalities whereas the bulk of technical regulations seem to address various types of problems associated with information asymmetries. In some major markets these regulations cover a large number of tariff lines and a significant share of imports, so there is potential for these regulations to have an adverse effect on trade. For example, based on a count of tariff subheadings, Brazil, the United States and Australia have thousands of items at the HS-6 level covered by technical measures. The share of imports covered by technical measures ranges, at the high end, from about half of total imports in the case of Brazil to about a third in the case of the United States and China.

Standards do not significantly increase the costs of large firms in OECD countries although smaller firms may face greater difficulties. In the case of firms in developing countries, the story is more complex - costs vary enormously across countries and depend on a range of factors.

The costs or price-raising effects of standards do not emerge as a major concern in OECD countries. Surveyed OECD firms did not generally identify major problems in complying with regulations in other OECD markets, although smaller firms tend to face greater difficulties than large ones. The evidence on the cost of compliance by firms in developing countries is mixed. Survey work suggests that some firms in developing countries face very high costs, sometimes almost doubling their production costs in order to meet technical requirements in major developed country markets. However, the case studies tell a more complex story where the costs of and benefits from compliance vary enormously among firms and countries and depend on a range of factors – industrial structure, the possibility of collective action, the strength of consumer preferences for safety, and so on.

Comparing the effectiveness of mutual recognition with harmonization in increasing trade flows, early evidence based on the EU experience suggests that mutual recognition has greater trade enhancing effects.

The available empirical literature on the effects of standards on international trade flows is still rather limited, reflecting the difficulty of the subject and the nature of the data. One approach to quantifying the impact of standards on trade has been to test whether country-specific standards and internationally harmonized standards have different effects on trade. All the empirical studies based on this approach use the count of idiosyncratic and shared product standards in a specific industry as a factor to explain trade flows. The idea is that national standards can facilitate or deter trade, depending on whether they decrease information costs more than they increase adaptation costs for foreign suppliers. Harmonized standards are believed to facilitate trade were it not for their negative effect on product variety. This specification of the empirical models, however, does not allow us to distinguish important aspects of standards, such as their role in solving market failures, their impact on compliance costs, technical complexity and innovativeness. These are all elements that can significantly affect trade. Moreover, the econometric models used are often *ad hoc* and lack theoretical foundations. Nevertheless, some interesting results have emerged. Most importantly, the adoption of standards, even purely national ones, can increase trade. One estimate suggests that a 10 per cent increase in the number of shared standards enhances bilateral trade by 3 per cent.

Another approach to quantifying the impact of the removal of technical barriers to trade has been to compare the effects on trade of harmonization as against mutual recognition of product standards. Early evidence based on the EU found more robust results for the trade enhancing effects of mutual recognition compared to harmonization.

It has been suggested in the literature that SPS measures have been too restrictive – the risks from the introduction of pests through imports would need to be very high to justify some of the measures deployed. But there is also evidence that the adoption of some quality and safety standards by producers has placed them in a better position in the global marketplace.

The welfare-based literature finds that SPS measures are generally restrictive and involve a welfare loss in the importing country. According to this work, the presumed health risks or losses from the introduction of pests through imports need to be extraordinarily high in order to justify some regulatory regimes in place. But questions have been raised about the appropriateness of the analytical framework employed, since there may be circumstances where regulatory authorities are not able to assign credible probabilities to outcomes and are therefore more risk averse than assumed in the studies.

Conflicting conclusions emerge as well on the trade impact of SPS measures in developing countries. There have been cases where access to export markets was denied on sanitary or phytosanitary grounds, resulting in substantial costs in terms of lost sales and market share. But rising standards also serve to accentuate underlying supply chain strengths and weaknesses and thus impact differently on the competitive position of individual countries. Some countries are able to use high quality and safety standards to reposition themselves in global markets.

Differences in environmental standards do not generally seem to spur a "race-to-the-bottom" or to create pollution havens.

Environmental standards do not appear to have significant effects on trade and investment flows, although more recent studies find a pollution haven effect compared to the older literature. But there is some question about the robustness of these results. Less work has been done to examine empirically the "race-to-the-bottom" story, but available studies point to little or no effect on the behaviour of regulators in this connection.

Institutions and policy issues

While information on standardization at the international level is fairly comprehensive and easily accessible, it is difficult to obtain a complete picture in many countries. But it is clear that approaches to standardization are evolving.

Outside the institutionalized system, including ISO and a few other international standardization bodies, information is scattered and often incomplete. However, our overview suggests that the standards regimes are evolving, including those at the national and regional levels.

Recent approaches to standardization require standardizing bodies to focus on the development of voluntary rather than mandatory standards, to become more responsive to markets, to rely more heavily on international standards, and to participate more actively in international standardization. These latter trends have enhanced the role of international standardization bodies.

At the regional level, initiatives aimed at reducing the trade restrictive impact of technical barriers have been implemented or announced. Integration in the area of standards and technical regulations is probably most advanced in Europe.

The national standardization infrastructures of most industrialized countries are now integrated into the network of international standardization. In Europe for instance, adoption of European standards is mandatory for national member bodies and European standards organizations transpose the international standards into European standards.

Change in the standardization field is putting pressure on governments in developing countries to reform and develop their standardization infrastructures.

Both the demand for standards infrastructure and the capacity to implement standardization activities depend on factors correlated with a country's level of development. Standardization infrastructure in developing countries has often been non-existent or rudimentary. National standardizing bodies are in many cases governmental bodies weakly linked to markets and largely inward-oriented.

African standardization bodies, for example, had produced an average of only 1,281 standards in total by the end of 2002, while the corresponding figure for Western European bodies was 15,407. Some developing countries are participating more fully in the system. Malaysia, for example has aligned some 40 per cent of its standards to international standards. But many low income and transition countries have not followed the trend and national institutions are not part of the international network. More than half the LDCs have no formal contact with ISO, the most important international standardization body.

The process of establishing voluntary, consensus based standards, and in particular the procedures used by ISO and many of its member bodies, are regulated by the WTO and ISO codes of good practice.

The process consists of several distinct but closely related activities. It is fairly open and transparent but producers who have clear priorities, and are usually better organized than consumers, typically play the leading role. In some industrial countries, governments actively promote the participation of consumers by funding consumer organizations.

Institutions that compete with less formal private standardization initiatives are concerned that their formal standardization process may be too slow. The general trend is towards separating standardization activities from regulatory activities, with the former left to the private sector and the latter with the public sector. However, the separation between public and private standard setting is not always clear-cut.

The organization of the process of standardization varies widely across countries.

In general, regulations concerning safety, health and the environment are issued by governments. Often, however, the specific measures that satisfy the objectives of government regulations are spelled out in technical standards developed by private organizations. In European countries, for instance, governments often refer to privately developed standards in regulations.

Standards institutions in poorer countries are generally in the public sector with little or no participation of the private sector. In a small number of countries, mainly in Africa, the CIS and the Middle-East, the share of national standards with a mandatory status exceeds 50 per cent of the total number of standards published.

Improving participation of developing countries in international standardization is crucial.

This need has been recognized for several decades and numerous initiatives have been undertaken to improve the situation. Recent evidence, however, suggests that these initiatives have not yet achieved much improvement. Major difficulties for developing countries seem to be the lack of expertise needed for participation in technical work on the formulation of standards, and limited support from the private sector.

Conformity assessment is not a trade barrier as such, but an everyday reality in commercial transactions. But conformity assessment arrangements can have important implications for competitiveness and market access.

Purchasers and regulators want to ensure that the requirements and standards they impose on suppliers are fulfilled. Sometimes these additional transactions costs can be higher for foreign suppliers than for domestic ones.

In a narrow sense, conformity assessment refers to testing, inspection and certification as well as a supplier's declaration of conformity – that is, activities that deal with the characteristics of the product itself. A wider definition includes the area of metrology, which is an important prerequisite for the proper conduct of all other forms of conformity assessment involving measurements, and accreditation (the evaluation of the competence of any institution involved in conformity assessment).

The degree to which the assessment of conformity with a regulation may act as a trade barrier hinges critically upon the flexibility provided to exporters in choosing conformity assessment providers, activities and procedures. But even if the importing country is rather flexible as to where and how conformity is demonstrated, transaction costs for foreign suppliers can be significant, depending on the availability and cost-effective provision of relevant conformity assessment services and their international recognition.

Ideally, an attestation of conformity with regulatory requirements should be carried out only once and in the most cost-effective manner and should be recognized in all markets. For this to become a reality, confidence in the work of conformity assessment bodies in other countries needs to be established through multilateral cooperation. Cooperation is facilitated if harmonized standards on best practices in conformity assessment are adhered to, such as the international standards/guides on conformity assessment established by the ISO's Committee for Conformity Assessment (CASCO).

A number of international and regional systems have developed over time with the objective of establishing networks of conformity assessment bodies whose competence can be relied upon by all members.

Cooperation on accreditation has proven particularly important in order to minimize the number of bilateral coordination efforts that confidence-building in other countries' conformity assessment arrangements would otherwise require. For instance, the International Laboratory Accreditation Co-operation (ILAC), has developed a "global" mutual recognition agreements (MRA) among all its 46 full Members.

Regional cooperation efforts often precede wider international engagement, not least since neighbouring countries may also be principal trading partners. But effective cooperation is not always an easy task where different levels of development exist among member countries.

Regional efforts can help to address the problem of a complete absence or insufficiency of relevant institutions in smaller or poorer countries. For instance, only two countries in Southern Africa (Mauritius and South Africa) currently have national accreditation bodies, and cooperation within the Southern African Development Community (SADC) is crucial for other members.

In developing countries, the provision of conformity assessment services is often inadequate, costly, government-driven and centralized.

Commercial provision of conformity assessment services, such as testing, inspection and certification may be inadequate for a variety of reasons, including restrictive policies, the small size of the domestic market, high costs of inputs and scarce human resources. Conversely, in the United States, the testing laboratories sector has grown at around 11 per cent in recent years. As a conservative estimate, the sector generates more than $9 billion in revenues annually.

Considerable technical assistance at the international, regional and bilateral levels is provided to developing countries in order to build the necessary conformity assessment infrastructure. Priority is usually given to conformity assessment needs in sectors of particular export interest, where suppliers face stringent conformity assessment requirements in major export markets. However, rigid prescriptions on conformity assessment by importing country governments can be challenging even for countries with a well-developed conformity assessment infrastructure.

Exporters may face extra costs due to: (i) difficulties in obtaining information on conformity assessment requirements and admissible providers; (ii) additional conformity assessment activities to those carried out domestically or a duplication of procedures; (iii) procedures that are more costly to exporters than domestic producers owing, for instance, to higher transport and communication costs; and (iv) administrative delays caused, for instance, by test reports and other documentation that may be refused, remitted for further clarification or, even when admissible, less familiar to importing country authorities.

A range of bilateral and plurilateral government-to-government mutual recognition agreements (MRAs) show that commitments to mutual acceptance of conformity assessment results in sectors involving health, safety and environmental regulations tend to be quite limited.

MRAs are more likely to exist among countries at higher and similar levels of development. According to the database on MRAs notified to the WTO under TBT Article 10.7, only 5 per cent of MRAs include African partners. More than half of all notified agreements (53 per cent) involve developed countries only.

There is an almost confusing multitude of publications describing institutional arrangements and conformity assessment concepts. However, the systematic reporting of conformity assessment procedures as barriers to trade, or of their cost implications for exporters, is extremely rare. This is especially so for developing countries, where at best some anecdotal evidence is available. In particular, there is a shortage of comparative analyses of conformity assessment practices across sectors or countries.

The absence of data on conformity assessment costs and on the costs of sustaining conformity assessment institutions makes it difficult to assess the real benefits of an ever more complex international conformity assessment infrastructure.

Standards in the multilateral trading system

Multilateral disciplines on standards seek to ensure an appropriate balance between WTO commitments to open trading arrangements and other public policy objectives.

WTO Members have committed themselves to ensure that technical regulations and standards do not create unnecessary obstacles to international trade, while also recognizing that governments should not be prevented from using standards to pursue other legitimate policy objectives. This implies that, in case of a dispute, a panel may be required to distinguish between a "legitimate" standard and an "illegitimate" standard, i.e. one that is inconsistent with WTO law.

The TBT and SPS Agreements seek to ensure that when governments pursue non-trade-related policy objectives through the use of standards, they do so with the least disruptive effect on trade consistent with the underlying policy objective. The MFN and national treatment obligations provide an important check against standards whose application results in less favourable treatment of foreign suppliers compared to domestic producers. The dispute settlement mechanism allows countries to settle disagreements regarding the consistency of specific standards with the requirements of the TBT and SPS Agreements and the obligations of GATT 1994.

Even though governments subscribe to the commitment that standards should be non-discriminatory and the least trade-restrictive possible, disagreements still arise sometimes over the specificities of particular situations.

It may not always be straightforward to distinguish a "legitimate standard" from an "illegitimate" one. While a tariff clearly has the purpose and effect of discriminating between imported and domestic products, it can in practice be quite difficult to establish the purpose and effect of a standard. Governments may claim that they have introduced a standard in order to correct for market imperfections, but in reality the standard has been designed so as to create an artificial comparative advantage for domestic producers. In other words, standards may be employed as a "disguised" form of protectionism. Note that this may not be in the interest of the country introducing the standard, as consumers tend to suffer from protectionist policies. Given the reliance of governments on information from producers when it comes to designing standards, the risk of government capture by the private sector can be real.

In addition, "legitimate" standards may have the effect of reducing trade if it increases transaction costs. From an economist's point of view, a well-designed standard would strike the best possible balance between the positive effects owing to an enhanced functioning of the market on the one hand and the costs of implementing the standard and any possible negative trade effects on the other. The notion of "striking a balance" is also present in WTO jurisprudence. Although the GATT has no specific language authorizing a balancing test, "balancing" of a range of factors has explicitly been mentioned in cases where recourse was taken to GATT Article XX(d) in interpreting the term "necessary". The factors evoked in the jurisprudence are very similar to those that inform economic thinking, and include the standard's positive effect on the policy aim and the possible negative effect on trade.

When it comes to disputes concerning standards, there is generally no disagreement about the legitimacy of the policy objective that the defendant claims to pursue. The protection of human or animal health, for instance, or the protection of the environment, are widely shared policy objectives. However, disagreement may arise within or among societies about the desirable degree of protection to be achieved. Disagreement may also arise about the existence of a link between a tradable good and the policy objective or about the true nature of that link. Last but not least, disagreement may arise about the effectiveness of a given policy instrument, like a standard, to achieve a certain policy objective. In practice, claims regarding any of these issues may involve a large amount of technical information.

Scientific evidence can play an important role in shedding light on these issues. Indeed, both the TBT Agreement and to a greater extent the SPS Agreement make reference to the use of scientific evidence in

order to establish links between trade and public policy objectives and the relevance of particular standards in given situations. The question arises, however, whether the WTO dispute settlement system is in all instances adequately equipped to deal with the scientific evidence provided by the parties and/or external experts.

In practice, the rules have to accommodate the reality that national and global welfare maximization will not always coincide in the field of standards.

The concept of own "appropriate level of protection" is closely related to the concept of "national welfare maximization". The WTO is a multilateral organization and its role has often been defined in terms of global welfare maximization. Yet, pursuing global welfare maximization in the context of standards may be difficult in practice as it would require the weighing of different "appropriate levels of protection" across Members.

Consumer preferences play a crucial role in economic analysis when it comes to determining appropriate government policy. Indeed, government intervention in standard setting is above all justified when the incentives of producers do not coincide with the interests of consumers. Scientific evidence is likely to be one of the determinants of consumer opinions, which raises important questions concerning the availability of scientific evidence to consumers, the quality of that evidence and its timeliness. Governments may have an important role in providing appropriate information to consumers on scientific evidence.

Harmonization of standards internationally is not always optimal from an economic standpoint, although the WTO rules encourage the use of international standards. This does not necessarily throw up contradictions.

The economic discussion of standards concluded that the international harmonization of standards is not a desirable objective in all cases, either from the national or global point of view. WTO Agreements encourage the creation and use of international standards. In particular, countries applying an international standard are presumed to be applying WTO-consistent policies under both the SPS Agreement and the TBT Agreement. Should it be concluded that WTO Agreements are in conflict with economic thinking? Not necessarily, as both Agreements allow for deviations from international standards under well-specified conditions. Moreover, harmonization brings advantages such as lower transactions costs and economies of scale in production.

In a global world, coherence between multilateral trade rules and standard-setting policies is necessary in order to avoid conflicts among trading partners. Currently the relationship between these two aspects of policy making in the global domain is not sufficiently well-defined. It is questionable whether the WTO dispute settlement system can always deal effectively with the type of disputes that may arise as a consequence of this lack of coordination.

Dealing with non-incorporated production and process measures may prove a challenge for the WTO dispute settlement system in the future.

The multilateral trading system has long been hesitant to deal with non-incorporated PPMs, but with the *US-Shrimps* decision, such measures may be argued to have become part of the system. The concerns about their enforcement, however, remain. Non-incorporated PPMs cannot be controlled at the border and involve control on the production site of the exporting country. It is doubtful that exporting countries will readily accept inspectors from importing countries to inspect production sites in their territory. It is not clear, therefore, whether solutions along the line of *US-Shrimps* can be found in future disputes involving process standards.

III. THEMATIC ESSAYS

Quantitative economics in WTO dispute settlement

There is a growing but still small literature on the economics of dispute settlement.

This essay focuses on quantitative economic analysis and the extent to which it has played a role in WTO dispute settlement, both in the interpretation and application of WTO rules and in respect of arbitration on authorized countermeasures. The essay does not question the economic rationale of WTO rules, although a

good deal could be said about the economic rationale of the rules. Neither does it deal with the much broader question of how economic concepts and terminology have been used or have influenced WTO adjudication bodies in structuring their reasoning.

Quantitative economic analysis has been used to address two main questions – the effect of a policy measure on trade flows (trade effects) and the effect of imports on similar domestic products or their producers.

The first of these questions has been dealt with in the context of arbitrations. Quantitative analysis has been used by some arbitrators to help determine the level of authorized countermeasures. But the issue of trade effects has also arisen in the context of determinations by panels and/or the Appellate Body whether a violation has occurred. In most cases, trade effects do not have to be demonstrated to prove a violation of WTO provisions.

An interpretation may be developed on the basis of the ordinary meaning and context of a WTO provision, as well as in the light of its object and purpose. The difference between arbitrations and Panel/Appellate Body proceedings can be illustrated in the *US–Continued Dumping Subsidy Offset Act (CDSOA)* case, where the Panel and Appellate Body found a violation by concluding that the CDSOA payments constituted a non-permissible specific action against dumping. However, in arbitration, it needed to be determined quantitatively to what extent such payments could affect trade.

The second question referred to above, on the effect of imports on similar domestic products or their producers, typically arises in the context of determining a violation in trade remedy cases. There are also a few WTO cases involving "directly competitive or substitutable" products, where quantitative economic analysis has been used to provide empirical evidence of the intensity of competition, notably by estimating cross-price elasticities.

Quantitative analysis generally involves the specification of a relatively simple model that can be used for estimation purposes.

The essay also provides a basic introduction into technical aspects of trade model-building. Such technical characteristics can be the subject of controversy if models form part of parties' submissions in a dispute. For instance, the application of aggregate elasticities to individual sectors, or of an average elasticity from disaggregated estimates to an aggregated commodity, can lead respectively to the under-estimation or over-estimation of values.

Quantitative economic analysis need not be complex for dispute settlement purposes. Elasticity estimates measuring the responsiveness of one variable to a change in another are the centre-piece of the ("comparative static") partial equilibrium approach used in many instances. Usually, a number of options exist for the construction of a model. The burden of data collection and estimation challenges may have to be compared to the expected gains in precision from greater complexity.

Economic modelling can provide useful benchmark values against which qualitative outcomes may be checked, especially if similar results are obtained using alternative methodologies. This is true despite the lack of absolute precision due to inherent difficulties in empirical work. For instance, a range of possible values may still give a good impression of the direction and magnitude of actual effects and confirm a theoretical penchant or intuitive guess.

The use of quantitative analysis has been relatively frequent in arbitrations and counterfactual analysis has been key in this context.

In arbitrations the concept of counterfactual trade effects – that is, the estimation of the level of trade that would occur if the contravening measure was brought into conformity – has provided the analytical backbone. Even in subsidies cases, such as the *US–Tax Treatment for "Foreign Sales Corporations" (FSC)* case, some analysis of trade effects has been carried out. In the FSC case the analysis played a supporting role, but only insofar as it coincided with the decision of the arbitrators to grant an award based on the value of the subsidy.

Arbitrators have been open to quantification on the basis of economic models where they have found it useful to fulfil their mandates, even though parties have sometimes argued against such analysis. In the *US-CDSOA* case, the arbitrator concluded that while "evaluating the trade effects [of a measure] cannot be accomplished with mathematical precision, ... economic science allows for the consideration of a range of possible trade effects with a certain degree of confidence." (*US–CDSOA (22.6)*: para. 3.125).

In the *US–FSC (22.6)* and *US–CDSOA (22.6)* cases, the arbitrators had to choose among competing models. In the *US–FSC* case, the arbitrator noted that his "task would not be to judge, with absolute precision which is the single correct model or which are the correct parameters, but to examine the results of these models to see if they provide an insight into the range of trade effects caused" *(US–FSCs (22.6)*: para. 6.47). The arbitrator in *US–CDSOA (22.6)* also rejected models proposed by parties in favour of his own approach.

In Panel and Appellate Body proceedings parties have sometimes submitted quantitative analyses, but such analysis has not so far been initiated by adjudicators.

The specific type of analysis submitted by parties in some Panel and AB proceedings has varied depending on the nature of the claims and legal provisions involved. In cases involving "serious prejudice", a complaining party needs to show that its trade flows are affected, for instance, because prices it obtained previously or could be expected to receive have been suppressed due to subsidization. There have only been three serious prejudice disputes to date, and in only one of them – the recent *US–Upland Cotton* case – did a party rely on economic modelling in presenting its claims and arguments.

The Panel was willing to grant that the outcomes of the simulations submitted were consistent with the general proposition that subsidies distorted production and trade and that the effects of a subsidy may vary depending upon its nature. But the Panel did not rely upon the quantitative results of the modelling exercise. This may be understandable when disagreements about a model turn on many technical issues, when documentation is not fully available and when economists themselves give conflicting views on the issues.

In some of the disputes involving taxes on alcoholic beverages (different cases involving Chile, Japan and the Republic of Korea), parties have adduced econometric evidence, in particular on cross-price elasticities, to see whether products were "directly competitive or substitutable". The advantage of using this type of analysis is that it is possible to control for other influences affecting the demand of the relevant good. Yet, in order for results to be reliable, the list of variables included needs to be complete and the posited relationships correctly specified. If, then, enough data of sufficiently high quality were used, the cross-price elasticity would indicate all that there was to know about the relationship between two products. However, in these cases, the interpretation and reliability of estimation results were subject to considerable controversy.

In trade remedy investigations, causation analysis is an important element. In particular, the causal importance of the injurious effects of each factor must be compared separately against the injurious effect of increased imports. A number of academic commentators have considered the kinds of analytical techniques that might be relevant to this analysis. In at least one dispute, the question was raised whether the investigating authorities had conducted a proper causation analysis. The Panel addressed arguments by parties on whether quantification was required and on the use of econometric models. In the same case, complaining parties criticized some of the simplifying assumptions of a model that investigating authorities had used to show that the safeguard measures in question had not been applied beyond the extent necessary.

In sum, quantitative economic analysis can rarely, if ever, provide clear-cut quantitative answers and such analysis certainly cannot determine points of law or dispute settlement outcomes.

But in certain cases, quantitative analysis may strengthen parties' argumentation before panels and increase the comfort level of arbitrators in making an award. Where empirical economic analysis is used, it can certainly help to inform legal reasoning. Quantitative economics can help to avoid misinterpretation when economic rationality is counter-intuitive and less than obvious, but nevertheless pertinent to the substance or direction of legal reasoning.

A limited but encouraging record is being built of how quantitative economics can be employed constructively in dispute settlement proceedings. One reason why the use of quantitative economics may intensify in the future is that cases seem to become more and more "fact-intensive". Parties are not subject to restrictions as to the type of evidence they wish to furnish, and panels themselves have often requested more detailed factual information. Hence, it is possible to discern a trend towards a higher level of technical sophistication upon which the legal argumentation is founded. If properly understood in its supporting role, there is no reason to believe that quantitative economics could not make a bigger contribution to an effective functioning of the dispute settlement process.

Trade in air transport services

The international air transport industry has demonstrated considerable ability to adapt to changes and shocks.

In the past decade technological developments, such as new aircraft and the internet, combined with regulatory change, have had far-reaching effects on the structure and performance of the industry. External events, such as the rise in fuel prices, the events of 11 September 2001, and the Severe Acute Respiratory Syndrome (SARS) outbreak have also had an impact on the industry.

Air transport services have direct and indirect effects on international trade. The sector has grown against a background of real yield declines and static financial performance. Air traffic remains highly concentrated by region.

These services involve the carriage of passengers, the movement of goods (freight), rentals (charters) of carriers and crews, and related supporting and auxiliary services. The WTO estimates that world trade in international air transport services is approximately 10 per cent of world trade in commercial services.

Overall traffic in the industry, as measured in tonne kilometres performed (TKPs) has increased steadily. The only two exceptions are in 1991 and 2001. Real yields in the industry have also been declining as revenues over expenses have been static. Taken together, these two indicators suggest that the financial performance of the industry has been fairly static. This weak performance is against a backdrop of increases in costs of inputs, such as fuel and labour, and productivity gains. In 2003, approximately 1,657 million passengers and 34.5 million tonnes of freight were carried.

International air traffic is highly concentrated. Flights between three regions of the world – East Asia, Europe and North America – account for 77 per cent of the total seat-kilometres available on international routes. International flights in Africa account for only 0.6 per cent of the total.

Change in the operating environment for international air transport services has resulted in an increasingly competitive industry.

Carriers have opted for a number of different ways to compete; including developing new business models, such as low cost carriers and non-price forms of competition such as airline alliances.

Deregulation and liberalization of the industry have allowed international air carriers to accommodate growth in demand for air transport in two different ways. First, in some cases, a hub and spoke model has emerged; where key ports in each region serve as hubs to connect different regions. Second, alongside this approach is a point-to-point model, where air traffic is not routed through hubs, but directly between city-pairs that connect various regions. Less government regulation has increased the competitive challenge for carriers.

Measures to address private anti-competitive practices are an important adjunct of efforts to liberalize international air transport markets.

If carriers are permitted to create market power through mergers, joint ventures and strategic alliances, or to collude or engage in predatory or other anti-competitive actions, this will limit the potential benefits from deregulation and liberalization.

Trade in international air transport services is regulated by a system of bilateral agreements that were developed in 1944. Competitive pressures have resulted in the development of a new breed of more liberal bilateral agreements called "Open Skies" agreements. A number of regional initiatives to govern international air transport have also been developed.

The General Agreement on Trade in Services (GATS) has been developed to govern international trade in services and provide opportunities for trade liberalization.

The GATS, however, only applies to three services that are relevant to international air transport. These are aircraft repair and maintenance services, the selling and marketing of air transport services and computer reservation services.

Differing views persist over the desirability of extending the GATS to cover all aspects of international trade in airline services. The principal area of difference turns on the question whether the pace and depth of liberalization delivered through existing bilateral approaches is sufficient to create an enabling environment that ensures the growth of the industry and its contribution to international trade.

Offshoring services

There is no commonly accepted definition of "offshoring" in the public debate nor in the economic literature. However, the term "offshoring" is widely used as a particular subcategory of "outsourcing". The latter has been defined as "the act of transferring some of a company's recurring interval activities and decision rights to outside providers, as set in a contract". From an international trade perspective, captive offshoring (supplies sourced from an affiliated firm abroad) and non-captive offshoring (supplies are sourced from a non-affiliated firm abroad) are particularly relevant.

The impact of offshoring services on production, employment and trade patterns is significantly less than suggested by press reports or popular perceptions.

The number of jobs affected by offshoring of information technology (IT) is small if related to overall employment in the developed countries most affected. It is also small in the countries which have started exporting IT services if related to their total employment. According to balance-of-payments statistics, Ireland and India have been the major beneficiaries of offshoring services. In Ireland, some 24,000 people were employed in the entire software industry (including but not limited to offshoring) in 2003. The relevant figure reported for India was 568,000.

Moreover, the United States and the United Kingdom have often been portrayed as the economies most severely affected by growing trends in offshoring of IT services. However, both the United States and the United Kingdom report a larger trade surplus in business services (including IT services) than India in 2003. In the case of the UK this surplus was even rising between 2000 and 2003.

Neither domestic outsourcing nor offshoring are new phenomena. They are conceptually no different from other forms of specialization that drive comparative advantage.

Among the determinants of decisions by enterprises whether to "make-or-buy" are the degree of feasible technical and institutional separability, the degree of standardization of tasks, transaction and managerial costs within the firm relative to outside suppliers, production costs, and the size of the market. As to the choice of foreign location for offshoring, among the determining factors are labour costs, trade costs, the quality of institutions, the tax and investment regime, the quality of infrastructure and workforce skills (particularly relating to language and computers).

Gains from offshoring accrue to both the countries exporting and importing the IT services.

The gains from offshoring in services-exporting countries are employment creation, capital inflows, a new channel for technology transfer and an opportunity to enter new industries before domestic demand can support them. Offshoring is not, however, a panacea for developing countries. Rising employment in the

export oriented business services can only account for a rather small part of the overall rise of the labour force in developing countries in the years to come. Moreover, evidence from India suggests that most of the recent growth in offshoring services has not been at the high-skill end of the IT sector.

The importing countries are able to release resources for more efficient uses elsewhere. Neither the efficiency gains nor the adjustment costs of new offshoring arrangements entered into in recent years are particularly large, as the activity is small from an economy-wide perspective.

The GATS offers opportunities for multilateral trade liberalization commitments on offshoring services.

Improvements in the GATS, such as a clearer distinction in the definition of mode 1 and mode 2, and more clarity in the nomenclature used in schedules of commitments, could facilitate new commitments and reduce uncertainty as to their implications. These are not issues limited to offshoring services, but have wider implications for the overall functioning and utility of the GATS.

I RECENT AND SELECTED MEDIUM-TERM TRADE DEVELOPMENTS

A RECENT TRENDS IN INTERNATIONAL TRADE

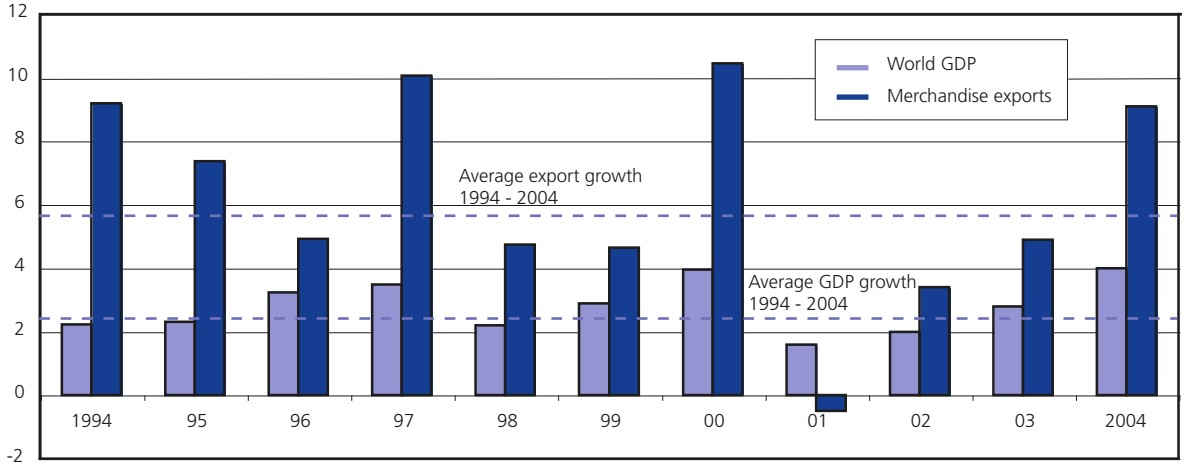
1. INTRODUCTION: TRADE AND OUTPUT EXPANDED ABOVE THE LONG-TERM GROWTH TREND IN 2004

The world economy grew at 4 per cent in 2004, the strongest annual growth rate in more than a decade. Global GDP last year was also more broadly based regionally than in the three preceding years, providing a solid basis for an acceleration in world trade growth. World merchandise trade rose by 9 per cent in real terms in 2004, the best annual performance since 2000, and more than twice as fast as world output (GDP measured at market rates) in 2004. Trade growth in 2004 also significantly exceeded average trade growth recorded over the last decade (see Chart 1 and Table 1).

At 7 per cent and 8 per cent respectively, developing Asia and the Commonwealth of Independent States (CIS) countries continued to report the strongest regional GDP growth worldwide. South America recorded GDP growth of 6 per cent, which represented not only the strongest improvement against the preceding year among regions, but also the highest growth rate since 1986. Africa and the Middle East registered GDP growth of approximately 4 per cent in 2004. This was faster than in the 1990s, and about the same rate as the global economy. North America's growth strengthened to 4.3 per cent, exceeding its expansion rate in the last two decades, which averaged slightly above 3 per cent. Economic activity picked up in Europe and Japan, but growth remained at 2.3 per cent and 2.6 per cent respectively in 2004, which was much weaker than the performance of all other regions. The weakness of European growth was concentrated in the euro-area, which recorded GDP growth of only 2 per cent.[1]

Per capita income increases do not necessarily reduce unemployment rates nor poverty. However, the strength of the economic expansion improved the employment situation in North and South America, in the CIS, and in Asia in 2004. Among the major developed countries, unemployment levels decreased in Australia, Canada, the United Kingdom and the Unites States as well as in Japan, but stagnated at high levels in the euro area.[2] According to ECLAC, urban unemployment decreased overall in Latin America, as the high unemployment rates prevailing in Argentina, Brazil, Colombia and Venezuela were significantly reduced in 2004.[3]

Chart 1
Growth in the volume of world merchandise trade and GDP, 1994-2004
(Annual percentage change)



Source: WTO.

1 A new regional breakdown has been introduced and is applied for the analysis of international trade flows in Section IA of this Report. The change in the country composition of regions was triggered by the enlargement of the EU in May 2004 which made the former grouping of "Western Europe" and "transition economies" redundant. Another major change has been made for the Americas, by including Mexico in North America, and the creation of a new region – South and Central America (including the Caribbean). For details see Technical Notes.

2 OECD, OECD Economic Outlook, Volume 2004/2, Nº 76, December 2004.

3 Economic Commission for Latin America, Preliminary Overview of the Economies of Latin America and the Caribbean, 2004.

Table 1
World trade and output developments, 1990-2004
(At constant prices, annual percentage change)

	1990-2000	2000-2004	2001	2002	2003	2004
Merchandise exports	6.4	4.2	-0.5	3.5	5.0	9.0
Merchandise production	2.5	...	-0.7	0.8	2.8	...
GDP at market exchange rates	2.5	2.5	1.4	1.8	2.6	4.0
GDP at PPP	3.4	3.6	2.4	3.0	3.9	5.0

Source: WTO; IMF, World Economic Outlook.

Monetary and fiscal policies continued to accommodate the recovery in most regions. Real interest rates remained very low and public deficits remained relatively large in the major economies. However, fiscal deficits did not widen further in 2004. Stock markets recovered markedly in the course of the year.[4]

The moderate increase in global foreign direct investment (FDI) inflows in 2004, after a steep fall over three years, also suggests improved business confidence in the state of the world economy.[5] The United States, a number of Asian developing countries, and also some Latin American countries were the principal beneficiary of the increase in global FDI flows. Despite the recent recovery in FDI flows, the 2004 level of some $600 billion was less than half the peak level recorded in 2000 and still below the level reached in 1998. One of the new developments in global FDI flows was the emergence of China as an investor in natural resources in a number of developing countries.[6] Total capital flows to emerging developing markets outside Europe increased in 2004, according to estimates made by the Institute of International Finance.[7] The increased net FDI inflows and private lending, together with a decrease in net official outflows, contributed to the marked rise in foreign exchange reserves in these economies.

Domestic inflation picked up moderately in the course of 2004, under the impact of strengthened economic activity and the increase in world fuel prices. The repercussions of higher oil prices on the domestic price level was attenuated in many countries by a currency appreciation *vis-à-vis* the US dollar, and in some cases by government measures, including price controls for petroleum products sold in local markets. Dollar prices of internationally trade goods increased by 11 per cent in 2004. The overall increase in commodity prices by about 25 per cent conceals wide differences among various product groups. Prices of fuels and metals recorded a marked increase in the course of 2004, lifting their average annual prices by 31 per cent and 36 per cent respectively. Rising global demand, combined with a decline in readily available reserves and the absence of excess production capacity provided the basis for stronger oil prices.[8] Unexpectedly strong demand from China in the course of the year, geopolitical tensions, and temporary selective transportation bottlenecks provoked large variations in monthly price developments.[9] Nominal oil prices reached $55 per barrel in November, a record monthly level. The annual average crude oil price rose to $36 per barrel in 2004, and matched the previous historic peak level of 1980. Deflated by the world merchandise export price index (base year 2000), the "real" oil price stood at $30 in 2004, double the level of 1995, and the highest level since 1985 (see Chart 2).[10]

Prices of agricultural raw materials and beverages, however, rose by only 3 to 6 per cent while food prices went up by 14 per cent. Prices of manufactured goods are estimated to have risen by 8.5 per cent on average in 2004. There were marked differences in the price developments of manufactured goods, not only regionally but also by product categories. Dollar prices in countries with an appreciating currency have recorded a much faster price

4 In respect of stock markets, the Morgan Stanley Capital International World Index reported an increase of 10.6 per cent, and the Citigroup World Government Board Index recorded a total return of 9.6 per cent on December 31, 2004, according to The Economist, January 15th-21st, 2005.

5 UNCTAD, Press Release 11/01/05.

6 The agreement reached between IBM and the Chinese firm Lenovo on the sale of the IBM's PC business in December 2004 indicates that China's foreign direct investment is not limited to primary commodities.

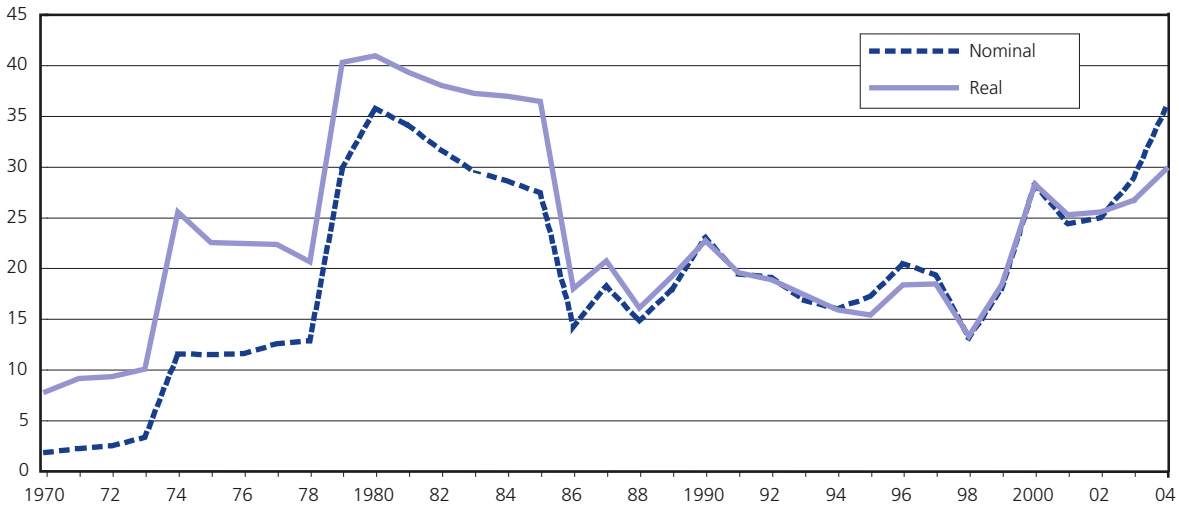
7 Institute of International Finance, Capital Flows to Emerging Markets, 19 January 2005.

8 Global oil demand rose by 3.3 per cent, to 2.66 million barrels per day in 2004, according to the International Energy Agency. See International Energy Agency (IEA), Monthly Oil Market Reports, January 2005.

9 OECD (2004) and IEA, Monthly Oil Market Reports.

10 There are different approaches to calculating the "real" oil price. Sometimes the nominal oil price is deflated by the US GDP deflator, and in other cases by the export unit value index of manufactured goods of developed countries. In reviewing global trade flows, the world export price index is considered to be the most appropriate deflator.

Chart 2
Crude petroleum price developments, 1970-2004
(US$/barrel)



Note: Real price is obtained by deflating the nominal IMF crude oil spot price by the WTO world export unit value index (2000=100).

increase in their exports of manufactured goods than those with a stable exchange rate *vis-à-vis* the US dollar. As regards relative price developments of the different product groups, it can be observed that the prices for iron and steel products surged, while those of computer and telecom equipment decreased. For iron and steel, strong global demand from the construction and investment goods industries, together with sharply higher prices of ores used as inputs, caused the steep price increase. For computer and telecom equipment, productivity gains and capacity expansion more than offset higher demand. Exports of chemicals, in particular organic chemicals and plastics, recorded price increases which exceeded those of all manufactured goods.

Prices, exchange rates and demand developments have all influenced global trade flows measured in dollar terms during the year. Higher oil and metal prices sharply increased the share of fuels, metals and iron and steel in world merchandise exports, to a new cyclical peak level. The Middle East, Africa and the CIS member countries are large net exporters of fuels and metals, and their share in world merchandise trade recovered further in 2004, largely due to these price developments. As developing Asia and South America also recorded merchandise export growth in excess of 25 per cent in 2004, the share of the developing economies in world exports reached a new peak level of 31 per cent.

The strength of developing Asia's merchandise exports can be attributed partly to recovery in the electronic goods sector.[11] Global shipments of digital cameras, mobile phones, semiconductors and personal computers expanded at double digit rates. For five Asian economies, office and telecom equipment accounted for between one-third and two-thirds of their exports in 2004, and played an important part in their export expansion.[12]

2. REAL MERCHANDISE TRADE DEVELOPMENTS IN 2004

The Asian region recorded the highest volume of real merchandise export growth in 2004, at 14.5 per cent. China, the Republic of Korea and Singapore recorded rates in excess of 20 per cent. Japan's real merchandise exports rose by 11 per cent, somewhat faster than world trade. Asia's merchandise import growth was close to 15 per cent in 2004, an acceleration in comparison to the preceding year. At a regional level, merchandise

[11] Worldwide mobile phone shipments rose by 29.3 per cent, to 665 million units in 2004 according to International Data Corporation (IDC) Press Release, 27 January, 2005. Unit shipments of personal computers recovered worldwide by 11.6 per cent, to 183 million in 2004 according to Gartner, Press Release, February 2005. Global sales of semiconductors advanced by 28 per cent, to $213 billion in 2004 according to the Semiconductor Industry Association, Press Release, 31 January, 2005.

[12] The five Asian economies are: Chinese Taipei, Malaysia, the Philippines, the Republic of Korea and Singapore.

import growth accelerated and matched the export expansion but at the country level large differences in export and import growth could be observed. Japan and the Republic of Korea report a markedly larger real export than import growth in 2004, while all other Asian economies combined expanded their imports in constant prices faster than their exports.

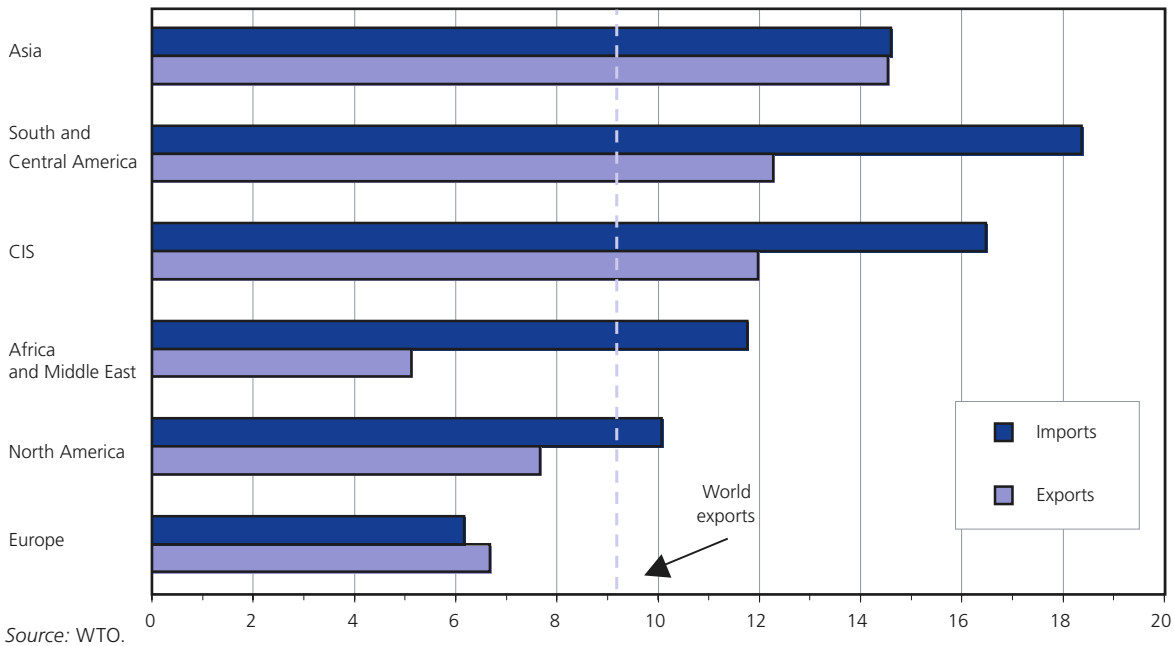
Linked to its economic recovery, South America's real merchandise trade rebounded vigorously in 2004. Real imports expanded nowhere faster than in this region. However, a number of economies in Central America and the Caribbean did not participate in this outstanding trade expansion, which was largely shaped by the region's major traders. Real merchandise imports in South America grew by 18.5 per cent, which was twice as fast as world trade in 2004. Argentinean and Venezuelan imports recovered dramatically, rising by at least 50 per cent, while those of Brazil and Chile expanded by 20 per cent. The region's export growth fell short of its import expansion, largely due to the sluggishness of exports from major traders such as Argentina and Colombia, and the incomplete recovery of shipments from Venezuela. Merchandise trade growth in the smaller economies of Central America and the Caribbean remained well below the regional average for both exports and imports.

Africa's trade expanded strongly in 2004. Exports rose by some 6 per cent and imports by approximately 11 per cent in real terms. Real export growth was about the same as in 2003 and much higher than in 2001 and 2002. On the import side, however, real growth in 2004 was considerably higher than in previous recent years. Nominal growth in African exports was, of course, dramatically higher in 2004 than in previous years because of oil price rises (see Section 4 below).

Merchandise exports and imports of the CIS continued to rise in real terms at a pace considerably faster than world trade. Benefiting from sharply higher world market prices for fuels and metals, which contributed to a sharp rise in export earnings, real imports of the CIS continued to expand, exceeding world trade growth for the fourth consecutive year. The region's real exports are estimated to have also expanded faster than global trade, although somewhat less rapidly than in the preceding year.

North America's export recovery, which started in 2003, gained momentum in 2004. Rising by 7.5 per cent, the region's exports again exceeded their previous peak level in 2000. Import growth accelerated by 10 per cent, thereby continuing to exceed the region's export growth. Mexico's import growth rebounded strongly and nearly matched the regional average while its exports recovered only moderately, remaining below their 2000 level. The development of Canada's trade contrasted with that of the United States and Mexico as Canada's exports expanded faster than imports in 2004.

Chart 3
Real merchandise trade growth by region, 2004



Source: WTO.

The pick-up in Europe's merchandise trade played an important part in the recovery of world merchandise trade, as the region accounts for about 46 per cent of global trade (exports and imports of merchandise and commercial services combined). Europe nevertheless recorded the lowest real merchandise import growth rate among all regions, a reflection of weak demand growth. Exports expanded faster than regional imports, but much less than global trade (see Chart 3).

The trade performance of individual European countries showed considerable variation, but a broad pattern can be discerned for European trade developments in 2004. Countries at the eastern border of the region reported the highest export and import growth, even exceeding the world average. The countries situated at the centre of the region recorded trade growth exceeding the regional average (exports and imports combined), while those situated at the western border of Europe experienced trade growth below the regional average. The first group of countries comprises new EU members such as the Baltic States, Poland, the Czech Republic, the Slovak Republic, Hungary and Slovenia, as well as the EU candidates, Romania and Bulgaria. The second group includes Germany, Sweden, the Benelux countries and Austria, which all reported more dynamic export than import growth in 2004. In the third group of countries, real merchandise export growth was weak (about 3 per cent in France, Ireland and Spain), stagnated (United Kingdom) or declined (Portugal). And although real merchandise import growth in this third group was stronger than for their exports, it remained below European average trade growth in 2004. Domestic demand growth was weaker in the second group than in the third, which contributed to the relative dynamic performance of exports in the central European group, and the relatively stronger performance of imports in the west European group.

But why did total trade (both exports and imports) expand more rapidly in the second than in the third group? And what could explain high trade growth in the eastern part of Europe? It seems that several factors played a role in this outcome. First, the enlargement process to the East of the European Union is fostering an integration process above all between the eastern and central part of Europe, resulting in a sharp rise in intra-industry exchanges (e.g. automobiles). Second, at the date of joining, some remaining barriers to merchandise trade between the old and new members were removed (e.g. in particular in the agricultural sector), leading to an additional boost to trade flows in 2004. Third, the trade of South-East Europe has benefited from lower trade barriers within the region in recent years, thanks to the Stability Pact for South-East Europe, with its extensive network of 28 bilateral free trade agreements. In some cases, the EU enlargement also provided improved access to the markets of the new EU members for countries in South-East Europe. Fourth, eastern and central European countries benefited from vigorous import demand in the CIS, perhaps more so than western European countries, given historical trade ties.[13]

3. NOMINAL MERCHANDISE AND COMMERCIAL SERVICES TRADE DEVELOPMENTS IN 2004

In 2004, the value of world merchandise trade rose by 21 per cent, to $8.88 trillion, and that of world commercial services trade by 16 per cent, to $2.10 trillion. For both merchandise and commercial services trade this represented an acceleration of growth for the third year in a row, and the strongest rise since 2000. A particular feature of nominal trade growth in 2004 was the fact that one major merchandise product – fuels – and one major services category – transportation – recorded an above average performance in 2004. Both these sectors had lagged well behind overall trade growth during the last two decades. In both cases, relatively strong prices contributed significantly to this outcome (see Table 2).

Table 2
World exports of merchandise and commercial services, 2001-2004
(Billion dollars and percentage)

	Value	Annual percentage change			
	2004	2001	2002	2003	2004
Merchandise	8880	-4	5	17	21
Commercial services	2100	0	7	13	16

Source: WTO.

[13] United Nations, Economic Commission for Europe, Economic Survey of Europe, 2005, Nº1, Chapter 6: Foreign Trade and Payments in the EU-10, South-East Europe and the CIS. In particular Box 62.2 Towards a free trade area in South-East Europe.

Price developments largely explain the differences in merchandise trade developments by region in 2004. Primary products and fuels are prominent in the merchandise export structure of Africa, the Commonwealth of Independent States, the Middle East and South America. The strength of global demand for fuels and metals, combined with substantial price increases, boosted the merchandise exports of these regions, with annual growth ranging from 26 per cent (Middle East) to 35 per cent (CIS). Despite this exceptionally strong increase, the combined share of these four regions in world merchandise trade amounted only to 13 per cent in 2004. All four regions are net exporters of fuels, which contributed to the fact that their merchandise exports expanded faster than their merchandise imports and that their merchandise trade surplus widened further in 2004. However, the strength in export earnings also stimulated import growth, which in each region is estimated to have grown faster than world merchandise trade. Asia, Europe and North America are all net importers of fuels and recorded an excess of import growth over export growth in dollar terms in 2004. Merchandise exports of the Asian region expanded by 24 per cent and thereby slightly less than imports, but still faster than global trade and faster than in the preceding year. Merchandise exports of Europe and North America were the least dynamic of all regions, expanding in dollar terms by 19 and 14 per cent respectively. North America's merchandise exports and imports rose faster than in the preceding year. No acceleration in the nominal trade growth could be observed for Europe's exports and imports in 2004, which expanded slightly less than the global average (see Table 3). A more detailed breakdown of merchandise trade by region is provided in Appendix Table 1.

Table 3
World merchandise trade by major region, 2004
(Billion dollars and percentage)

	Exports					Imports				
	Value	Annual percentage change				Value	Annual percentage change			
	2004	2001	2002	2003	2004	2004	2001	2002	2003	2004
World	8880	-4	5	17	21	9215	-4	4	16	21
North America	1330	-6	-4	5	14	1727	-6	2	7	16
United States	819	-6	-5	4	13	1526	-6	2	8	17
South and Central America [a]	272	-2	0	13	28	238	-1	-13	5	27
Europe	4024	1	7	19	19	4133	-2	5	20	20
European Union (25)	3708	1	7	19	19	3784	-1	5	20	19
CIS	263	0	5	27	35	171	16	9	27	31
Africa	228	-6	3	23	31	207	4	1	22	25
Middle East	379	-8	5	21	26	243	5	4	13	23
Asia	2385	-9	8	18	25	2214	-7	6	19	27
China	593	-16	22	35	35	561	-8	21	40	36
Japan	565	7	3	13	20	455	8	-3	14	19

[a] Includes the Caribbean.
Source: Appendix Table 1.

On a country level, a large number of countries which export primarily fuels and other mining products recorded export increases between one-third and about one-half – for example, Chile (52 per cent), Kazakhstan (54 per cent), Nigeria (57 per cent) – while only a few countries recorded a decline in their merchandise exports. The latter outcome is attributable either to political instability (e.g. Côte d'Ivoire) or natural disasters (e.g. hurricane-affected Caribbean economies).

Among the 20 leading merchandise exporters, China replaced Japan as the third largest exporter. The Russian Federation moved ahead of Chinese Taipei and Singapore, and became the world's fourteenth largest exporter. China and the Russian Federation both expanded their exports by more than one-third in 2004. Exports of the Republic of Korea increased by 31 per cent, making the country the twelfth largest exporter in the world. Among the top 20 importers in 2004 the ranking of France, Belgium and Chinese Taipei improved (see Appendix Table 3).

Commercial services trade growth by region differed less than merchandise trade across regions in 2004. It is estimated that above global average growth was experienced in the CIS and Asia (for both exports and imports), while in North and South America commercial services trade was less dynamic than world trade. However, in all four regions the growth in the dollar value in 2004 exceeded that in 2003, for both exports and imports. In Europe, the world's largest services trader, however, exports and imports of commercial services expanded less rapidly in 2004 than in the preceding year. A detailed breakdown of world commercial services by region is provided in Appendix Table 2.

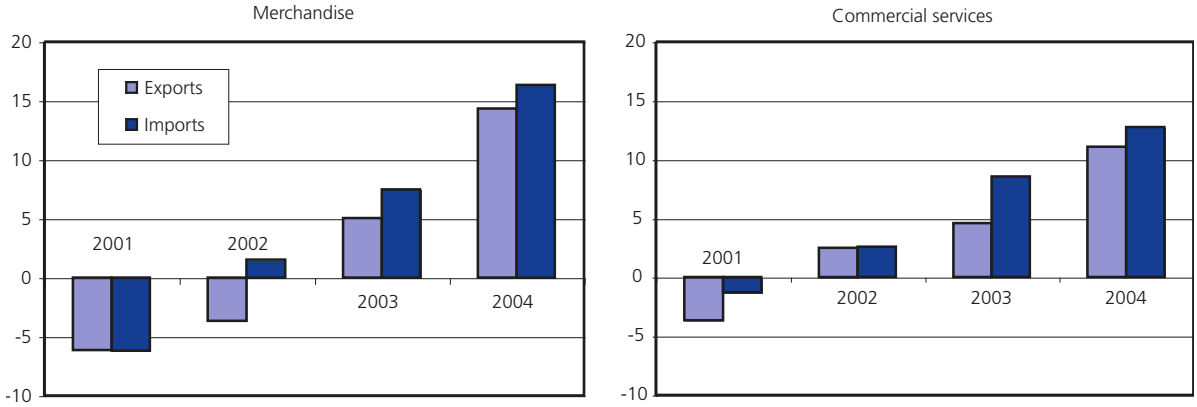
Information (albeit incomplete) on commercial services trade by country in 2004 point to faster growth in commercial services trade in the Asian economies than in North American or European economies. The services exports and imports of the United States rose somewhat less rapidly than world services trade, but the United States remained the world's largest exporter and importer of commercial services. Partly due to a revision of its services statistics, Japan is now ranked as the fifth largest exporter of commercial services, moving ahead of Italy and Spain. Although Japan's commercial services imports rose faster than world services trade in 2004, Japan continued to be the fourth largest importer. Among the major European traders, the United Kingdom recorded the strongest export growth, thereby confirming its position as Europe's leading services exporter. Although German services exports and imports rose less rapidly than world services trade, Germany kept its position as the world's second largest services importer and the third largest exporter in 2004 (see Appendix Table 5).

4. REGIONAL TRADE DEVELOPMENTS

North America's GDP grew 4.3 per cent in 2004, the highest rate since 1999. This acceleration in economic growth can be attributed largely to the strengthening of US domestic demand (4.7 per cent), which benefited from a rebound of nearly 9 per cent in fixed investment. Mexico's GDP growth of 4 per cent in 2004 contrasted favourably with its sluggish growth in the three preceding years. Despite a deceleration in domestic demand growth, Canada's GDP grew faster in 2004 than in 2003 due to the reversal in its external balance.

As economic activity picked up, the trade expansion accelerated in 2004. North America's merchandise exports rose by 14 per cent to $1.33 trillion, again less than merchandise imports, which increased by 16.3 per cent to $2.01 trillion. It is estimated that the region's commercial services trade expanded less rapidly than merchandise trade, with imports up by nearly 13 per cent and exports up by 11 per cent in 2004 (see Chart 4). Consequently, the region's overall merchandise trade deficit continued to rise and the surplus in commercial services was further eroded.

Chart 4
North America's merchandise and commercial services trade, 2001-2004
(Annual percentage change in value)



Source: Appendix Tables 1 and 2.

Trade developments of the North American region are largely driven by the US economy. The United States accounted for more than 70 per cent of the region's merchandise imports and more than 60 per cent of its exports. Trade developments in the United States also have a major impact on global trade flows as US merchandise imports are the largest in the world, and at $1.526 trillion exceeding the extra-regional imports of the enlarged European Union(25) in 2004.

The US merchandise trade deficit continued to rise to a new record level, while the commercial services trade surplus stagnated. The United States recorded a merchandise trade deficit with all seven major regions and in all these bilateral trade flows US imports rose faster than US exports in 2004. Seemingly, exchange rate adjustments had only a limited impact on trade flows in 2004, as imports from countries and regions with appreciating currencies also increased faster than US exports to these regions (e.g. Japan and Europe). Although nearly one-half of the US merchandise trade deficit is accounted for by trade with Asia, the excess of imports over exports in relative terms is even larger with Africa, the CIS and the Middle East. US imports from the latter regions are two to three times larger than the corresponding export flows.

The large and rising deficit in 2004 underlines the role of the United States in the global trade expansion, even though the share of US imports in world merchandise imports decreased slightly for the second year in a row. These value developments conceal the fact that US imports continued to rise in real terms (11 per cent) faster than world merchandise trade, as US import prices increased far less rapidly than global trade prices.

In 2004, US merchandise imports from its three major trading partners – Asia ($568bn), North America ($418bn) and Europe ($317bn) – increased less rapidly than from South America ($105bn), the Middle East ($54bn), Africa ($48bn) and the CIS ($15bn). On the export side a similar development could be observed, with shipments to the latter regions growing faster than those to the three major trading partners of the United States. Although the performance of US trade by region largely reflects the relative strength of the various markets in 2004, it should be noted that US exports continued to lose market shares, as US export growth remained well below overall import growth in Asia, Europe, North America and South America.

US trade with Asia, its largest trading partner (exports and imports combined), has undergone marked changes since the middle of the last decade. While the share of Asia in US imports decreased from 42 per cent in 1995 to 37 per cent in 2004, the share of China more than doubled from 6.2 per cent to nearly 14 per cent over the same period.

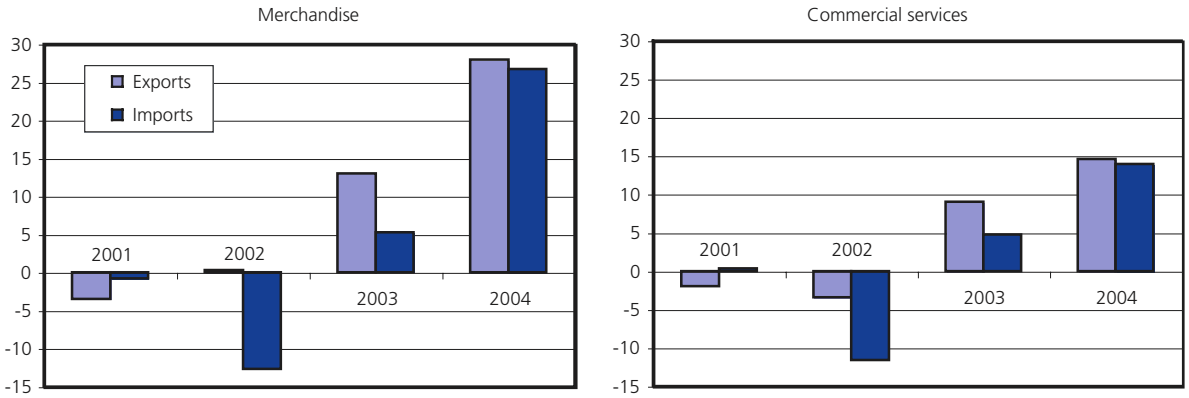
The further decline of the overall Asian share in US imports in 2004 was partly due to the one-third rise in US fuel imports, to $206 billion, which are largely sourced from the Americas, Africa and the Middle East. Imports of manufactured goods, which predominantly originate in Asia, increased by 14 per cent to $1175 billion. The rise in fuel imports was largely due to an average price increase of 28 per cent over the year. Adjusted for price changes, the real increase of US fuel imports was limited to 5.5 per cent, or about one-half of the overall volume increase. Among manufactured goods, imports of office and telecom equipment rose by 18 per cent, to $208 billion, and were only surpassed by imports of iron and steel products which went up by 102 per cent, to $22 billion. Imports of clothing ($72bn), toys, sporting goods ($22bn) and footwear ($16.5bn) increased in a range of 4 to 6 per cent. Imports of road vehicles rose by nearly 9 per cent, which was less than growth in all manufactured good imports.

US merchandise exports expanded less rapidly than imports in every sector with the exception of aircraft (incl. parts) and chemicals. Exports of all manufactures goods rose by 11.7 per cent while the corresponding imports increased by 14 per cent. Consequently, the US trade deficit in manufactured goods rose to a new record level ($562bn f.o.b-c.i.f), while the surplus in agricultural commodities trade shrank (to $7bn).

In 2004, US commercial services trade was marked by a rebound in transportation and travel services, which expanded at double digit rates on the export and import side. The strong rise in transportation services can be attributed partly to increased trade activity and partly to sharply higher prices for many transportation services. The acceleration in the expansion of commercial services trade in 2004 was attenuated by a deceleration in the growth of the "other commercial services" trade category (both exports and imports).

At almost 6 per cent, economic growth in South and Central America (including the Caribbean) was outstandingly strong in 2004, and contributed to a marked expansion of exports and imports. The region's merchandise exports rose by 28 per cent, to $272 billion, and its imports by 27 per cent, to $238 billion. Although commercial services trade accelerated too, its expansion was only half that of merchandise trade and less than the growth rate of world trade in commercial services (see Chart 5).

Chart 5
South and Central America's merchandise and commercial services trade, 2001-2004
(Annual percentage change in value)



Source: Appendix Tables 1 and 2.

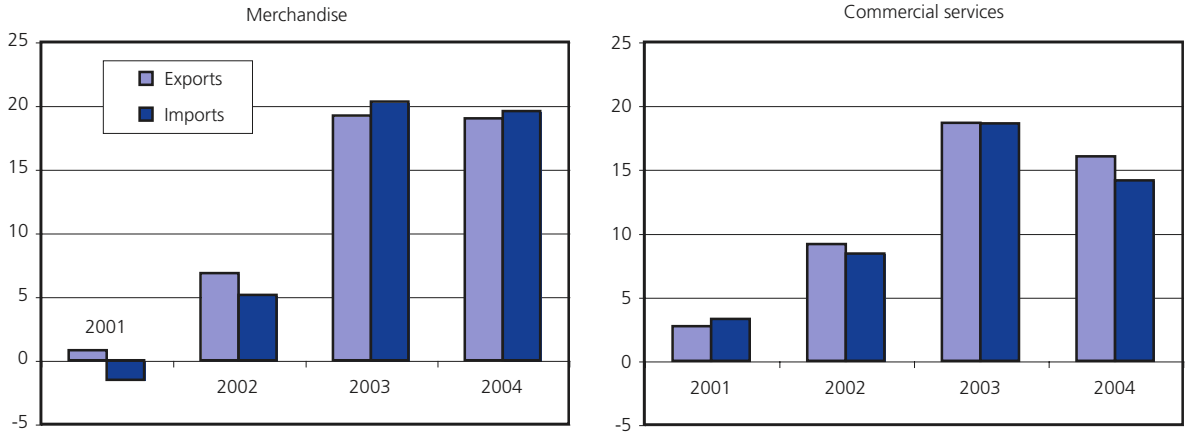
The region's merchandise exports benefited from favourable global demand trends for many of its major products (fuels, metals and agricultural products), which led to higher prices and a recovery of intra-regional trade. Among the four major exporters in the region, three of them – Brazil, Chile and Venezuela – recorded an increase in merchandise export earnings of more than 30 per cent in 2004. Argentina, the second largest merchandise exporter in the region, reported an increase of "only" 16 per cent, but its merchandise exports reached a new peak level. Despite the outstanding surge in the merchandise imports of Argentina and Venezuela (62 per cent and 87 per cent respectively) in 2004, the value of imports remained well below their previous peak levels in both countries. This highlights the severity of the import contraction in preceding years caused by a financial crisis (in Argentina) and domestic unrest (in Venezuela). Merchandise trade of both Central America and the Caribbean was far less dynamic than that of South America in 2004. Exports and imports of the seven Central American countries combined, and those of the group comprising 16 Caribbean countries, are estimated to have increased by about 9 per cent. A small number of them, affected by bad weather, even experienced a decrease in merchandise exports. Commercial services exports are in many Caribbean countries larger than merchandise exports. For the Caribbean countries combined, however, merchandise exports of about $18 billion still exceeded commercial services exports, as the latter are estimated to have grown at about the same rate as merchandise exports.

The dollar value of Europe's merchandise exports and imports increased by about 20 per cent in 2004, roughly the same rate as in 2003. Commercial services trade rose by about 15 per cent, which was less than Europe's merchandise trade and less than in the preceding year (see Chart 6).

About two-thirds of the increase in the dollar value of Europe's merchandise trade can be attributed to the impact of the appreciation of European currencies *vis-à-vis* the US dollar and some genuine price changes.[14] The newly enlarged EU, with its 25 member states, accounted for somewhat more than 90 per cent of Europe's total trade. Merchandise trade growth in the 10 new EU members was, at about 30 per cent, far more dynamic than the trade growth of the old 15 members. The share of the new members in total EU merchandise exports and imports reached 7 per cent and 8 per cent respectively in 2004. The dollar value of the new EU members' imports ($300bn,c.i.f) exceeded not only their own exports of $260 billion, but also the merchandise imports of the Middle East ($243bn), South America ($238bn) and Africa ($207bn). Exports and imports of South-East Europe, comprising seven Balkan countries and Turkey, also expanded much faster than the European average in 2004. Among the major European traders, German merchandise exports expanded by 22 per cent, much faster

[14] Measured in euro terms Europe's merchandise exports rose by 8.2 per cent in 2004 following a stagnation in 2003.

Chart 6
Europe's merchandise and commercial services trade, 2001-2004
(Annual percentage change in value)



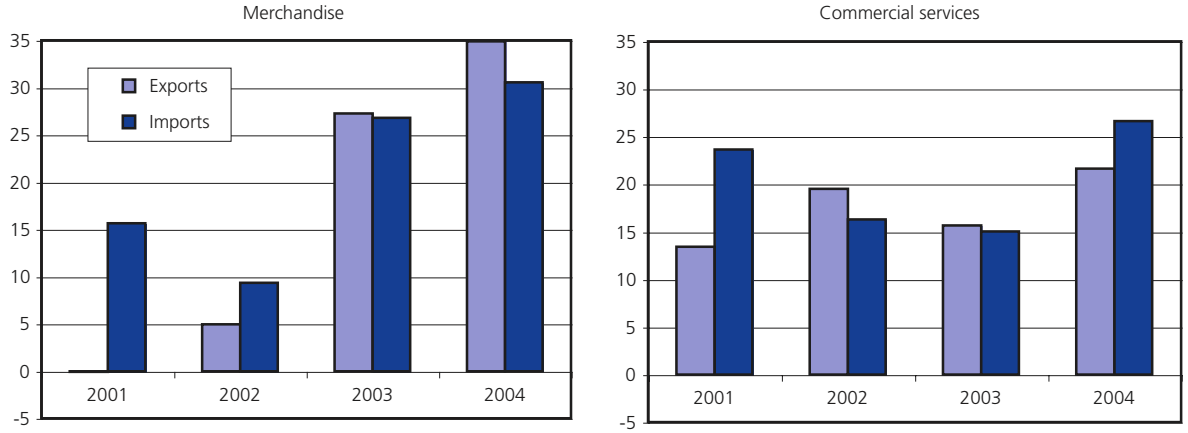
Source: Appendix Tables 1 and 2.

than those of Italy (16 per cent), France (15 per cent) and the United Kingdom (13 per cent) in 2004. Merchandise import growth was more uniform among these four major traders, with German imports only a few percentage points ahead. The relatively dynamic export and import performance of Germany in 2004 might be attributed partly to its close economic ties with the fast growing new EU members, and the global recovery in demand for investment goods, which figure prominently in the German export structure.

Europe's commercial services exports (and imports) rose by 16 per cent (14 per cent) to $1114 billion ($1019 billion) in 2004, consolidating Europe's moderate commercial services trade surplus.[15] According to preliminary information, Europe's receipts from transportation services rose faster than those from other commercial services and travel in 2004. The EU(25), other western Europe (comprising Iceland, Norway and Switzerland) and South-East Europe each recorded a surplus in their commercial services trade.

The dollar value of the merchandise and commercial services trade of the Commonwealth of Independent States again expanded much faster than global trade in 2004. Merchandise exports and imports were up by 35 and 31 per cent respectively, and commercial services trade is estimated to have risen by more than 20 per cent (see Chart 7). The CIS merchandise export surplus, which was already large in 2003, increased further in 2004. As this surplus of about $100 billion (f.o.b-f.o.b.) is substantially in excess of the region's commercial services deficit ($15 billion to $20 billion), the resulting size of the current account surplus led to a sharp rise in foreign exchange reserves, in particular in the Russian Federation.

Chart 7
CIS merchandise and commercial services trade, 2001-2004
(Annual percentage change in value)



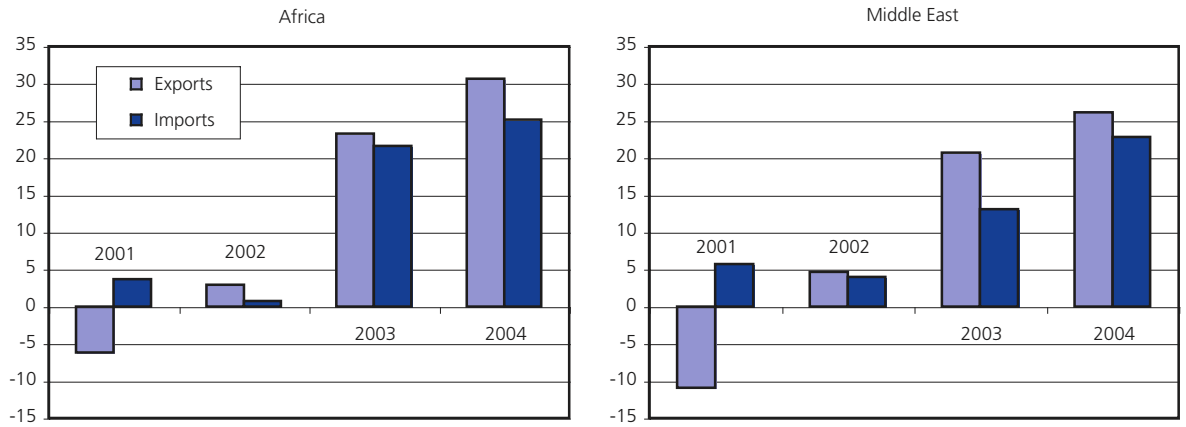
Source: Appendix Tables 1 and 2.

[15] The euro value of Europe's commercial services exports (imports) is estimated to have increased by 5.4 per cent to € 897 billion (€ 820 billion) in 2004.

The Russian Federation alone accounts for nearly 70 per cent of the CIS exports and 55 per cent of its imports. Ukraine and Kazakhstan, accounting for 12 per cent and 8 per cent of the CIS exports, expanded their export shipments by 42 and 54 per cent respectively in 2004. These outstandingly high growth rates are linked to the strong price increases for fuels and metals, which figure prominently in the export structure of these countries. Shipments from Armenia, Belarus and Turkmenistan are estimated to have increased by only between 5 and 12 per cent.

Preliminary information on the merchandise trade of Africa and the Middle East highlights the importance of oil market developments for these two regions. The sharp rise in both regions' merchandise exports in 2004 was driven by markedly higher volumes of oil exported and sharply higher average oil prices (see Chart 8). The export strength in volume terms was due to an expansion of African oil production of about 10 per cent and a recovery of the production in the Middle East of about 7 per cent.[16] Merchandise export growth of 31 per cent in Africa and 26 per cent in the Middle East was much greater than global merchandise trade growth in 2004. Although merchandise imports also expanded faster than in the preceding years, their rise was less pronounced than for exports. Consequently, Africa and the Middle East recorded a further increase in their trade surpluses. For the Middle East, the surplus is estimated to be in the order of $150 billion on a f.o.b.-f.o.b. basis in 2004.

Chart 8
Merchandise trade of Africa and the Middle East, 2001-2004
(Annual percentage change in value)



Source: Appendix Table 1.

The merchandise export performance of individual African countries showed very large variations in 2004. Exports of Chad are estimated to have increased fourfold under the impact of increased oil shipments, while the exports of Zimbabwe stagnated and those of Côte d'Ivoire decreased. Many of the established oil exporters in the region have increased their exports by more than one-third (Angola, Equatorial Guinea, Libya, Nigeria and Sudan). Mozambique also recorded a very large increase in its merchandise exports, above all due to a further substantial increase in shipments of aluminium. Morocco and Mauritius, however, recorded a rather subdued export expansion due to sluggish exports of clothing and fish to Europe. South Africa, the largest trader in the region, increased its exports in dollar terms by one-quarter in 2003 and 2004, most of this value increase is due to price and exchange rate changes. The sharp appreciation of the Rand in 2003 and 2004 stimulated South Africa's imports, which rose by one-third in dollar terms and by about 15 per cent in real terms in 2004.

Partly linked to oil market developments, the regional breakdown of African merchandise exports continued to shift from Europe, its major market, to Asia and North America.[17] Imports of the United States and Japan from Africa have increased by 44 and 35 per cent respectively. Imports of the European Union are estimated to have increased by 14 per cent. Thanks to AGOA, US imports of clothing from Africa have expanded by 16 per cent. A number of African countries like Uganda, Ethiopia, Namibia and Ghana have nearly doubled their exports to the United States. Finally, Chinese imports of cotton from Africa increased by 192 per cent in dollar terms from $223 million to $650 million.

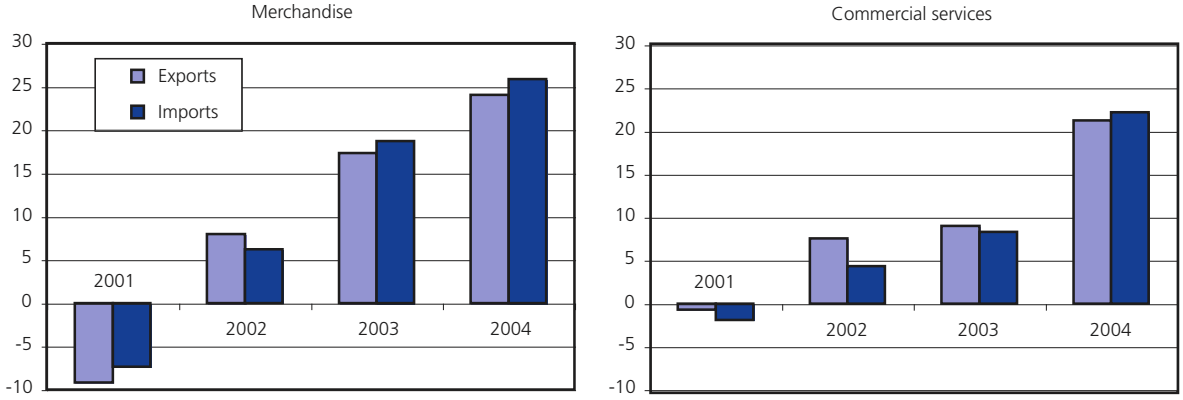
16 Estimates are taken fom IEA, Monthly Oil Report, January 2005.

17 In 2004, imports from Africa grew by 43 per cent (to $48.3 billion) in the United States, by 87 per cent (to $15.6 billion) in China and by 28 per cent (to $8.7 billion) in Japan.

In the Middle East, merchandise exports of the oil exporting countries rose on average by more than one quarter, with exports of Iraq up by more than three-quarters in 2004. The value of Israel's merchandise exports rose less than the regional average in value terms, but due to moderate price changes, its real exports expanded by nearly 10 per cent, which was faster than the average for the region.

Merchandise and commercial services trade in Asia continued to expand faster than world trade. Asia's merchandise exports rose by one quarter, to $2385 billion, and its commercial services exports by 21 per cent to $436 billion. The region's dollar import value expanded faster than the export value for both merchandise and services trade (see Chart 9).

Chart 9
Asia's merchandise and commercial services trade, 2001-2004
(Annual percentage change in value)



Source: Appendix Tables 1 and 2.

Intra-regional trade was particularly strong as the region continued to enjoy one of the highest economic growth rates in the world. The Chinese economy continued to expand vigorously, with GDP growing 9.3 per cent and stimulating its own and the region's trade expansion. For the first time, China's exports exceeded those of Japan. The most dynamic product category in China's exports was office and telecom equipment, which increased by 45 per cent to $171 billion in 2004. Clothing exports were far less dynamic, advancing by 19 per cent to $62 billion. Chinese merchandise imports rose by 36 per cent in 2004, somewhat faster than its exports. The stagnation of the Japanese economy in the last three quarters of 2004 kept the growth of Japan's merchandise trade well below the regional average. The recovery in global demand for a number of electronic products (e.g. personal computers, semiconductors and mobile phones), and the surge in the demand for a number of new or sharply improved products (e.g. digital cameras), is reflected in the high trade growth of economies which largely export office and telecom equipment (e.g. Chinese Taipei, the Republic of Korea, Malaysia and Singapore). High GDP growth combined with more open trade policies stimulated India's trade performance in 2004. Merchandise imports rose by more than 34 per cent, compared to a 27 per cent growth rate for exports.

Although the share of the United States in the region's merchandise exports (and imports) continued to decline in 2004, the bilateral merchandise trade surplus of Asia with the United States widened further in absolute terms. According to US statistics, in 2004 merchandise exports of the United States to Asia rose by 12 per cent to $226 billion, while imports went up by 17.4 per cent, to $568 billion (c.i.f).

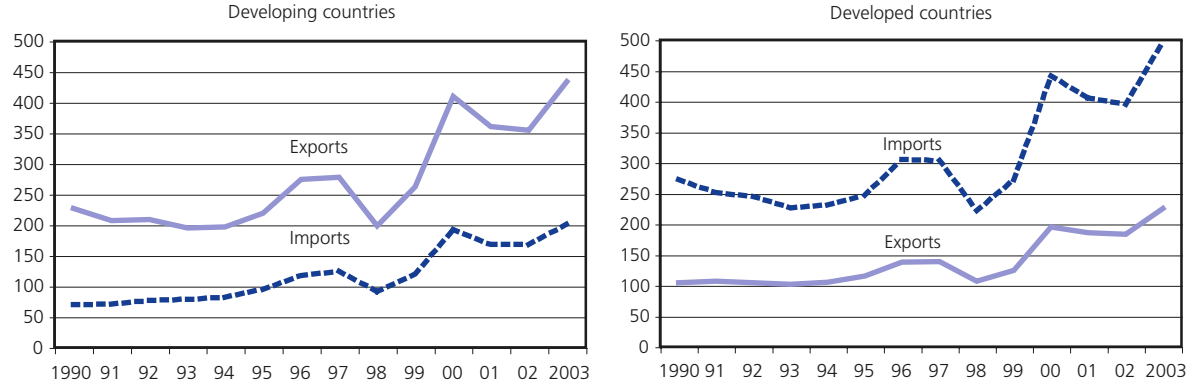
B SELECTED MEDIUM-TERM DEVELOPMENTS

International trade in fuels and pharmaceuticals has expanded at above-average rates in recent years, affecting the structure of global merchandise trade flows. These developments are examined here.

1. OIL MARKET DEVELOPMENTS AND DEVELOPING COUNTRIES

Developing countries have been the principal exporters of fuels over the last four decades, accounting for well over half of world exports of this product. This has always translated into a large surplus in trade in fuels for developing countries as a group. The surplus has fluctuated with oil price changes, in a range between $110 billion and $230 billion per year over the period 1990 to 2003 (see Chart 10).

Chart 10
Exports and imports of fuels of developing and developed countries, 1990-2003
(Billion dollars)



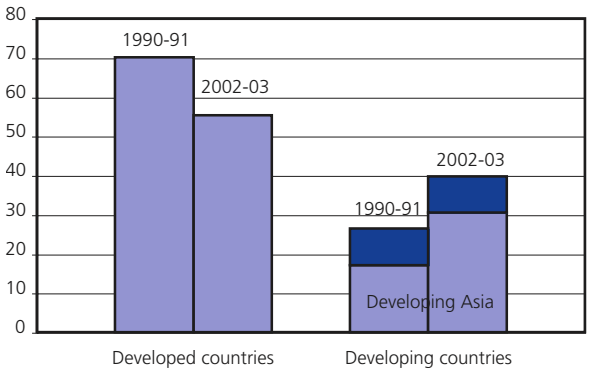
Source: WTO.

Developing countries as a group have accounted for between 58 and 63 per cent of annual world fuel exports since 1990. Clothing is the only other sector where developing countries have accounted for a dominant share of world exports. Although most developing country fuel exports are destined for developed country markets, the latter's share decreased sharply between 1990 and 2003 (from 71 to 56 per cent). Meanwhile, trade in fuels among developing countries rose from 25 to 40 per cent of the total exports of this group of countries during the same period (see Chart 11).

The increased weight of developing countries in this trade is not only limited to exports – import shares have also grown. According to WTO estimates, the share of the developing country imports in the value of world fuel exports rose from 20 per cent in 1990-91 to 27 per cent in 2002-03. The share increased further in 2004. The principal factor for this development is the large increase in import demand in Asian countries, in particular China, the Republic of Korea and India.

The marked increase in prices of fuels in 2003 and 2004 has benefited a number of net-fuel exporting developing countries by improving their terms of trade and increasing their foreign exchange earnings. However, the numerous oil-importing developing economies have been adversely affected.

Chart 11
Developing countries' fuels exports by region, 1990-2003
(Shares)

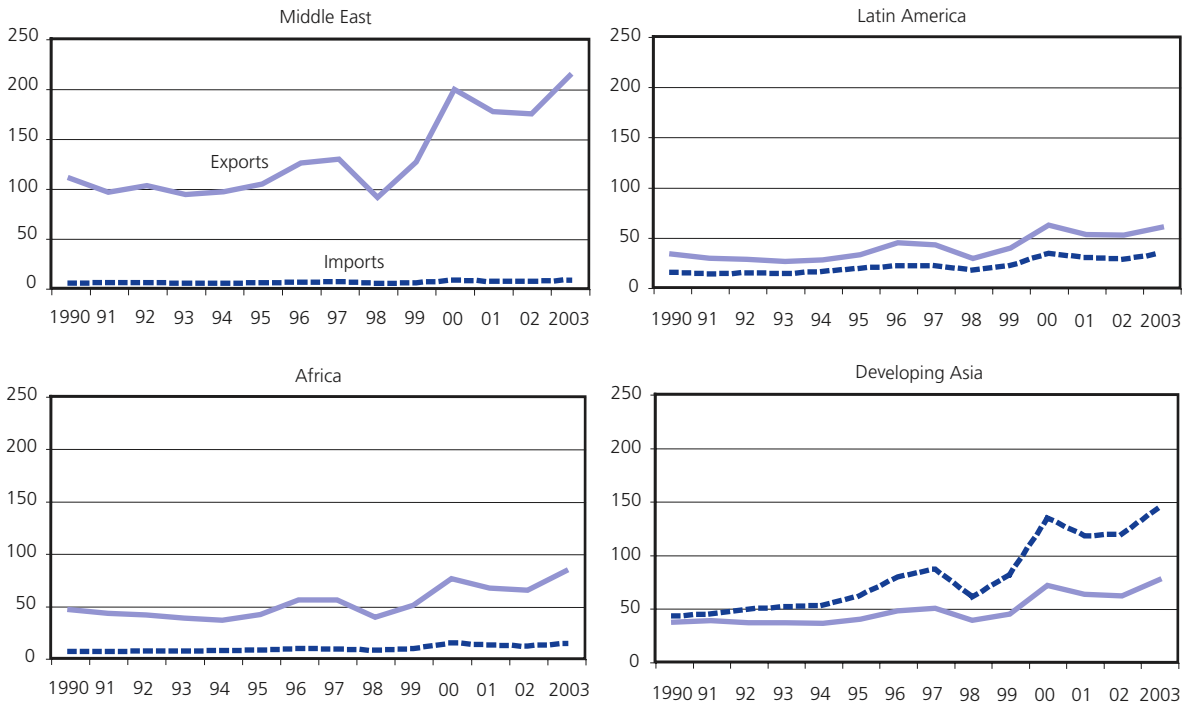


Source: WTO.

In 2004, developing country fuel exports exceeded the $500 billion mark for the first time, more than twice the average level recorded in the 1990-99 period. The sharp rise in the value of merchandise exports of oil-exporting developing countries contributed prominently to the rise in the share of developing countries in world merchandise exports.

Among the developing regions, the Middle East and Africa are the two largest net exporters and greatly increased their export earnings in 2003 and 2004. Latin America is also a net exporter but developing Asia has become a large net importer of fuels. Chart 12 shows the development of exports, imports and the balance of fuels trade for the four developing regions. The Middle East and Africa accounted for 49 and 19 per cent, respectively, of developing country fuel exports in 2003. The net exports of fuels of the Middle East are estimated at $205 billion in 2003, equivalent to 88 per cent of developing countries' total net exports of fuels.

Chart 12
Fuels exports and imports of four developing regions, 1990-2003
(Billion dollars)



Source: WTO.

The fact that the developing countries as a group are a large net exporter of fuels could lead an observer to conclude that higher oil/fuel prices are a largely positive development for this group. A more differentiated analysis has to take into account the great diversity of the situations in individual countries, and the rather high oil intensity of production and GDP in the developing world. A noteworthy development in global energy markets is that the energy intensity of production in developing countries has increased over the last 30 years, partly due to their industrialization, while that of the high income countries has decreased significantly.[18] Some estimates have shown that the net result of an oil price hike on GDP growth in the developing world as a whole might even be slightly negative in the short run, despite the large surplus in fuels trade recorded by developing countries.[19]

[18] OECD, OECD Economic Outlook (December 2004).

[19] Simulations undertaken by the IMF Research Department suggest that a permanent oil price increase of $5 would result in a net loss of GDP growth in subsequent years both for industrial countries and developing countries as a group. See IMF, The Impact of Higher Oil Prices on the Global Economy, Table 2, December 2000 available at http://www.imf.org/external/pubs/ft/oil/2000/oilrep.pdf.

Given the uneven distribution of oil production and reserves among developing countries, it is obvious that differences in the repercussions of an oil price increase are much larger on the country than on the regional level. Differences among countries in respect of their fuels trade balance illustrate the divergences in their energy situation. Appendix Tables 5 through 8 provide information on individual developing country average exports and imports of fuels in the period 2001-2003. These Tables also report the ratio of the fuels trade balance to total export earnings (merchandise and commercial services combined).

In Africa, large net-exporting positions are reported by 12 countries, while 37 other African countries are net importers of fuels.[20] Four African countries account for about 77 per cent of African fuel exports. The populations living in the net-fuel importing countries account for 57 per cent of the total African population. The fuel import value of net importers of fuels in Africa is rather small if compared with regional or world trade in fuels. However, even these small trade flows can represent a large share of these African countries' exports earnings. It has been estimated that 19 African countries had to spend more than 15 per cent of their export earnings (merchandise and commercial services) to finance their net imports of fuels in the 2001-03 period. Algeria, Nigeria, Libyan Arab Jamahiriya and Angola are the largest fuel exporters in Africa, reaping large benefits from high oil and gas prices. Morocco and South Africa, the two major net importers of fuels in the region stand to be adversely affected by an oil price increase (see Appendix Table 5).

In Latin America, eight countries were net exporters of fuels in 2001-03, and 25 were net importers. And like in the African region, a majority of the population (56 per cent) lives in countries which are net importers of fuels. Among the latter group, nine countries had to spend at least 15 per cent of their total export earnings to (net) import fuels. Venezuela and Mexico account for nearly two-thirds of the region's fuel exports while Brazil and Chile are the two largest importers of fuels in Latin America (see Appendix Table 6).

Among the 23 developing economies in Asia included in the sample, six were net exporters and 17 were net-importers of fuels. The population of the net exporters in Asia stood at 371 million and that the net importers at 2,948 million in 2002. Nearly 90 per cent of the population in developing Asia lives in economies which are net importers of fuels. Among the developing regions, Asia is the most adversely affected by higher fuel prices on global markets. Nepal, Mongolia, Pakistan and India spent between 20 per cent and 35 per cent of their export earnings from merchandise and commercial services on (net) imports of fuels in 2001-2003. The three biggest net importers of fuels in Asia during the same period were the Republic of Korea, India and China.[21] Net exports of fuels from Indonesia and Malaysia were higher than those of Brunei Darussalam, although in the latter country fuels accounted for nearly 90 per cent of total merchandise exports, compared to 25 per cent for Indonesia and 10 per cent for Malaysia (see Appendix Table 7).

The Middle East is the only developing region in which the majority of countries and the majority of the population lives in countries which are net exporters of fuels (see Appendix Table 8).

Taking the developing countries together, one finds that at the beginning of this decade more than 70 per cent of them were net importers of fuels and more than three-quarters of the population of developing countries lived in net-fuel-importing economies. While the share of developing countries in world exports of fuels was roughly stable over the 1990-2003 period, their role as a consumer and importer has increased in global markets. Asian developing countries recorded the strongest expansion in energy demand and the sharpest rise in imports of fuels of all regions over this period. These developments in energy markets are linked to the extraordinary economic expansion of developing Asia over the last decades. These trends in energy markets will continue and perhaps even strengthen further if the dynamic expansion of the developing Asian economies continues unabated. In the short run, domestic energy supplies are unlikely to expand fast enough to cover the increased energy needs of this group of economies in the future. One option for Asian developing economies to assure increased and stable supplies of fuels in the years ahead is to participate more actively in exploration and in the development of transportation infra-structure and energy supplies in other countries. In particular, intra-regional cooperation in Asia has considerable potential to enhance the volume and security of future supplies of fuels from within the region.

20 The reference period 2001-2003 has been chosen for the determination of the net-exporting position.

21 By 2004, China had overtaken both the Republic of Korea and India as developing Asia's largest fuel importer.

2. WHY IS GLOBAL TRADE IN PHARMACEUTICAL PRODUCTS EXPANDING SO FAST?

In the 1990s, world trade in pharmaceutical products[22] expanded much faster than world merchandise trade and trade in chemical products. Between 1990-91 and 2001-02, the average annual growth in world exports of pharmaceutical products was close to 12 per cent, more than twice as high as the rate for chemical products. Chemicals are a rather heterogeneous product group, including inorganic chemicals, paints, detergents, fertilizers, petrochemicals, plastics, and pharmaceutical products. Among the 25 major chemical product groups, trade growth varied widely, but as already noted, of these groups pharmaceutical products grew very strongly over the decade ending 2001-02 (see Appendix Table 9).

The relative strength of global pharmaceutical trade compared to that of manufactures and other chemical products was even more pronounced in the 2000-03 period than in the 1990s. Trade in pharmaceutical products expanded at an average annual rate of 23 per cent between 2000 and 2003, twice as fast as chemicals and four times faster than global trade in manufactures. In 2003, world trade in pharmaceutical products reached $200 billion, accounting for 3 per cent of world merchandise exports. Trade in pharmaceutical products exceeded that of textiles and iron and steel products, and remained only slightly below the world trade in clothing (see Table 4).

Table 4
World exports of chemicals and manufactured goods, 2000-2003
(Billion dollars and percentage change)

	Value	Annual percentage change			
	2003	2000-03	2001	2002	2003
Manufactures	5437	5.0	-3.8	5.2	14.5
Chemicals	794	10.7	2.6	11.0	19.0
Pharmaceutical products	200	23.0	22.4	26.3	20.3
All other chemical products	594	7.5	-1.8	6.7	18.6

Note: Pharmaceutical products are defined as SITC Rev.3 division 54.
Source: UNSD Comtrade Database; WTO.

World trade in pharmaceutical products is largely concentrated on trade among developed countries. North America, Western Europe and Japan account for about 90 per cent of world exports and more than 80 per cent of world imports of pharmaceuticals. This large share of high income countries in world pharmaceutical trade is due to the latter's dominance of global R&D, a high level of intra-industry and intra-firm trade in this industry and high health expenditures among the population. Almost all principal traders recorded strong growth in recent years. Outstanding pharmaceutical export growth since 2000 was reported by Ireland, Belgium, Canada and Israel. Intra-EU(15) and US imports more than doubled between 2000 and 2003. But strong expansion of pharmaceutical trade was not only limited to the OECD countries. China and India – both net exporters of pharmaceutical products – recorded strong export and import expansion over the 2000-2003 period. However, during the same period some others, such as Singapore and Hong Kong, China, recorded a decline in their pharmaceutical exports (see Table 5).

Although a general perception exists that the United States has the most innovative and competitive pharmaceutical industry, recent trade data reveal that the traditional US trade surplus in pharmaceuticals turned into a rapidly rising trade deficit from 2000 onwards.[23]

22 Pharmaceutical products are defined to correspond to SITC Rev. 3 division 54.

23 In R&D expenditure and in the introduction of top selling new chemical entities (NCE) US firms have a lead over European firms according to various reports. See Gambardella, A. et al. (2000) "Global Competitiveness in Pharmaceuticals A European Perspective", report prepared for the Directorate General, Entreprise and Industry, of the European Commission, November.

Table 5
Major exporters and importers of pharmaceutical products, 1990-2003
(Billion dollars and percentage change)

	Exports			Imports		
	Value	Annual percentage change		Value	Annual percentage change	
	2003	1990-00	2000-03	2003	1990-00	2000-03
United States	19.0	12.1	13.5	32.0	19.3	28.8
Canada	2.0	16.9	24.0	6.0	16.0	17.3
EU(15)	141.0	11.3	26.7	113.0	10.8	29.1
EU(15) extra	59.0	11.6	21.5	28.0	11.3	20.3
EU(15) intra	81.0	11.1	31.1	85.0	10.6	32.6
Switzerland	18.0	9.3	20.2	10.0	16.0	22.1
Japan	3.0	12.0	5.3	6.0	5.3	9.1
China	3.0	...	17.0	2.0	...	21.4
India	2.0	10.7	17.2	1.0	4.0	18.4
Israel	1.0	18.9	30.8	1.0	12.9	9.3
Memorandum item:						
Belgium	26.0	15.4	55.3	24.0	13.9	62.4
Ireland	15.0	17.7	45.4	2.0	12.8	19.6

Source: UNSD Comtrade Database; WTO.

Pharmaceuticals have now attained a prominent position in the chemical exports and imports of the major developed economies. The share of pharmaceuticals in the chemical exports and imports of the five leading traders combined reached 30 per cent in 2003, more than twice the share observed in 1990. For all major traders, with the exception of Japan, the share of pharmaceuticals in chemicals trade increased sharply in terms of both exports and imports (see Table 6).

Table 6
Share of pharmaceuticals in chemicals exports and imports of major traders, 1990-2003
(Percentage)

	Exports			Imports		
	1990	2000	2003	1990	2000	2003
EU(15)	12	23	32	10	21	32
EU(15) extra	18	28	34	16	25	31
EU(15) intra	9	19	30	9	20	32
Switzerland	32	48	54	15	38	46
United States	11	16	21	11	20	31
Canada	4	8	14	11	19	25
Japan	6	8	8	19	18	21
Total of above	**12**	**21**	**30**	**11**	**21**	**31**

Source: UNSD Comtrade Database; WTO.

What explanations can be given for the recent expansion of global trade in pharmaceuticals? A number of factors have contributed to this development, some related to demand developments and industrial restructuring, while others are likely to be due to government actions. First, demand for pharmaceutical products in the major markets (United States and Western Europe) was relatively strong. According to industry sources, global pharmaceutical sales rose by nearly 50 per cent over the 2000-2003 period, or three times faster than nominal global GDP growth.[24] Various factors have sustained this strong demand growth, such as the aging of the populations and the increased importance of "life-style" drugs.

[24] Global audited sales of pharmaceutical products rose from $317.2 billion in 2000 to $466.2 billion in 2003. See *IMS World Review 2004*. Nominal world GDP (valued at market exchange rates) expanded from $31.43 trillion in 2000 to $36.24 trillion in 2003 according to IMF (September 2004).

Second, mergers and acquisitions as well as outsourcing have led to a concentration in the production of bulk ingredients and end products on fewer plants and locations, in order to reap benefits from increasing returns to scale.[25] The stronger specialization of pharmaceutical plants within large multinationals and the development of production networks in this industry have led to increased shipments between the different locations and a rise in cross-border transactions.

Third, cross-border shipments have benefited from trade liberalization since 1995, following the elimination of tariffs for pharmaceutical products in the Uruguay Round negotiations in all major producing markets.[26] For the Quad countries (United States, EU(15), Japan and Canada), it is estimated that the average MFN bound duty of pharmaceuticals stood at 6.2 per cent in 1994 and became zero by 1999.

Fourth, the dynamic growth of Ireland's pharmaceutical industry and exports is due to a substantial FDI inflow, attracted by a well developed infrastructure and favourable tax conditions. According to the Industrial Development Agency of Ireland (IDA), 13 out of the top 15 pharmaceutical companies in the world currently have substantial operations in Ireland and employ more than 17,000 people at 82 production facilities.[27]

Fifth, there were a number of specific developments which boosted trade flows, unrelated to strong demand growth or the re-allocation of production among affiliates or unaffiliated firms through network-related companies. At the end of 2001, Belgium became a hub for the distribution of pharmaceuticals produced in Ireland. This resulted in a jump of Belgium's imports and exports of pharmaceuticals of more than 100 per cent in 2002, and turned Belgium into the world's largest exporter of pharmaceuticals and the second largest importer (after the United States).[28] However, once established as a trading hub, the growth in Belgium's pharmaceutical exports and imports slowed down sharply in the subsequent year. Obviously, this rise in Belgium's pharmaceutical trade does not correspond to a rise in traded value-added but more to a shift in wholesale trading patterns and might be considered largely as a double counting of trade flows.

Sixth, extensive regulation of sales of pharmaceuticals to end-users in many developed markets has led to significant price differences among national markets, even within the European Union. In a number of countries, these price differences contributed to a rise in parallel imports and re-imports of pharmaceutical products in excess of the overall market expansion. As regards re-imports of pharmaceuticals, they are illegal in the United States and therefore not recorded in its trade returns. In Germany, re-imports from the European Union member countries are not only legally possible but in certain cases even prescribed by the German government to lower overall health costs. As a consequence, German re-imports of pharmaceuticals increased five-fold over the last four years, to €1.3 billion in 2003.[29] [30]

The above observations illustrate some of the diverse factors at play in the expansion of global pharmaceutical exports in recent years. While strong demand growth and industrial restructuring have been major factors in the dynamic growth of pharmaceuticals trade, government policies have also in some cases had a significant influence of the evolution of these trade flows. This short examination of international trade flows can, of course, only touch upon some of the forces at play in the pharmaceuticals sector. More research is required to analyse in depth the economic factors behind the trade developments within this highly regulated industry.

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25 United States International Trade Commission (2003), found at http://www.usitc.gov/tradeshifts/default.htm and accessed on 9 August 2004.

26 Nine WTO Members, including Canada, the EU, Japan, Switzerland and the United States committed themselves in their tariff schedules to grant MFN duty-free access for pharmaceutical products at the end of the Uruguay Round. The Pre-Uruguay MFN bound tariff averages (arithmetic) of pharmaceutical products was 8.8 per cent for Canada, 6.3 per cent for the EU, 4.9 per cent for Japan and 4.6 per cent for the United States, according to WTO calculations.

27 Industrial Development Agency of Ireland (2004) at http://www.idaireland.com/home/index.aspx?id-64, accessed on 16 August 2004.

28 Agence pour le Commerce Extérieur (2002) at http://www.abh.acc.org/frameset/acciframe.html.

29 IMS (2004) at http://www.imshealth.com, accessed on 10 August 2004.

30 In order to limit the growth in health expenditure, the German Bundestag has passed a law forcing pharmacies to make at least 7 per cent of their turnover of pre-packaged drugs with lower priced imports. See Bundesverband der Pharmazeutischen Industrie e.V., Pharma-Daten (2003) at http://www.bpi.de/internet/download/pharmadaten_2003.pdf, accessed on 24 August 2004.

APPENDIX TABLES

Appendix Table 1
World merchandise trade by region and selected country, 2004
(Billion dollars and percentage)

	Exports						Imports					
	Value	Annual percentage change					Value	Annual percentage change				
	2004	1995-00	2001	2002	2003	2004	2004	1995-00	2001	2002	2003	2004
World	8880	5	-4	5	17	21	9215	5	-4	4	16	21
North America	1330	7	-6	-4	5	14	2010	11	-6	2	7	16
United States	819	6	-6	-5	4	13	1526	10	-6	2	8	17
Canada	322	8	-6	-3	8	18	276	8	-7	0	8	13
Mexico	189	16	-5	1	3	14	206	19	-4	0	1	16
South and Central America[a]	272	5	-3	0	13	28	238	3	-1	-13	5	27
Brazil	96	3	6	4	21	32	66	2	0	-15	2	30
Other South and Central America[a]	175	6	-7	-1	9	26	172	4	-1	-12	6	25
Europe	4024	2	1	7	19	19	4133	4	-2	5	20	20
European Union (25)	3708	2	1	7	19	19	3784	4	-1	5	20	19
Germany	915	1	4	8	22	22	717	1	-2	1	23	19
France	451	2	-1	3	18	15	464	3	-3	0	21	16
United Kingdom	346	4	-4	3	9	13	462	5	-3	4	13	18
Italy	346	1	2	4	18	16	349	3	-1	5	20	17
Other Western Europe	204	3	0	4	14	19	165	1	-1	2	15	18
Switzerland	118	0	1	7	15	18	111	1	1	-1	15	16
South-East Europe	112	5	10	15	29	32	183	8	-8	20	32	36
CIS	263	5	0	5	27	35	171	-3	16	9	27	31
Russian Federation	183	5	-2	4	27	35	95	-6	20	12	23	28
Africa	228	6	-6	3	23	31	207	0	4	1	22	25
South Africa	46	1	-2	2	23	26	55	-1	-5	4	40	34
Africa less South Africa	183	7	-7	3	23	32	152	1	6	0	16	22
Oil exporters[b]	113	12	-13	1	27	41	52	0	20	-5	21	32
Non oil exporters	69	0	2	7	18	19	100	1	1	2	14	18
Middle East	379	12	-11	5	21	26	243	4	6	4	13	23
Asia	2385	5	-9	8	18	25	2214	3	-7	6	19	27
Japan	565	2	-16	3	13	20	455	2	-8	-3	14	19
China	593	11	7	22	35	35	561	11	8	21	40	36
Four East Asian traders[c]	637	5	-14	5	15	26	586	2	-16	3	13	28
India	73	7	2	14	16	27	95	8	-2	12	26	34
Memorandum items:												
MERCOSUR (4)	135	4	4	1	19	28	94	2	-6	-26	10	37
ASEAN (10)	550	6	-10	5	12	20	491	1	-8	4	10	26
EU (25) extra-trade	1203	-	1	6	17	20	1279	-	-4	1	19	20
EU (15)	3447	2	0	6	19	18	3485	3	-2	4	20	18
EU (new members, 10)	260	8	11	14	29	32	299	9	6	11	26	28
Developing economies	2780	8	-7	7	18	26	2523	5	-4	4	16	27
Developing Asia	1712	7	-7	10	20	27	1629	4	-7	9	21	30

[a] Includes the Caribbean.
[b] Algeria, Angola, Congo, Equatorial Guinea, Gabon, Libya, Nigeria, Sudan.
[c] Chinese Taipei, Hong Kong China, Rep. of Korea, and Singapore.

Source: WTO.

Appendix Table 2
World trade of commercial services by region and selected country, 2004
(Billion dollars and percentage)

	Exports						Imports					
	Value	Annual percentage change					Value	Annual percentage change				
	2004	1995-00	2001	2002	2003	2004	2004	1995-00	2001	2002	2003	2004
World	2100	5	0	7	13	16	2081	4	1	5	14	16
North America	380	7	-4	2	5	11	334	9	-1	3	9	13
United States	319	7	-4	2	5	11	259	10	-1	2	8	13
Canada	47	9	-3	4	5	12	56	6	-1	3	12	12
Mexico	14	7	-7	-1	1	11	19	13	-1	3	4	8
South and Central America[a]	55	6	-2	-3	9	15	57	4	0	-12	5	14
Brazil	11	8	-3	1	9	20	16	3	2	-15	8	12
Other South and Central America[a]	44	6	-2	-4	9	13	41	4	0	-10	4	15
Europe	1114	4	3	9	19	16	1019	4	3	8	19	14
European Union (25)	1005	4	4	9	18	16	948	4	4	8	19	14
Germany	126	2	5	17	18	9	191	1	4	4	18	11
United Kingdom	169	9	-1	11	13	16	135	9	0	9	13	13
France	108	-1	2	5	15	10	95	-1	3	11	22	13
Italy	85	-2	2	4	18	21	80	0	3	9	20	9
Other Western Europe	64	3	-3	9	15	15	46	2	5	8	15	15
Switzerland	37	2	-6	11	14	12	21	1	6	5	12	8
South-East Europe	44	8	-11	1	35	21	24	9	-12	8	26	30
CIS	32	2	13	20	16	22	49	0	24	16	15	27
Russian Federation	20	-2	17	20	18	25	34	-4	23	15	16	27
Africa	47	3	1	4	21	22	54	2	2	5	13	19
South Africa	8	2	-7	1	40	24	9	0	-9	2	40	24
Middle East	36	10	-5	-2	11	18	66	5	-2	1	22	17
Asia	436	3	-1	8	9	21	501	2	-2	4	8	22
Japan	94	1	-6	2	8	23	134	-1	-7	0	3	21
China	59	10	9	20	18	...	70	8	9	18	19	...
Four East Asian traders[b]	156	3	-1	5	7	20	145	4	-1	6	4	22
India	32	21	19	12	20	...	38	14	16	-2	25	...
Memorandum items:												
MERCOSUR (4)	18	6	-5	-11	14	21	24	4	-2	-25	10	15
ASEAN (10)	87	-1	-1	7	-2	21	108	2	-1	4	4	18

[a] Includes the Caribbean.
[b] Chinese Taipei, Hong Kong China, Rep. of Korea and Singapore.

Source: WTO.

Appendix Table 3
Leading exporters and importers in world merchandise trade, 2004
(Billion dollars and percentage)

Rank	Exporters	Value	Share	Annual percentage change	Rank	Importers	Value	Share	Annual percentage change
1	Germany	914.8	10.0	22	1	United States	1526.4	16.1	17
2	United States	819.0	9.0	13	2	Germany	717.5	7.6	19
3	China	593.4	6.5	35	3	China	561.4	5.9	36
4	Japan	565.5	6.2	20	4	France	464.1	4.9	16
5	France	451.0	4.9	15	5	United Kingdom	462.0	4.9	18
6	Netherlands	358.8	3.9	21	6	Japan	454.5	4.8	19
7	Italy	346.1	3.8	16	7	Italy	349.0	3.7	17
8	United Kingdom	345.6	3.8	13	8	Netherlands	319.9	3.4	21
9	Canada	322.0	3.5	18	9	Belgium	287.2	3.0	22
10	Belgium	308.9	3.4	21	10	Canada	275.8	2.9	13
11	Hong Kong, China	265.7	2.9	16	11	Hong Kong, China	273.0	2.9	17
	domestic exports	22.6	0.2	15		retained imports[a]	29.9	0.3	24
	re-exports	243.1	2.7	16	12	Spain	249.8	2.6	20
12	Korea, Republic of	253.9	2.8	31	13	Korea, Republic of	224.4	2.4	26
13	Mexico	188.6	2.1	14	14	Mexico	206.4	2.2	16
14	Russian Federation	183.2	2.0	35	15	Taipei, Chinese	167.9	1.8	32
15	Taipei, Chinese	181.4	2.0	21					
16	Singapore	179.5	2.0	25	16	Singapore	163.8	1.7	28
	domestic exports	98.5	1.1	23		retained imports[a]	82.8	0.9	30
	re-exports	81.0	0.9	26	17	Austria	115.1	1.2	16
17	Spain	179.0	2.0	15	18	Switzerland	111.5	1.2	16
18	Malaysia	126.5	1.4	21	19	Australia	107.8	1.1	21
19	Sweden	121.0	1.3	19	20	Malaysia	105.2	1.1	26
20	Saudi Arabia	119.6	1.3	28					
	Total of above[b]	6823.4	74.8	-		Total of above[b]	7142.7	75.5	-
	World[b]	9123.5	100.0	21		World[b]	9458.3	100.0	21

[a] Retained imports are defined as imports less re-exports.
[b] Includes significant re-exports or imports for re-exports.

Source: WTO.

Appendix Table 4
Leading exporters and importers in world trade in commercial services, 2004
(Billion dollars and percentage)

Rank	Exporters	Value	Share	Annual percentage change	Rank	Importers	Value	Share	Annual percentage change
1	United States	319.3	15.2	11	1	United States	259.0	12.4	13
2	United Kingdom	169.2	8.1	16	2	Germany	190.8	9.2	11
3	Germany	126.1	6.0	9	3	United Kingdom	134.7	6.5	13
4	France	108.4	5.2	10	4	Japan	133.6	6.4	21
5	Japan	93.8	4.5	23	5	France	94.5	4.5	13
6	Italy	84.6	4.0	21	6	Italy	79.6	3.8	9
7	Spain	84.2	4.0	10	7	Netherlands	72.4	3.5	11
8	Netherlands	72.4	3.4	15	8	China	69.7	3.3	...
9	China	58.9	2.8	...	9	Ireland	58.2	2.8	11
10	Hong Kong, China	54.0	2.6	20	10	Canada	55.9	2.7	12
11	Belgium	49.5	2.4	15	11	Spain	53.3	2.6	17
12	Austria	47.2	2.2	12	12	Korea, Republic of	49.6	2.4	24
13	Canada	46.9	2.2	12	13	Belgium	48.4	2.3	15
14	Ireland	46.2	2.2	22	14	Austria	48.0	2.3	16
15	Korea, Republic of	39.7	1.9	26	15	India	37.9	1.8	...
16	Sweden	37.8	1.8	25	16	Singapore	36.2	1.7	23
17	Denmark	37.5	1.8	18	17	Denmark	34.3	1.6	21
18	Switzerland	37.1	1.8	12	18	Russian Federation	33.5	1.6	27
19	Singapore	36.6	1.7	19	19	Sweden	33.2	1.6	16
20	Luxembourg	33.4	1.6	35	20	Taipei, Chinese	29.9	1.4	20
	Total of above	1585.0	75.4	-		Total of above	1555.0	74.6	-
	World	2100.0	100.0	16		World	2080.0	100.0	16

Note: Figures for a number of countries and territories have been estimated by the Secretariat. Annual percentage changes and ranking are affected by continuity breaks in the series for a large number of economies, and by limitations in cross-country comparability.

Source: WTO.

Appendix Table 5
Fuels trade of African countries, average 2001-2003
(Million dollars and percentage)

	Exports of fuels	Imports of fuels	Balance	Net fuel trade to exports[a] (%)	Population (Million) 2002
All net exporters	**66388**	**1724**	**64664**	**72**	**355**
Algeria	20459	93	20366	92	31
Nigeria	16454	545	15908	85	133
Libya	11805	...	***11805***	93	5
Angola	6875	...	***6875***	88	13
Congo	2135	...	***2135***	81	4
Equatorial Guinea	2037	18	2019	90	1
Gabon	1895	...	***1895***	73	1
Egypt	1951	563	1387	10	66
Sudan	1482	128	1354	65	33
Cameroon	991	297	694	29	16
Congo, Dem.Rep.	220	71	148	14	52
Seychelles	84	8	76	14	0
All net importers	**5916**	**13111**	**-7195**	**-8**	474
Sao Tome and Principe	0	4	-4	-21	...
Central African Republic	0	5	-5	-3	4
Eritrea	0	6	-6	-3	4
Guinea Bissau	0	7	-7	-10	1
Gambia	0	13	-13	-19	1
Cape Verde	0	15	-15	-9	1
Burundi	0	18	-18	-46	7
Comoros	0	19	-19	-47	1
Chad	27	54	-26	-11	8
Rwanda	1	36	-34	-29	8
Niger	3	65	-62	-18	11
Côte d'Ivoire	607	676	-69	-1	17
Senegal	231	315	-84	-5	10
Togo	2	88	-86	-18	5
Zambia	16	108	-93	-9	10
Sierra Leone	0	99	-99	-98	5
Malawi	1	109	-108	-22	11
Mauritania	0	112	-112	-26	3
Benin	1	115	-115	-19	7
Swaziland	8	126	-119	-11	1
Mozambique	72	200	-128	-12	18
Botswana	2	137	-135	-4	2
Guinea	3	144	-141	-16	8
Kenya	538	680	-142	-5	31
Burkina Faso	3	162	-158	-52	12
Namibia	8	172	-164	-11	2
Uganda	17	201	-184	-25	25
Mali	0	191	-191	-19	11
Tunisia	650	852	-203	-2	10
Madagascar	15	231	-216	-24	16
Mauritius	1	235	-235	-8	1
Tanzania	5	274	-269	-17	35
Ethiopia	0	276	-276	-29	67
Ghana	148	491	-344	-13	20
Zimbabwe	10	529	-519	-38	13
South Africa	3237	4303	-1067	-3	45
Morocco	312	2041	-1729	-14	30
Liberia				***-17***	3
Somalia				***-6***	9
Total of above	**72304**	**14835**	**57469**	**31**	**829**
Africa	**72018**	**13244**	**58774**	**32**	**...**

[a] Exports of merchandise and commercial services.

Source: WTO; UNSD Comtrade Database; World Bank World Development Indicators.

Appendix Table 6
Fuels trade of Latin American countries, average 2001-2003
(Million dollars and percentage)

	Exports of fuels	Imports of fuels	Balance	Net fuel trade to exports[a] (%)	Population (Million) 2002
All net exporters	**51779**	**9730**	**42050**	**16**	**229.8**
Venezuela	20705	380	20325	78	25.1
Mexico	15118	5375	9743	6	100.8
Colombia	4482	212	4270	30	43.7
Argentina	4654	623	4031	13	37.0
Ecuador	2189	414	1775	29	12.8
Trinidad and Tobago	2375	924	1450	30	1.3
Bolivia	358	108	250	15	8.8
Netherland Antilles	1898	1693	205	6	0.2
All net importers	**5300**	**20823**	**-15523**	**-10**	**296.4**
Dominica	0	13	-13	-10	0.1
Saint Kitts and Nevis	0	15	-15	-13	0.0
Saint Vincent and the Grenadines	0	17	-17	-10	0.1
Grenada	0	19	-19	-10	0.1
Saint Lucia	3	35	-33	-9	0.2
Suriname	33	87	-54	-12	0.4
Belize	0	66	-66	-19	0.3
Barbados	44	120	-76	-6	0.3
Haiti	0	95	-95	-22	8.3
Bahamas	120	250	-131	-5	0.3
Guyana	0	132	-132	-20	0.8
Nicaragua	10	280	-270	-34	5.3
Paraguay	1	325	-323	-20	5.5
Uruguay	29	394	-365	-13	3.4
Panama	38	494	-455	-15	2.9
Costa Rica	43	517	-475	-6	3.9
El Salvador	170	712	-541	-15	6.4
Jamaica	31	622	-591	-19	2.6
Peru	521	1151	-630	-7	26.7
Guatemala	172	829	-657	-19	12.0
Honduras	4	718	-714	-40	6.8
Cuba	23	919	-896	-22	11.3
Dominican Rep.	839	1916	-1077	-13	8.6
Chile	308	3172	-2865	-12	15.6
Brazil	2913	7925	-5012	-7	174.5
Total of above	**57079**	**30553**	**26526**	**6**	**526.2**
Latin America	**55226**	**30957**	**24269**	**3**	**...**

[a] Exports of merchandise and commercial services.

Source: WTO; UNSD Comtrade Database; World Bank World Development Indicators.

Appendix Table 7
Fuels trade of Developing Asian economies, average 2001-2003
(Million dollars and percentage)

	Exports of fuels	Imports of fuels	Balance	Net fuel trade to exports[a] (%)	Population (Million) 2002
All net exporters	**31835**	**13511**	**18324**	**9**	**371**
Indonesia	14626	6570	8056	13	212
Malaysia	8875	4094	4780	4	24
Brunei Darussalam	3540	9	3531	83	0
Viet Nam	3748	2230	1518	7	80
Myanmar	705	413	293	9	49
Papua New Guinea	342	196	147	7	5
All net importers	**35052**	**125371**	**-90319**	**-8**	**2948**
Maldives	0	51	-51	-11	0
Fiji	32	110	-79	-8	1
Cambodia	0	116	-116	-6	13
Mongolia	6	147	-141	-22	3
Macao, China	25	191	-165	-2	0
Nepal	0	314	-314	-35	24
Bangladesh	26	566	-539	-8	136
Sri Lanka	18	725	-707	-11	19
Pakistan	219	3033	-2814	-24	145
Philippines	409	3815	-3406	-9	80
Hong Kong, China	143	4036	-3893	-6	7
Singapore	10363	15688	-5325	-3	4
Thailand	1938	8077	-6138	-7	62
Taipei, Chinese	2428	12846	-10418	-7	23
China	9478	21972	-12494	-3	1280
India	2637	18116	-15479	-21	1049
Korea, Republic of	7284	35162	-27878	-14	48
Afghanistan				*(-9)*	28
Lao people's Dem. Rep.				*(-15)*	6
Korea, Dem. Rep.				(-29)	22
Total of above	**66887**	**138882**	**-71994**	**-5**	**3319**
Developing Asia	**67370**	**127406**	**-60036**	**-4**	**...**

[a] Exports of merchandise and commercial services.

Source: WTO; UNSD Comtrade Database; World Bank World Development Indicators.

Appendix Table 8
Fuels trade of Middle East countries, average 2001-2003
(Million dollars and percentage)

	Exports of fuels	Imports of fuels	Balance	Net fuel trade to exports[a] (%)	Population (Million) 2002
All net exporters	**181529**	**3301**	**178229**	**72**	**157**
Saudi Arabia	69902	67	69835	84	22
United Arab Emirates	26342	242	26100	45	4
Iran, Islamic Rep. of	25205	872	24333	77	66
Kuwait	15651	...	15651	85	2
Iraq	13670	...	13670	96	24
Qatar	10325	25	10301	81	1
Oman	8849	184	8665	74	3
Syrian Arab Republic	4056	133	3923	55	17
Yemen	3491	...	3491	96	19
Bahrain	4037	1777	2260	33	1
All net importers	**118**	**5466**	**-5348**	**-11**	**16**
Jordan	2	776	-774	-19	5
Lebanon	3	1115	-1112	-97	4
Israel	112	3575	-3463	-8	7
Total of above	**181647**	**8767**	**172881**	**59**	**173**
Middle East	**188471**	**7551**	**180921**	**62**	...

[a] Exports of merchandise and commercial services.

Source: WTO; UNSD Comtrade Database; World Bank World Development Indicators.

Appendix Table 9
World exports of chemicals by product group, 1990-1991 and 2001-2002
(Billion dollars and percentage)

(SITC Rev.2 at 3-digit level)	Value		Annual average percentage change
	1990-91	2001-02	
All products	**3326.7**	**5210.2**	**4.2**
Chemicals	**290.4**	**520.7**	**5.5**
511 Hydrocarbons n.e.s.	15.1	17.1	1.1
512 Alcohols, phenols, etc.	8.0	11.3	3.2
513 Carboxylic acids, etc.	10.1	14.4	3.3
514 Nitrogen-function compounds	17.6	31.4	5.4
515 Organo-inorganic compounds, etc.	12.1	32.0	9.2
516 Other organic chemicals	7.0	11.6	4.8
522 Inorganic chemical elements, oxides, etc.	12.4	14.4	1.3
523 Other inorganic chemicals	8.0	11.0	3.0
524 Radioactive materials	5.0	5.1	0.0
531 Synth. dye, natural indigo, lakes	7.7	7.5	-0.2
532 Dyes n.e.s., tanning products	0.6	0.8	1.7
533 Pigments, paints, varnishes etc.	11.8	21.3	5.5
541 Medicinal, pharmaceutical products	**38.7**	**129.0**	**11.6**
551 Essential oils, perfume, etc.	3.7	8.3	7.6
553 Perfumery, cosmetics, etc.	10.5	24.0	7.8
554 Soap, cleansing, etc.	7.1	12.2	5.1
562 Fertilizers, manufactured	13.0	11.4	-1.2
572 Explosives, pyrotechnic products	1.5	1.1	-2.7
582 Products of condensation, etc.	16.4	26.5	4.5
583 Polymerization products	48.1	69.7	3.4
584 Cellulose, derivatives, etc.	1.8	2.3	2.6
585 Plastic materials, m.e.s.	0.3	0.7	7.6
591 Pesticides, disinfectants	7.2	9.6	2.6
592 Starches, insulin, gluten, etc.	4.9	8.0	4.5
598 Miscellaneous chemical products, n.e.s.	21.8	39.9	5.6

Source: UNCTAD, Handbook of Statistics, 2004.

II TRADE, STANDARDS AND THE WTO

A INTRODUCTION

Product standards specify or pin down the characteristics of a product. These characteristics can include design, size, weight, safety, energy and environmental performance, interoperability, material, and even the process of production. Examples of standards include the dimensions of freight containers and of screw threads; safety performance of seat belts, air bags and medical devices; pasteurization of milk; and protocols that allow computers from different vendors to communicate with one another.

Standards have been applied in international trade with growing intensity over the past few decades. Moreover, the effects of standards have become more discernible as unilateral and multilateral trade liberalization has brought down tariffs in many parts of the world.

Although no definitive count of standards exists, data obtained from a number of international sources suggest that the number of product standards world-wide is very large. The International Organization for Standardization (ISO) has published some 14,900 international standards. Perinorm, a consortium of European standards organizations, maintains a database of around 650,000 standards (national, regional and international) from about 21 countries. The bulk of these standards have been set by the private sector and many of them are international in scope. Non-governmental organizations (NGOs) have also been involved in standard-setting, working with industry and international organizations to develop standards in such areas as corporate social responsibility. Increased standardization activity reflects, among other factors, demand by consumers for safer and higher quality products, technological innovations, the expansion of global commerce and the increased concern paid by many governments and NGOs to social issues and the environment. Standards have played an important role in fulfilling these needs.

On the other hand, standards can be a means of hidden protection. Even if standards are not protectionist in intent, badly designed and applied standards can have highly discriminatory consequences for trade partners. In a world of reduced tariff protection and multilateral trade rules that limit the ability of governments arbitrarily to increase taxes and quantitative restrictions on trade, it is not surprising that they are sometimes tempted to use other means to restrict imports. This is a perennial issue in international trade relations.

Concern with how standards may affect international trade has long been reflected in multilateral trade rules. GATT 1947 contains provisions relevant to technical regulations and standards, including in Articles III (National Treatment), XI (Quantitative Restrictions) and XX (General Exceptions). In 1979, thirty-two GATT Contracting Parties signed the Agreement on Technical Barriers to Trade (TBT Agreement), which elaborated upon the original GATT rules. This Agreement formed part of the results of the Tokyo Round. In 1995, with the completion of the Uruguay Round and the establishment of the World Trade Organization, a revised TBT Agreement and a new Agreement on Sanitary and Phytosanitary Measures (SPS Agreement) came into force. Unlike the plurilateral nature of the Tokyo Round TBT Agreement, both these WTO Agreements (TBT and SPS) were made binding on all WTO Members as a consequence of the "single undertaking" which characterized the Uruguay Round.

The attention given to the trade impact of standards has sometimes obscured the important role that standards play in increasing economic efficiency and dealing with market failures. It is in performing these functions that they create societal benefits. An important point to emerge from economic theory is that there is no monotonic relationship between welfare and trade volumes. Changes in trade flows do not always bear a matching relationship to changes in welfare. The empirical evidence also suggests that standards can have both positive and negative effects on trade flows. This Report seeks to shed light on these various functions and consequences of standards. An important and recurring theme in the Report concerns the role of international cooperation in managing trade and the public policy challenges facing standards regimes, whether these emanate from the trade rules or from rules and processes involved in the setting and administration of standards.

The Report focuses on three key areas: (i) the economics of standards in relation to international trade; (ii) the institutional setting in which standard-setting and conformity assessment occurs; and (iii) the role of WTO agreements in reconciling the legitimate policy uses of standards with an open, non-discriminatory trading system. While much of the analysis deals with product standards, a large number of the issues discussed also apply in the field of services. The Report is organized into four major sections.

Section IIB begins with the economics of standards and trade. The need for standards and the role they play in economic activity is examined. Standards provide scope for the realization of economies of scale and network externalities. They increase economic efficiency by enhancing compatibility among products and providing information. They serve important public policy goals in solving problems associated with imperfect information and negative externalities. Standards will be compared with other economic instruments that are available to firms and governments. Then the likely impact of standards on international trade is explored. Taking into account the functions of standards and the needs that they meet, under what conditions are standards likely to create or impede trade. The role of harmonization, equivalence and mutual recognition in reducing the trade-hampering effects of standards is then examined. Finally, the available empirical literature on the relationship between standards and trade is reviewed. Questions addressed include the impact of standards on prices, costs, trade volumes and social welfare.

Section IIC then focuses on the institutional architecture of conformity assessment and standardization, and in particular the challenges these issues pose for developing countries. The Section describes how national standards are set in practice and who designs them. It turns out that standard-setting involves a diverse group of actors from government bodies, industry groups, consortia of firms, individual companies and NGOs. A description is also provided of the international architecture of conformity assessment and standardization, which is relevant to the national context and the overall standards regime encountered in trade. Finally the specific problems faced by developing countries in complying with the requirements set in the advanced countries are discussed.

Section IID relates the economic analysis of standards to the relevant WTO legal texts – GATT 1994, the TBT Agreement and the SPS Agreement – and related jurisprudence. The major provisions of these Agreements are identified and it is shown how, taking into account the public policy objectives underlying standards, the provisions reduce the threat of standards being used for hidden protection or discrimination. The Section contains detailed analyses of the extent to which the major economic principles underlying the role of standards are reflected in WTO agreements, and ultimately in WTO jurisprudence. Finally, the main conclusions are discussed in Section IIE.

B THE ECONOMICS OF STANDARDS AND TRADE

We live in a world profoundly reliant on product standards. Faxes can be sent around the world because fax machines obey a common protocol. Computer files can be shared because computers employ various standardized hardware and software formats. The need for product standards is not a new phenomenon. In biblical times, the lack of a common (standardized) language wreaked havoc at the Tower of Babel (Shapiro, 2000). In more recent times, during the great Baltimore fire of 1904, fire fighters called in from neighbouring cities were unable to fight the blaze effectively because their hoses would not fit the hydrants in Baltimore.

The specific functions that standards fulfil are very diverse. Two of the most important are providing compatibility and information. It is through sharing a common standard that anonymous partners in a market can communicate, can have common expectations on the performance of each other's product, and can trust the compatibility of their joint production. Thus, standards are necessary for the smooth functioning of anonymous exchanges – and therefore, for the efficient functioning of the market. Although standardization is necessary, it does not follow that all variety is undesirable. Standards reflect the needs of the groups that express them, and as long as groups differ, their optimal standards will reflect their differences (Casella, 2001).

This Section is about the economics of standards and trade. It provides an explanation of the basic economic concepts related to standards and explains what economic role these standards play. It will explore the implications of adopting standards on international trade. The terminology used in the economic analysis of standards does not always correspond to that used in the legal literature on the same subject, and these differences are explored.

Subsection 1 introduces the most important economic concepts relevant for any discussion on standards. Subsection 2 discusses in detail the different situations in which standards can improve efficiency and what this means for international trade flows and welfare. In particular, it discusses standards in markets characterized by direct or indirect network externalities, standards in markets characterized by information asymmetries, and standards in markets with negative consumer or producer externalities. A well-designed standard can increase efficiency and trade. Standards can, however, also create new inefficiencies through their effect on the range of varieties supplied in a market and through the possible resulting effects on competition in the relevant market. For each of the different types of standards discussed, the likely effect on international trade flows will be considered and welfare implications will be discussed. Given the diversity of roles of standards, it is likely that they can have different, possibly even opposing, impacts on international trade and welfare. The discussion will show that the actual impact of standards will to a large extent depend on their design. It will also depend on whether and to what extent standards are set by public or by private actors.

In many instances, the existence of product standards is necessary to allow international exchange between anonymous economic agents, since parties to the transaction must be assured of the nature and quality of products. But differences in preferences, tastes and assessment of risks among countries can lead to the adoption of differing product standards. Imports may only be allowed if products have been tested to conform to the standards adopted in the destination country. This can increase the costs incurred by exporters and thereby lower the volume of international trade. Subsection 3 examines to what extent mutual recognition and harmonization can reduce any trade-distorting effects of standards in these cases. It also discusses the welfare implications of both policy options. Finally, Subsection 4 examines the empirical evidence bearing on the effects of standards on international trade.

1. DIFFERENT TYPES OF STANDARDS AND SOME DEFINITIONAL ISSUES

An on-line search for the word "standard" in the Compact Oxford English Dictionary returns two definitions of relevance for this Report: "a (required or agreed) level of quality or attainment" and "something used as a measure, norm, or model in comparative evaluations". The requirement that chocolate does not contain more than 5 per cent vegetable fat (instead of cacao butter) in order to warrant the name chocolate, could probably fall under both definitions of a standard. The requirement for a traffic light to use the three colours

red, yellow and green would fall under the second definition, but not necessarily under the first one. The difference between the two examples is that in the first case the "norm" refers to something that can be measured (lower or higher percentage of vegetable fat), whereas the second does not. For an economic analysis of standards, the difference between norms referring to characteristics that can be measured on an objective scale and norms referring to other characteristics that cannot be measured is quite important.

(a) Vertical versus horizontal differentiation

Product standards specify the characteristics of a product. By nature product standards therefore play a role in markets of differentiated products, i.e. products that appear in different varieties. Economists distinguish between two types of product differentiation: "vertical" product differentiation and "horizontal" product differentiation. In the case of vertical differentiation, different varieties can be ordered according to a certain scale. One variety is better than another, larger than another, safer than another, etc. Examples of such varieties are chocolates with higher or lower contents of cacao butter, or cars that use more or less petrol per kilometre. The differentiation is based on content of cacao butter in the first case and petrol use in the second case. This differentiation always appears in varying degrees among the different product varieties. One feature of vertical differentiation is that it often leads to price differences among varieties. Consumers will, for instance, agree that a computer with a memory of 512 MB is better than one with a memory of 256 MB and they will be willing to pay a higher price for the first one. This does not imply, however, that all consumers will buy the computer with the higher memory, as this decision depends, among others, on consumers' disposable income.

In the case of horizontally differentiated products, the characteristic that is responsible for the differentiation cannot be ranked. Colour is an example of such a characteristic, or flavour. A red t-shirt is different from a blue t-shirt, but the two varieties cannot really be ranked according to an objective scale. The same for strawberry ice-cream and vanilla ice-cream. Horizontal differentiation is not necessarily associated with price differences among varieties. In the real world many products are differentiated along both lines. Cars for instance appear in different colours and differ in their use of petrol.

The concept of a "minimum standard" only makes sense in the context of vertically differentiated goods. It implies that only products reaching a certain level of "quality or attainment" or higher are considered to meet the relevant standard. The introduction of a minimum standard therefore does not necessarily reduce the number of product varieties in the market to just one (the minimum standard), as products exceeding the standard are also allowed to circulate in the market.

The difference between horizontal and vertical product differentiation is relevant for the structure of the rest of this Section. Each of the following Subsections discusses a different type of market failure, in the presence of which the introduction of a standard may be welfare improving. Problems of imperfect information (e.g. safety standards) and negative production or consumption externalities (e.g. environmental standards) are typically analysed in models of vertical product differentiation, while for the analysis of network externalities (compatibility standards) both types of differentiation play a role.

(b) Private versus public standards

Another distinction of importance for this Section is between private standards and public standards. Unfortunately, the line separating these two concepts is not entirely clear and probably depends on the perspective from which the issue is examined. From the point of view of international trade law, "public standards" imply the existence of a domestic or internal law which refers to the standard. Yet, when looking at the institutional environment in which standard-setting takes place (discussed in Section IIC) it appears that many standards which are public by law are based on technical specifications and initiatives by private standard-setting organizations. The question thus arises as to whether such standards should indeed be considered "public".

This Section looks at standards from the point of view of economic theory. The distinction between public and private standards will depend not so much on whether standards are public law, but rather on whose interests are taken into account when a standard is set and enforced. In the case of public standards, it is

assumed that the interests of all actors in an economy are taken into account when the standard is set. This implies that the effect on the profits of all companies and the wellbeing of all consumers have been considered. Externalities like those related to the environment or to public health are also factored into the decision-making of the government. Private standards, on the other hand, are assumed to take account only of the profits of firms. Depending on the situation, individual firms will decide if they are willing to cooperate in standard-setting activities. Private standards may implicitly take consumer interests into account, but only if these interests correspond to their own interests. Standards are also sometimes set by non-governmental organizations (NGOs).[1] From the point of view of international trade law such standards would probably be considered "private standards". For the purpose of this Section, NGO standards would probably represent a separate category as NGO activities tend not to be profit-oriented and do not necessarily pursue the same objectives as governments. This Section does not deal with NGO standard-setting activity in any systematic manner and the term "private standard" only refers here to standards set by firms.

(c) Mandatory standards, voluntary standards and the role of labels

While private standards are by definition voluntary, public standards can either be mandatory or voluntary. In the case of mandatory standards, only standardized products are allowed to circulate in the market, whereas in the case of voluntary standards even those products not meeting the standards can be supplied. Note that in this particular aspect the terminology used in this Report differs from the one used in WTO law. While the distinction between voluntary and mandatory standards is common among economists and practitioners, only the former are considered to be standards in WTO terminology. The term "mandatory standard" does not exist in WTO terminology. Mandatory standards would, according to TBT terminology, fall under the term "technical regulation". Depending on its function, a mandatory standard could also fall under the term "sanitary or phytosanitary measure" as defined in Annex A of the SPS Agreement. This would, for instance, be the case of certain mandatory food safety standards. Section IID will discuss in more detail the differences and similarities between economic and legal thinking.

The term "minimum standard" does not exist in the legal terminology of the TBT Agreement and the SPS Agreement. As explained previously, minimum standards refer to standards used in the context of vertically differentiated goods, i.e. goods that have characteristics that can be ranked according to an objective scale. Food safety standards (imperfect information) and environmental standards (environmental externalities) often take the form of minimum standards.[2] Voluntary minimum standards would in the TBT Agreement fall under the term standards, whereas mandatory minimum standards would be covered by the term technical regulation.

In the case of voluntary standards, different varieties of goods are allowed to circulate in the market – those conforming with a standard and those not conforming with it. In many cases, it is not easy for consumers to distinguish between the two types of products. Labels are then necessary to support this policy.[3] Two types of situations can arise. The government may choose to oblige producers not meeting the standard to label their products. A voluntary standard may, for instance, pin down the characteristics of clothing that can be considered to limit flammability and the government may decide that clothing not corresponding to these characteristics has to carry a label "flammable". This type of "negative" labelling is typically mandatory, but would in this particular case support a voluntary standard.[4] Alternatively, the government may decide not to combine the voluntary standard with a mandatory labelling policy. In such cases, producers of the standardized

1 Although strictly speaking many standard-setting organizations (discussed in Section II.C) can be considered to be non-governmental organizations, they are not embraced by the term NGOs in this Report. See Section II.C for a definition of NGOs and further discussions.

2 Such standards can also be expressed in terms of upper limits instead of lower limits, e.g. the maximum amount of pesticides used. These concepts would also be covered by the idea of "minimum standards" as they refer to characteristics that can be ranked (more or less pesticides).

3 The relevant market is thus partitioned into two segments: products carrying the label and those not carrying the label. It could be argued that a continuous variable (e.g. more or less petrol use, more or less cacao butter) is transformed into a binary variable (e.g. environment friendly or not, chocolate or not).

4 Labelling policies are not always linked to standards, but may exist for purely informative reasons. Textiles may for instance be required by law to carry a label indicating the composition of the fabrics used. Such a label would also be mandatory, but would not partition the relevant market into one of goods meeting a standard and one of goods not meeting a standard. The discussion of this type of label falls out of the scope of the current Report.

products will often voluntarily label their products in order to signal to consumers that their products meet the "(required or agreed) level of quality or attainment". The possible combinations of voluntary and mandatory standards and labels are summarized in Table 1.

Table 1
Standards and labels: economic versus legal terminology

Economic terminology used in this Report			WTO legal terminology
Mandatory (minimum) standard	1. No label necessary		Technical regulation under TBT or sanitary or phytosanitary measure under SPS
Voluntary (minimum) standard	Label necessary in order for consumers to distinguish between products meeting the standard and those not meeting the standard	2. (a) Government obliges those not meeting the standard to use a label ("negative labelling"): mandatory labelling	Technical regulation under TBT or sanitary or phytosanitary measure under SPS
		2. (b) Government does not oblige those not meeting the standard to use a label. Producers of products meeting the standard may end up labelling voluntarily ("positive labelling")	Standard under TBT

When introducing a public standard a government thus has the choice of the three approaches depicted in Table 1. The following Subsections discuss in detail the effects of these policy options in different market set-ups. In general, the government needs to take into account a number of trade-offs. Mandatory standards tend to lead to the supply of fewer varieties in the market than voluntary standards. This outcome can be desirable if fewer varieties increase efficiency, for instance in the case of network externalities, or if the government has strong reasons to ban certain varieties from the market, for instance in order to protect the health of consumers. When a voluntary standard is introduced, the choice between "negative or positive" labelling will determine who carries the cost of the labelling policy. In the first case the producers (and thus ultimately the consumers) of products not meeting the standard end up paying the labelling costs, whereas in the second case the price of products meeting the standard will incorporate the labelling costs. It has also been argued that consumers react differently to negative labelling than to positive labelling, in the sense that the labelling policy determines whether they purchase the product meeting the standard or the one not meeting it.

(d) Process standards

This Section deals with both product and process standards.[5] Process standards specify the characteristics of a production process. Processes are typically not traded. But the goods they produce may be traded and process standards are therefore relevant to the multilateral trading system. This "indirect" relevance – that is, through the traded products – explains to a large extent why multilateral trade law finds it difficult to deal with process standards.

Process standards are introduced for different reasons:

- because they affect the goods that are produced (e.g. hygiene standards);
- because they affect the efficiency of the production process (e.g. in the case of network externalities);
- because they affect the environment (e.g. pollution standards).

It is only in the first case that process standards may be reflected in the final good and thus have a direct impact on trade. WTO terminology would refer to such standards as "incorporated processes and production methods (PPMs)" and their relevance for trade policy is relatively straightforward. The relevance

[5] Process standards are also referred to as production standards.

of unincorporated PPMs for trade policy is less straightforward as they do not directly affect anything that is traded. Yet at the same time, consumers or governments in an importing country may care about the way in which an imported good is produced – for instance, because they care about the environmental impact of the production process. This Section discusses the role of both incorporated and non-incorporated PPMs in the presence of environmental externalities and their relevance for trade flows and trade policy.[6] While the discussion will focus on economic aspects of the issue, the relevance of process standards for multilateral trade law will be discussed in Section IID.

2. WHY STANDARDS ARE SET AND THEIR EFFECTS ON TRADE

Consumers differ and they appreciate the characteristics of products in different ways. The availability of different varieties of products in the market should, therefore, be welcomed. As a starting point, it is often presumed that markets provide those varieties demanded by consumers and that they provide them in the appropriate quantities. However, this is not always the case. Sometimes consumers may be better off if governments or private institutions enforce the supply of only one product variety in the market. In other instances, there is an undersupply of varieties in the market, or certain varieties are not supplied in optimal quantities. In all these situations, the introduction of a standard can improve welfare, even though it may create new problems, in particular through its effect on the competitive forces at work. The following Subsections will discuss in detail in which type of market set-up the introduction of a standard can be considered desirable.

(a) Network externalities and compatibility standards

Many products have little or no value when consumed in isolation, but generate value when consumed together with other products. For example, computers are of no use without a monitor or without software. Similarly, camera bodies are not useful without lenses or a film, just like a CD player is useless without speakers or headphones and CDs. In the economic literature, these are all examples of products that are strongly complementary. Complementary products need to be compatible. Computer software must be specified in a way that makes it workable on a certain operating system. Likewise, lenses must be designed in a way that they can fit on a camera.

Other products generate a value to users only if they are consumed together with other users. In a communication network, for example, such as a network of electronic-mail users or a network of mobile phone users, each person finds subscribing to a certain electronic-mail system or buying a mobile phone valuable only if she can communicate with other people. This requires that people buy compatible mobile phones. Likewise, if people want to exchange emails they need to subscribe to compatible networks. Compatibility can be achieved in two ways: standardization, whereby products are designed according to certain specifications; or adapters, which provide an interface between products with different specifications. The principal cost of an adapter is the adapter itself. The primary cost of standardization is a loss in terms of product variety.[7] In all these cases, consumers do not shop for individual products, but for systems. The peculiarity of system markets is that the utility that a consumer derives from the consumption of the product does not depend only on the quantity and quality of the product itself, like in the case of bread, but also on the availability and variety of complementary goods and/or the number of people using the same product or compatible ones.[8]

System markets are characterized by potential problems of coordination, whereby market forces may lead to inefficient outcomes. The source of this market failure is network externalities. Positive network externalities arise when a good is more valuable to a user the more users adopt the same good or compatible ones. The

6 Labour standards share many characteristics with process standards. However, labour standards are not discussed in this Report.

7 Other costs include switching to a different system if the one selected turns out to be inferior, and the risk of anticompetitive behaviour in the market, as discussed below.

8 See Shy (2000) for a comprehensive study on network industries.

externality can be direct or indirect. A telephone network is an example of a direct externality because its value for the consumer increases as the total number of network users increases (actual network). A computer is an example of an indirect externality because its value increases as the variety or quality of compatible complementary goods (i.e. compatible software) increases (virtual network). Indirect network effects arise in this case from improvements in the supply of complementary goods. It may happen that the increase in the sale of a given product results in lower prices, better quality and/or greater variety of its complementary goods. Consider the situation when a consumer needs to buy a durable good such as a computer – say IBM or Apple. In making such a choice, a consumer needs to form expectations about the availability of software in the future for each of the computers. If the production of software exhibits economies of scale, this in turn will depend on how many people installed the hardware product in previous purchases. This positive feedback effect of the network constitutes an indirect externality. This "virtual" network creates welfare effects similar to that of the physical network, such as the telephone network, where users are physically linked to one another.

The market, in these cases, may fail to deliver an efficient outcome because the marginal benefit of one more consumer joining the network differs from the social benefit. The private marginal benefit determines whether a consumer joins the network or not. The social benefit of one more user joining the communication network includes the private benefit of the new user and the increase in benefits of the old users. Since social marginal benefits exceed private marginal benefits, the equilibrium network size is smaller than the socially optimal network size, and the perfectly competitive equilibrium is not efficient (Katz and Shapiro, 1985a and 1994). In the case of indirect network externalities, a consumer decision to choose a certain product does not affect the utility of other consumers at present but impacts on future variety and prices of compatible components. Again, it is in the interest of consumers to purchase the most popular product to benefit from an improvement in the supply of complementary goods. However, lack of information, different preferences and firms' marketing actions (such as promotional pricing and advertisements) may generate a non-optimal outcome (David and Greenstein, 1990).

In all these cases, setting a single standard solves the problem of coordination among consumers. Compatibility standards are standards that promote network effects. They can increase welfare because they increase the network of users adopting the same good or compatible ones. Moreover, compatibility standards allow each consumer to "mix and match" components from different manufacturers. Therefore, consumers may enjoy a greater variety of available systems (Matutes and Regibeau, 1988). A classic real world example is that of home HiFi stereos, where all components are compatible and the consumers are free to combine components from different brands to assemble the stereo most preferred. To the extent that compatibility standards reduce the costs to consumers of switching between different interfaces and thereby promote competition.

Welfare effects of compatibility standards may, however, depend on the particular variety chosen as the standard, and this may in turn depend on who sets the standard. In the case of network industries, three types of standards have been observed (Gandal, 2001): i) de facto standards (often proprietary), e.g. Microsoft, and VHS/Betamax; ii) voluntary industry agreements (typically non proprietary), e.g. in the case of Sony and Philips CD-players; and iii) government-imposed standards, e.g. national standards imposed by the US Federal Communication Commission (FCC) for compatibility in the telephony network.

Virtual networks exhibit a natural tendency towards de facto standardization or voluntary open standards (Katz and Shapiro, 1994). This is because, as a consequence of the strong feedback effects, network industries often show a propensity to "tipping" – that is, the tendency for a single technology to dominate the whole market once it has reached a certain critical mass. For example, no one would choose Betamax videocassette recorders over VHS, even if they preferred the former technology, because there is little or no pre-recorded material in Beta format. Therefore, firms owning different technologies will either engage in fierce competition with each other to persuade a sufficiently large number of consumers to choose their technology, or they will cooperate, agree on a single standard, and compete "within" that standard. In the former case, the dominant firm is likely to win the whole market and the risk of anticompetitive behaviour emerges (e.g. Microsoft).

Network externalities may also lead to dynamic inefficiencies when users have to decide whether to switch to a new technology and which competing technology to choose. In particular, network externalities may lead to excess inertia (users delay adopting a new technology or choosing among several technologies) or excess momentum (consumers rush to an inferior technology) for fear of becoming stranded (Katz and Shapiro, 1985b). Also, supply-side mechanisms can lead to excess inertia, since in industries characterized by network externalities the dominant firm usually sets the standard. Competing firms may then wait to adopt a new technology because they fear being displaced by a subsequent innovation of a dominant firm. Standards are necessary for the diffusion of a new technology in network industries. Setting a standard has, for instance, proven to be essential for successful innovation in the wireless networking industry (so-called Wi-Fi). Initially, vendors of wireless equipment developed their own standards. In this way, users of the Wi-Fi technology were locked into a particular vendor's products. It was not until 1999, when the six major companies of wireless technology – Intersil, 3Com, Nokia, Aironet, Symbol and Lucent – agreed on a common standard, that the Wi-Fi market took off.

An important issue is whether compatibility standards should be determined by the market or whether there is a role for the government to play. Coordination problems, excess inertia and excess momentum are all cases of market failure. Firms may fail to agree on a standard or a dominant firm may impose its own standard and develop anti-competitive behaviour. Government intervention may then be needed to improve market performance, either by setting a standard or ensuring competition.

Costs are, however, associated with standardization on a single technology, and the government does not seem to be in a better position than the market to minimize these costs. Standardization can result in large costs, for example, if the technology selected turns out to be an inferior technology. Learning to use a certain system takes time. Switching to a different system has costs in terms of retraining. Switching costs may lock consumers into using an inferior technology. A well known case is that of the commonly used QWERTY keyboard configuration.[9] There is no reason to think that the government is better informed and less prone to mistakes than the private sector. Analysis of standard setting in mobile telecommunications in Europe and the US (see Box 1) provides a useful case to compare alternative approaches to standardization. The European and US experience in the wireless telecommunication industry shows that a government-mandated standard can partially solve the coordination problem among consumers, as the critical mass of the network is reached very quickly and consumers benefit from the network externalities associated with a larger market. When the AMPS was deployed as the American standard for the first generation mobile phones, it quickly became a de facto world standard. The adoption of the GSM as the pan-European standard for second generation mobile phones (1989) also fostered the diffusion of GSM outside Europe. As a result, GSM is the de facto global standard today. At the end of 2003, GSM was used by more than 72 per cent of mobile phone subscribers. However, government-mandated standards do not avoid the risk of being locked into obsolete technologies, or the risk of inertia. Switching costs for consumers (such as the cost of replacing a cellular phone or breaking an existing contract) and carriers (such as the costs of replacing base stations, retraining employees and redesigning contracts) may lock in obsolete technologies. For example, the use of AMPS technology (government-mandated first generation technology in the United States) continues to be widespread in the United States despite the availability of superior second and third generation technology. On the other hand, the case of third generation (3G) mobile phones shows that the support for a specific standard by a regional entity, such as ETSI, was not sufficient to trigger its adoption in the global market. Commercialization of 3G mobile phones has been retarded not by the non-availability of the 3G technology, but rather by the fact that for over five years no agreement was reached on what the standard would be adopted by the International Telecommunications Union.

[9] This configuration was initially introduced by the Remington Arms Company, a leading manufacturer of manual typewriters, deliberately to slow down typists and avoid jams. At this time, available keyboard technology had no engineering solution to the problem of frequent jams. In 1911, the QWERTY keyboard became a de facto standard when it was applied to the first typewriter that allowed characters to be visible to the typist immediately after they had been typed. Typists started being trained on these new machines, and other keyboard arrangements were abandoned. In the 1930s, Dvorak developed a more efficient keyboard that allowed a typist to type up to 20 per cent faster. The American National Standards Institute published a standard for keyboards based on the Dvorak configuration. However, this configuration was not taken up by the market as the costs for producers and consumers of switching to the new configuration were considered too high (David, 1985).

Box 1: The mobile phone industry in Europe and the United States

Mobile communication networks have experienced dramatic growth over the past decade. In 2002, the number of cellular mobile subscribers around the world exceeded 1 billion, up from just 11 million in 1990. In 1990, mobile phone subscribers represented only 2 per cent of fixed telephone line subscribers, while by the end of 2002 there were more mobile cellular subscribers than subscribers to fixed telephone lines.

The creation of standards in the wireless telecommunication industry followed a different pattern in Europe and the United States. In the early 1980s, Ameritech installed the first analog mobile phones system in the United States. The Federal Communication Commission (FCC) mandated the adoption of a single standard for the United States – the AMPS system (Advanced Mobile Phone Service). To avoid the emergence of a monopoly service provider, the FCC also imposed an antitrust regulation. The adoption of a unified, government-backed standard fuelled the growth of the network, and by 1993 more than half of the worldwide wireless cellular systems used this technology.

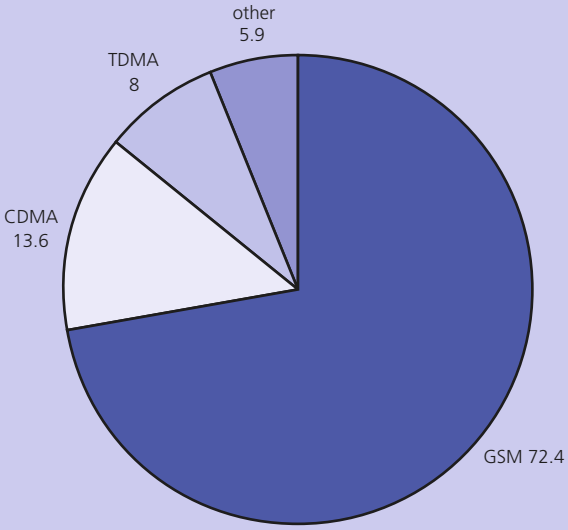
By contrast, in Europe standards for first generation mobile phones differed across countries and were not compatible with each other. Two standards for first generation cellular phones competed in the European market: the Nordic Mobile Telephone (NMT) and the Total Access Communication System (TACS). The former was developed by Nokia and Ericsson. It was first implemented in Sweden, then spread to other Scandinavian countries. The latter standard was established in Italy and the United Kingdom. In this situation, not only was mobile communication equipment limited to operation within national boundaries, but there was also limited scope for exploiting economies of scale and forgone savings. The rate of diffusion of mobile phone communication (growth of the percentage of people using mobile phones) remained higher in the United States than in the EU during the whole of the 1980s.

In 1991, the second generation digital mobile phone was commercialized. The United States and the EU again chose different approaches to standardization. The FCC adopted a market-based approach. Several standards for digital mobile phones emerged in the United States market and they were left to compete for the dominant position in the market. In contrast, in 1989 the European Telecommunication Standards Institute (ETSI) adopted a unified Global System for Mobile Communications, or GSM. This continent-wide standard for the digital network allows one cell phone to work across all European countries. The adoption of a single standard in Europe favoured the rapid diffusion of GSM technology in Europe, where analog technologies (such as AMPS, TACS, NMT) were nearly completely displaced. The digital network grew very rapidly in Europe. The number of users of the digital network for cellular communication rose in Europe from 4 per cent in 1992 to over 90 per cent in 1998. In North America, where the choice of the second generation technology was left to the market, there were a variety of technologies used, including AMPS, a first-generation technology. The growth of digital mobile phones suffered as a result. In the United States, they began to be used only in 1995, and in 1998 the percentage of mobile phone subscribers using digital cellular phones was still below 30 per cent.

Harmonization of standards in the network industry in Europe allowed the rapid diffusion of the GSM technology across users, including outside European boundaries (see Chart below for an indication of the diffusion of the GSM technology as of 2003). By 1993, there were 36 GSM networks in 22 countries and over 1 million subscribers worldwide. At the end of 2003, over 400 GSM networks were operational in over 110 countries around the world and there were nearly 1 billion GSM subscribers, more than 70 per cent of the digital network. Standardization and diffusion of the GSM technology in the United States followed, but with a delay. In 2003, 20 per cent of North American mobile telecommunication used a GSM technology. The advantage is that now a European mobile user who travels to the United States can use her mobile phone to make a phone call in the United States (so called international roaming).

In 2000, in an effort to consolidate existing incompatible mobile environments into a global network, the International Telecommunication Union (ITU) adopted a standard for third generation (3G) mobile phones: the International Mobile Telecommunication 2000 (IMT-2000). Two technologies were competing in the market to become the 3G global standard: Universal Mobile Telecommunication System (UMTS) and Code Division Multiplexing Access (CDMA-2000). UMTS was supported by European and Japanese telecommunication firms. ETSI recommended that the ITU adopt this technology and a European decision in 1998 had mandated that 3G UMTS service cover 80 per cent of the population in Europe by 2005. The wireless communication company Qualcomm had endorsed CDMA-2000 as a 3G standard and protected this technology entering into a patent dispute. Discord on a global standard retarded the commercialization of 3G mobile phones, which only just started at the end of 2004. The transition to the new technology will ensure compatibility with mobile phones from previous generations. In this way, switching costs will be minimised. Producers and consumers will benefit from economies of scale and network externalities.

World mobile telecommunication by type of technology, 2003
(Percentage)



Source: GSM Association.

Source: Ritchie et al. (1999); ITU (1999); ITU (2004); www.gsmworld.com as at November 2004. John Scourias "Overview of the Global System for Mobile Communications" at http://ccnga.uwaterloo.ca/~jscouria/GSM/bib#bib.

The effect of compatibility standards on international trade

To the extent that compatibility standards allow network externalities to be captured, or allow producers to coordinate their activities more efficiently or embody information about consumer preferences in foreign markets, they are likely to enhance international trade. Several network industries are global in scope: the telecommunications, personal computers, and car industries are examples where global competition prevails. In some of these cases, firms compete in markets with different government-imposed standards. In other cases, perhaps more frequently, product standards are set by industry groups whose membership is increasingly international in scope.

The theoretical literature on compatibility standards shows that when network externalities are large, countries (and industrial groups operating in different countries) have an incentive to harmonize standards or make them compatible, and that in these situations there is more international trade (Gandal and Shy, 2001).[10] For products or services which are characterized by global network externalities, the adoption of an agreed standard facilitates the expansion of the market, which can extend beyond national borders, for the product or service. For example, the adoption of the GSM standard in cellular phones enabled rapid penetration of cellular phones in Western Europe, and then it quickly extended to Asia and Africa (see Box 1). Not only did this result in massive growth in domestic calls using cell phones, it has also led to the growth of

[10] Gandal (2001) used the example of Japanese television set exports to the United States and Europe to study the effect of differing standards on international trade. Both Japan and the United States had adopted the same National Television Standards Committee (NTSC) system, while European countries had adopted either the Phase Alternate Lines (PAL) or Sequential Couleur Avec Memoire (SECAM) standards. The three standards are incompatible. Despite the strong competitive advantage of Japanese TV manufacturers, their market share differed significantly in the United States and Europe. By the early 1980s, Japanese sets accounted for 43.5 per cent of the US market while their market share in Europe was only 15.2 per cent. He attributes the failure to develop an integrated global market in TV receivers to the adoption of different standards in the major markets.

roaming (which represents trade in telecommunications service), in which a caller with a domestic cell phone subscription can make a call while overseas, utilizing the network of a foreign telecommunications provider. As the number of GSM users increased from 258 million to 456 million between 1999 and 2000, the number of international roaming calls surged to 540 million in 2000, doubling relative to the year before.

Compatibility standards also facilitate trade in the case of virtual network industries built on complementarities in production or consumption, since an incentive exists here to ensure that compatibility is extended across countries. Modern manufacturing involves a large number of firms in different locations, often also in different countries, who produce parts and components which are assembled before being distributed to the final consumer. Effective assembly of products from a host of suppliers require that the inputs are compatible with each other such that they can be fitted together with as little adjustment as possible. The role of standards is particularly important in the information technology sector, but all sectors depend on common standards in order to exchange goods, services and information. Some standards such as measurement units are internationally accepted and others are global, national or regional. However, in order to ensure compatibility of purchased inputs firms or coalitions of firms typically develop standards that are specific to their technology. Often the ability to conform to a firm's standards is a prequalification criterion for a potential supplier to be allowed to bid for contracts. This creates a supplier base of qualified firms, and the larger this supplier base the more competitive the market and the lower the cost of inputs to the downstream firm producing final goods.[11]

In industries where the final product is assembled from parts and modules, the compatibility of parts and components (i.e. to what extent they are standardized) is decisive for whether or not the firms in the industry are vertically integrated. With standardized inputs, it is easy for suppliers of parts and components to find a customer and vice versa. If, on the other hand, a downstream firm has set product standards that are specific to the firm, it might have difficulty in persuading suppliers to conform to the standard. The supplier cannot be sure that the customer will actually pay for its effort, since *ex-post* nobody else will be interested in buying the product in question.[12] When lack of trust or lack of opportunities for setting up a mutually beneficial enforceable contract makes this a serious problem, the assembler will have to produce its firm-specific components in-house. When the majority of companies in an industry use their own standards and produce their components themselves, the market for independent suppliers of components is thin and underdeveloped. McLaren (2000) shows that trade liberalization is a possible way of thickening the market for suppliers of components and thus inducing more firms to diversify the sources of their input purchases. Clearly, replacing firm-specific standards with shared standards will have the same effects within and across international boundaries.

Standards therefore represent an important way to ensure the compatibility of inputs, parts and components. They are also essential in ensuring adequate quality and coordinating the pace of adoption of innovation across suppliers of parts and components (see Box 2 for the role of standards in fostering technology diffusion). Internationally accepted product standards can facilitate international trade in intermediate products through reducing search costs and production costs. Production costs are reduced because imported inputs can enter the production process directly without any intermediate processing and also because an international market can support a larger supplier base and thus a more competitive market for intermediate inputs.

[11] This relationship between the degree of specialization (as given by the number of differentiated suppliers) and the extent of the market is referred to as pecuniary externalities in the literature. This is because the entry of a new supplier lowers the cost of the downstream firm by extending the number of inputs and reducing everybody's margin. Since the impact is reflected in prices, it is not a pure externality.

[12] This is the so-called hold-up problem discussed in the industrial organization literature.

Box 2: Technology diffusion and the technology content of standards

The information contained in standards can also play a role in the diffusion of technology. The information contained in non-proprietary standards is in principle accessible to everybody. In particular, standards may embody considerable technological knowledge. Firms can access and acquire this knowledge and standards can therefore serve as a vehicle for technology diffusion within or across countries. Even where knowledge is patent-protected, information registered under patents may permit useful knowledge adaptations that can be incorporated into standards.

In industries that assemble parts and components from various providers, both uniform quality and uniformity in the pace of technological advancement are essential. Standards are crucial in coordinating the pace and the adoption of innovation across suppliers of parts and components, thus fostering technology diffusion across sectors.

A recent study has found that standards play an important role in the diffusion of new technology and ultimately contribute to growth. On the basis of a survey conducted of 700 companies, the study finds that in the period 1960-96, one per cent of Germany's gross domestic product and one-third of its economic growth were attributable to standards. Standards are at least as important as patents for growth. They act as catalysts for the spread of innovations into the market. The study found a positive correlation between patent applications and new technical regulations, especially in innovative fields (Blind et al., 1999).

To the extent that standards incorporate information about a particular technology, they create a means of diffusing know-how internationally. While a technology that has now become an industry standard may not be on the technological frontier, one can imagine a situation where technological know-how differs among firms in developed and developing countries. So a mature technology which is adopted as an industry standard in developed countries may still represent an advance for firms in developing countries. The existence of such standards that can be adopted by firms in poor countries can represent an important mechanism for diffusing technology.

However, while these conditions make it more likely that compatibility standards increase trade, there are no guarantees. Where network externality effects are strong, compatibility standards can also be a source of market power. In the information technology sector, for example, firms can garner an important, if not decisive advantage when their standard (usually in the form of copyrighted software) is adopted as the de facto industry standard. When a de facto standard conveys market power, it will limit competition and act as a deterrent to trade.

Moreover, while network externalities provide incentives for international compatibility, it may be difficult to achieve such an outcome. The coordination problem consumers face – trying to avoid either excess inertia or excess momentum – is likely to be more acute in an international setting since there are more consumers to coordinate and they are spread across different jurisdictions. To the extent that promoters of competing standards come from different countries and the winner can claim rents from the adoption of their standard, strategic trade policy considerations can come into play. A government can try to tip the balance in favour of its national champion by mandating the use of the firm's standard at home. This would be in the hope that an installed base of users would create a strong enough bandwagon effect to convince foreign suppliers to switch to the national firm's standard in other markets.

Recent developments in the computer industry have shown that multinational companies may also have incentives to avoid international competition. For example, the new iMac G5s sold in the United States are designed to work only with the electric power systems in the United States and Japan, but not in Europe. Similarly, some of the latest printers from Hewlett-Packard Co. are configured to use only printer cartridges

purchased in the same region as the printer. Adoption of incompatible standards across countries works as a market segmentation device and reduces competition and trade. Faced by strong competitive pressure, for example the pressure resulting from the recent depreciation of the dollar for those producing in Europe, multinationals may be induced to price discriminate across countries. Setting incompatible standards between the EU and United States allows multinationals to set different prices for the two markets, as arbitrage from imports is rendered impossible.

(b) Imperfect information: the case of safety standards

Many situations in which consumers, producers and governments have to make decisions are characterized by Imperfect information. Decision-makers do not have all the information at hand when they make purchases, investments or decide on policies. Sometimes, both parties to a transaction do not have all the necessary information. But in many instances, one party to a transaction (typically the seller) may have better information about a product than the other party (typically the buyer). This is the case of information asymmetry. While the former case is also important, the focus in this Report would be on problems created by asymmetry of information and the role that standards can play in these situations.

Information asymmetries occur when producers have information about the characteristics of goods they produce which users do not have when purchasing these goods. Users may in this case be consumers of final goods or companies buying intermediate goods as an input for their production process. In both cases, the information asymmetry may significantly hamper the efficient functioning of markets. Standards can solve the information problem and thus enhance efficiency.

Because consumers differ they appreciate characteristics of products in different ways. The availability of different varieties of products in the market should, therefore, in principle be welcomed. In the presence of information asymmetries, markets that are left alone may end up undersupplying certain varieties of goods. The market outcome in the case of information asymmetries thus stands in stark contrast to the case of network externalities discussed in the previous Subsection. While in the case of network externalities markets may end up supplying too many varieties, the opposite is likely to be the case in the presence of information asymmetries.

If, for instance, consumers have only imperfect information about the characteristics of a product upon purchase, there may be an undersupply of higher-quality varieties, where the term "quality" can refer to any characteristic that can be ranked by consumers according to an objective scale (e.g. size, durability, safety). The safety of meat may, for instance, depend on the way cattle have been raised. "Safer" meat may be more costly to produce and therefore demand a higher price in the market. Yet if consumers are not able to distinguish the quality of the meat upon purchase, they will tend to buy the cheapest meat on offer. Production may become unprofitable for producers of high quality meat and they may disappear from the market or switch to cheaper production methods that increase health risks for consumers. Thus, the market alone may end up undersupplying "safe meat".

Perhaps the most typical example of standards that work against the undersupply of "quality" output relates to product safety. Indeed, a wide range of consumer goods – food, drugs, vehicles, electrical appliances, safety equipment – face many types of requirements, from design (e.g. toys), to ingredients (e.g. chemicals), to the process of manufacture or production (e.g. pasteurization of milk), and to performance (e.g. helmets). Mandatory standards act in these situations like minimum standards, as they rule out the supply of products not meeting the quality (e.g. safety) level determined by the standard. Voluntary standards in combination with a label, e.g. child-safe toys, have the effect of guaranteeing the supply of higher quality products next to the supply of lower quality products. Voluntary standards thus do not rule out the supply of lower quality products, but ensure that higher qualities are not pushed out of the market. The fact that lower quality products are not banned from the market can be considered more "market-friendly", but also more "risky". Voluntary standards will therefore be preferable to mandatory standards if the risks involved are considered to be acceptable to society.

The economic cost from accidental injuries and deaths can be large. In the United States, for example, there were more than 12 million accidents in 2003 from the use of consumer products that required treatment in hospitals.[13] The US Consumer Product Safety Commission estimates the economic costs of these accidental deaths and injuries at $700 billion annually. Unfortunately, risk and its cost are not always easy to measure, in particular because consumers tend to value risk in different ways. It is therefore not straightforward to design optimal policy instruments in these cases.[14]

Public versus private initiatives to protect consumers

The rationale for government intervention rests on the existence of information asymmetry between the producer of the possibly defective product and the consumer. A manufacturer knows more about the reliability or safety of his product than the consumer. Of course, it may be possible that the threat of a consumer backlash against firms discovered selling unsafe products will deter producers from willingly selling substandard products in the marketplace. Firms also have an incentive to improve the reliability of their products in order to differentiate their output and create a price premium for them (Shapiro, 1983). The extent to which consumers can "punish" producers providing unsafe products or reward those supplying safe products will, however, depend on whether consumers identify the exact characteristics of a product they buy and on how frequently they return to the market to buy that product.

Economists have classified goods into three categories that signal the degree of information available to consumers when purchasing a good. These are search goods, experience goods and credence goods. In the case of search goods – for example, clothing – quality can be ascertained by consumers before purchase. In other cases, the quality may be learned after the good is bought and consumed. This is the case for instance with the quality of food or washing machines. The literature refers to these goods as experience goods.[15] For still other goods, aspects of quality (e.g. the amount of fluoride in toothpaste or the amount of calories in a snack) are rarely learned, even after consumption. This last type of product is referred to as credence goods in the economic literature.[16] Note that credence goods have above all been analysed in the context of services: the timeliness of a doctor's intervention, the quality of a lawyer's advice and the reliability of car repairs are typical examples of credence good characteristics. Box 3 discusses the case of standards in services.

Box 3: Services as credence "goods"

Credence goods refer to goods and services whose quality cannot be determined before, during, or sometimes even after their use. The usual examples are services – medical, legal, financial and auto-repair services – where the consumer is largely dependent on the expertise and counsel given by the provider of the service. The information asymmetry between provider and consumer arises because of the specialized knowledge of the provider and the high cost involved for the consumer to verify the advice he is given. So in the case of medical services, a patient will just be told what ails him and what medical tests and procedures to undergo. A patient must take much of the medical advice he is given on faith (hence the term credence). In many cases, the consumer will not be able to determine the quality of the service provided even after its consumption. A patient would not be able to appraise how well he was treated by his physician since the medical outcome (good or bad) will only partly depend on the physician's skills.

[13] NEISS is a national probability sample of hospitals in the United States and its territories. Patient information is collected from each NEISS hospital for every emergency visit involving an injury associated with consumer products.

[14] See also Section 4 on balancing.

[15] Nelson (1970).

[16] The term was first used by Darby and Karni (1973).

This asymmetry of information gives providers ample opportunity to exploit consumers. The provider may recommend expensive procedures, even though less expensive alternatives are available. Or the provider may recommend treatments that are not even necessary. Emons (1997) gives some examples of the possible effects of this information asymmetry:

- In the Swiss canton of Ticino, ordinary patients (i.e., the population average) had 33 per cent more of the seven most important operations than medical doctors and their families;
- In Germany, the most expensive garages charge up to double the amount that the cheapest garages charge for bodywork without necessarily being any better;
- In the United States, unnecessary repairs were recommended to car owners by employees of Sears Automotive Centres in 90 per cent of the test cases.

Given that the consumer will not be in a position to appraise the quality of the services which are provided, markets often require some public or private regulatory structure to remove the inefficiency. In the case of service providers, these often take the form of minimum qualification or educational standards. In many countries, in order to practice medicine, a medical licence is required. Licensing, in turn, requires the would-be physician to complete an approved medical training programme and pass a standardized test. Since the licence must be renewed, a physician's performance is monitored by the licensing board. Lawyers also face similar standards. In the United States, one must have graduated from law school and passed the state bar exam in order to practice law in a particular state.

Foreign service suppliers usually face more severe requirements. Seldon et al. (1998), for example, point out that the residency requirements for foreign-trained physicians exceed the requirements for graduates of US medical schools.

In the case of credence goods, consumers rely to a large extent on government intervention to ensure the quality of products provided in the market, reflecting both the difficulty for consumers to evaluate a product's safety or to take recourse against producers if the product turns out not to meet expectations. If the government has serious reasons to believe there is a demand for (what is perceived by consumers as) higher quality goods, it may want to introduce voluntary standards in order to increase the range of qualities provided in the market. But where deceptive practices by producers have such serious effects as to endanger the health of consumers, the government may wish to take preventive action in order to rule out such cases. In these circumstances, the government will choose mandatory standards.

In the case of experience goods, producers have an incentive not to sell unsafe or unreliable products in order to avoid a consumer backlash against the firm, as described above. Government intervention could be minimal in such cases and, for instance, take the form of product liability legislation, which allows a consumer who has been injured by a defective product to claim damages from the producer through the courts.[17] In some ways, this is a less intrusive form of public action than specifying what types of technical specifications a product must have before it can be sold in the market. But there are cases in which product liability legislation would not result in satisfactory outcomes. The impact of a product defect may, for instance, be catastrophic – with victims suffering from severe injuries or deaths – so that survivors can never be entirely compensated for their sufferings. Finally, manufacturers who face a large number of lawsuits and claims may go into bankruptcy first before payments to claimants are ever made.[18]

[17] Another source of market imperfection continues to exist in such cases; in an imperfect information setting, there is a positive externality from knowledge acquired by the subset of consumers who have consumed a product. This information about the product's reliability is essentially a public good that government should then make available to the uninformed.

[18] See Tirole (1993) for a further discussion of these issues.

Without some form of public intervention, the market will produce a welfare-inferior outcome in such cases. But if the need for public intervention can be justified in this case, should it take the form of product standards? And if so, how should these standards be designed? Designing standards often implies the specification of a large number of technical details. Ideally, consumer preferences should be taken into account when designing standards but a government's knowledge of consumer preferences is typically imperfect. Small changes in the specification of a standard may also have an important impact on producers and on the competitive setting in a market. Designing optimal standards is therefore not a straightforward exercise.

There are a number of advantages to mandatory product standards which lead to their wide application by governments. An extensive set of safety-related standards exist for many consumer products. (See, for example, Box 4 on federally-mandated motor vehicle standards in the United States). The use of technical standards can build on accumulated experience and scientific knowledge about the likely effect of a product standard on consumer safety. Second, conformity with technical standards provides an objective and easily monitored benchmark for the regulator. Third, the imposition of product standards is more likely to convey to consumers that public attention is being paid to important safety issues and that action is being taken by responsible authorities.

Box 4: US Federal Motor Vehicle Safety Standards and Regulations

In the late 1960s, public concern over motor vehicle safety in the United States was a major factor in the establishment of the National Highway Traffic Safety Administration (NHTSA). The public uproar was sparked by the publication of Ralph Nader's book *Unsafe at Any Speed: The Designed-in Dangers of the American Automobile,* which accused General Motors of corporate negligence in its design and manufacture of the popular Corvair. This was followed up by a congressional investigation. The NHTSA has the mandate to issue federal motor vehicle safety standards and regulations to which manufacturers of motor vehicles and items of motor vehicle equipment must conform. The first standard to become effective, on 1 March 1967, was for seat belt assemblies.

The federal standards cover motor vehicle components (e.g. tires, brake hoses), systems (e.g. hydraulic and brake systems) and protection devices (e.g. seat belt assemblies). They also include requirements on fuel economy, anthropomorphic test devices (size, shape, weight, etc. of the test dummies to test performance of safety systems in motor vehicles). Safety-related defects must be reported to the NHTSA and made public.

Notwithstanding these efforts, fatalities from motor vehicle crashes continue to number in the tens of thousands. In 2000, the NHTSA reported 41,821 casualties from motor vehicle crashes. The total economic cost of motor vehicle crashes was estimated at $230.6 billion, which included the present value of lifetime costs for the fatalities, 5.3 million non-fatal injuries, and 28 million damaged vehicles.

However, this benign view of regulatory action does not go unchallenged. An important argument against the use of mandatory product standards is that they can create moral hazard, creating an impression in the public mind that government-mandated standards have succeeded in eliminating all the risks from a given product. Given what is essentially a public guarantee about the safety of the product, consumers may then become less cautious in their use of it. So if this induced change in consumer behaviour is taken into account, there may be no significant difference in accident and mortality rates arising from the mandatory adoption of product standards. In the meantime, the requirement for manufacturers to configure their products according to government specifications increases the costs of production.

The empirical evidence on whether mandatory standards improve safety is mixed. A study by Peltzman (1975) on auto safety belt regulations found no significant differences in total fatalities from automobile accidents. Similarly, another study by Peltzman,[19] on mandatory prescription drugs, found no effect of standards on the incidence of accidental poisonings or adverse reactions to drugs. Viscusi (1984, 1985) also found no evidence that product specific standards set by the US Consumer Product Safety Commission reduced accident rates. However, Magat and Moore (1995) examined the bicycle industry in the United States and United Kingdom and found a statistically significant decline in accident rates as the stock of bicycles in compliance with mandatory standards increased.

The impact of safety standards on trade

The area of government-mandated product (and process) standards is where the greatest concern exists about possible adverse effects on trade. There are two reasons for this. First, such standards are a requirement supported by the coercive power of the state. Second, it is likely that in the course of developing standards, governments will be most responsive to domestic concerns, in particular the interests of domestic industry whose product competes with imports. As a result, standards may be designed in such a way that gives domestic producers a competitive advantage. Although this is, in principle, not in the interest of domestic consumers, governments may – deliberately or not – impose safety standards that act as protectionist devices.

Safety standards designed with the aim of maximizing national welfare, i.e. not as a protectionist device, may increase trade, decrease it, or leave it unaltered (see Box 5 for an example). The outcome will to a large extent depend on a standard's effect on the relative costs of domestic and foreign producers. But it also depends on many other factors, like the level of competition in exporting and importing countries and the willingness of consumers in different countries to pay higher prices for safer products. It is therefore difficult to predict the effect of a safety standard on trade flows. The following discussion should therefore be considered as indicative of what could happen rather than as assertions on what will happen.[20]

Box 5: Standards, trade and welfare

To investigate the ambiguity of the effect of a product standard on trade and welfare, consider a two-country situation in which there are many consumers and many firms in each, i.e., there is perfect competition, except that the assumption of perfect information is not met for consumers. The product is assumed to have a credence characteristic. The possibility that it might be optimal for the government in each country to exploit its international market power is ignored. Prior to imposition of the product standard by the importing country, the equilibrium world price (p_{ns}) is found in the middle panel where the export supply function (ES_{ns}) and the import demand (ED_{ns}) function intersect (see Chart below). These functions are derived from the domestic demand and supply functions for the exporting country (left-hand panel) and the importing country (right-hand), respectively. The volume of the product traded is q_{ns} and the welfare gains from trade for both countries jointly, measured from no trade, is given in the middle panel by the area of the triangle bounded by the price axis, and the ED_{ns} and ES_{ns} functions. The area below the price line (p_{ns}) and above the ES_{ns} line is the gain to the exporting country; and the area above the price line and below the ED_{ns} line is the gain to the importing country.

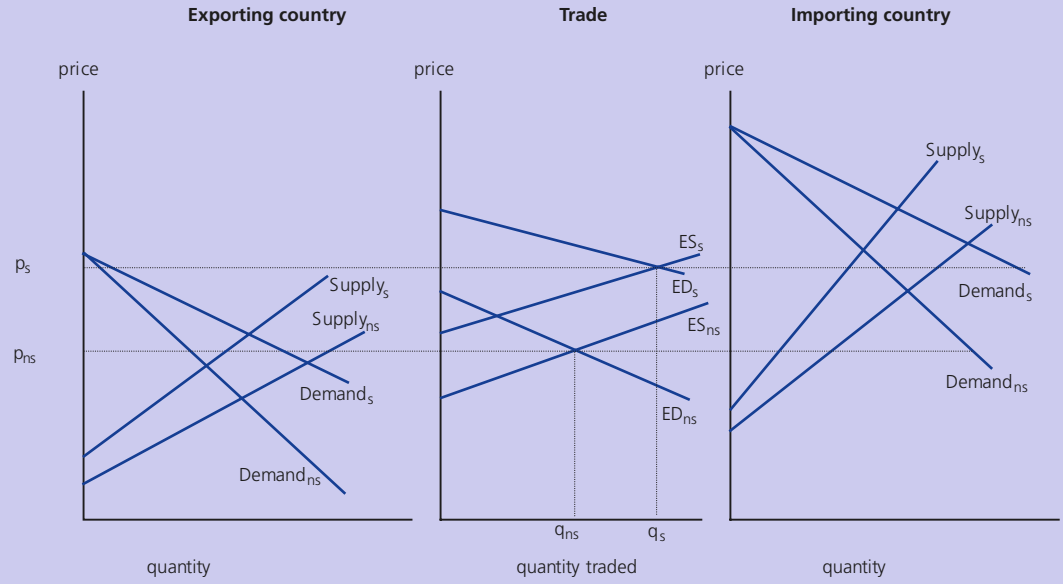
To overcome the market failure caused by lack of information about the quality of this product, suppose that the government in the importing country imposes a standard which has to be complied with by both domestic and export suppliers. There are two consequences in the importing country: production costs are likely to rise and consumers will gain greater utility from consuming the good. These effects are illustrated in the right-hand panel by the upward shift in the supply function and the rotation of the demand function,

19 Peltzman (1987).

20 As Ganslandt and Markusen (2001) put it: "...one could imagine a whole portfolio of models to deal with these issues."

respectively. Together, these changes alter the position of the import demand function from ED_{ns} to ED_S. In the exporting country, production costs will also rise, at least in producing the product for export. Consumers in the exporting country may or may not hold the same preferences as those in the importing country and, therefore, there may or may not be a rotation in the domestic demand function. In the diagram it is assumed that costs rise for all production and that consumers prefer the higher standard.

The effect of the standard on trade and welfare are shown in the middle panel. Given the assumptions made about cost increases and consumers' utility, there is an increase in the volume of trade, an increase in welfare for each country and for this two-country world. However, it is straightforward to show that this is not the only possible outcome. By altering the assumptions and reflecting these in the relative shifts of the trade functions, it is possible to show that the exporting country can lose welfare from the imposition of the standard by the importing country and that world welfare could still rise. But it is also possible to show that there is no monotonic relationship between the direction of change in the volume of trade and that of welfare for the exporting country or for world welfare: the volume of trade could increase and yet world welfare could fall. It can be assumed that the welfare of the importing country will not fall because a rational government would not impose a welfare-reducing standard in order to correct a market failure.



If the country introducing the standard is an exporting country, trade is unlikely to increase. To the extent production costs are higher for safer goods, domestic exporters will become less competitive in world markets where their competitors do not need to meet the same safety standards.[21] If the country imposing the standard imports the relevant good, the effect on trade is ambiguous. Foreign exporters will, in this case, incur higher costs as they must adapt their products to conform to the new regulations. Typically, the change in costs can be modelled either as an increase in fixed cost with marginal cost remaining unchanged (as in the case of a once-and-for-all redesign change) or a percentage increase in cost (Ganslandt and Markusen, 2001). But domestic producers also have to adapt their production and incur higher costs. If the standard affects marginal costs, trade will tend to decrease if the cost increase for foreign producers exceeds that experienced by domestic producers. Trade will tend to increase in the opposite case.

Welfare effects are even more difficult to predict than trade flow effects, but the following scenario cannot be excluded. When trade flows decrease as a result of the standard, the reduction in imports represents a welfare

[21] It may be possible for exporters to produce different goods for foreign markets than for the domestic market in order not to deteriorate their competitive position abroad. But maintaining two production lines may involve additional costs and thus not increase trade.

loss for the country setting the standard. On the other hand, the standard increases product safety, i.e. it corrects an existing market failure. This has a positive effect on domestic welfare. The optimal standard from the point of view of the country setting the standard is the one that leads to the best trade-off between a negative trade effect and a positive welfare effect due to increased product safety. In other words, safety standards may increase national welfare even if they decrease imports. Besides, a decrease in the exporting countries' welfare cannot be excluded, implying ambiguous global welfare effects. In theory, at least, standards may thus create conflicts of interest even if they are not set with the intention of protecting domestic producers.

The risk of disagreements among countries about the appropriateness of certain measures is likely to be higher the more different countries are. In particular, the level of development of countries is likely to play an important role, as it affects the level of available production technologies and consumer preferences. Producing higher quality goods may be relatively more expensive in developing countries than in developed countries.[22] More importantly, the demand for quality, for instance in terms of product safety, is likely to increase with income. Theoretical considerations would therefore suggest that optimal safety standards may differ significantly between developing and developed countries and that the potential for conflicts of interest is relatively high. In practice, however, significant conflicts of interest also appear to exist among developed countries. All six GATT/WTO disputes involving product safety have been disputes among developed countries. However, only one of them – *EC–Asbestos* – has been ruled in favour of the standard-setting country. This might indicate that protectionist interests were deemed to have influenced the design of the standards causing disagreement, or at any rate that avoidable protection effects resulted from the design or application of a measure.[23]

(c) Negative production and consumption externalities: the example of environmental standards

An important area where governments around the world have increased regulatory activity in recent decades is in the environmental sector. Environmental externalities are a form of market failure that arises because the use of environmental resources, whether in the form of air, water, land, etc. is not properly priced. Therefore, producers make use of these resources at a rate that is not socially optimal. Production may occur to the point where the air pollution, for example, results in respiratory problems whose costs are considered to outweigh the benefits obtained from more goods. To achieve the efficient outcome, economic theory recommends the use of environmental taxes or charges (the so-called Pigouvian tax) to manage environmental externalities.[24] But many governments prefer to pursue their environmental objectives through performance standards or mandated technologies, licenses, permits, zoning regulations, registration, and other regulations.

Why are environmental regulations preferred to taxes?

In theory, regulations are less efficient than taxes because they do not reduce environmental damage at the lowest cost possible to society. By contrast, an environmental tax will do so, if the tax is set equal to the marginal social cost or damage of the environmental externality. An intuitive explanation for this result is that in the case of a production externality, the firm whose production causes the externality will continue to produce so long as the revenue (price) to be earned from the sale of the product exceeds the (private) cost of producing an extra unit of the good. In its calculations the firm does not take into account the damage caused to the environment through its activities. In other words, the firm does not take into account the environmental cost to society. This "under-evaluation" of production costs leads to a higher level of production than is desirable from an environmental point of view. A tax could remedy this situation as it increases the firm's production costs. Ideally, the tax should be set at the level that guarantees an equilibrium situation in which the social value of the good (price) equals the social cost of producing an additional unit of the good. This (Pigouvian)

22 The issue of available production technologies for instance played a role in *US-Shrimps* (see Section IID).

23 The relevant cases are discussed in Section 4. Section 4 also argues that it is not entirely clear whether WTO Agreements intend to ensure global welfare maximization or only intend to ensure that standards are not abused as protectionist devices.

24 More precisely, in the absence of transaction costs, private bargaining will achieve the efficient outcome (Coase, 1960). In the presence of transaction costs, the Pigouvian tax is efficient.

tax would guarantee an optimal production level for society as both the pure economic benefits of producing and consuming a good and the environmental effects of producing that good are taken into account.[25]

Although Pigouvian taxes, in theory, represent an optimal policy instrument, their application raises a number of concerns. These include distributional issues, uncertainty about the costs and benefits of abatement, and the costs of monitoring and enforcement (Bovenberg and Goulder, 2001). Governments may be reluctant to saddle households and firms with the distributional consequences of an environmental tax. While an increasingly wider set of methods are being applied by social scientists to measure the monetary value of environmental costs (including hedonic pricing, contingent valuation, etc.), there continues to be a great deal of uncertainty about the exact magnitudes of the benefits and costs from pollution abatement. Finally, there is the cost of monitoring and enforcement. As a result, calculating the Pigouvian tax rate is not a straightforward exercise. It requires knowledge of the cost of the pollution (monetary value of the increase in mortality or morbidity) at the optimal level of production. For these and other reasons, policy makers tend to give a preference to the use of environmental standards.[26] It may, for instance, be much easier to monitor and enforce compliance by manufacturers through environmental standards than though the more market-based approach of fiscal interventions.

Preferences for different environmental policy instruments are likely to differ across countries. Some governments are more able than others to absorb the costs of environmental policies. Producers and consumers with lower average incomes are also less able and willing to incur such costs. Members of lower-income societies often face greater uncertainty about the future and therefore are more reluctant to invest in it, which after all is what much environmental policy is about. These are all reasons why industrialized countries tend to have more stringent environmental standards than developing countries.

Environment-related product and process standards

While there are a number of ways in which environmental standards can be categorized, the distinction between product and process standards has become important in the context of the multilateral trading system. Process standards are typically used in situations where environmental externalities arise during the production process, while product standards tend to be used when the externality arises through the consumption of a product. Carbon dioxide (CO_2) emissions by a plant, for instance, would be considered to lead to production externalities, while CO_2 emissions by cars are to a large extent related to consumption externalities. This distinction is important for the multilateral trading system, as many consumer goods can be traded, whereas production processes are typically not traded. Besides, a distinction has to be made between global/transboundary and local externalities. Carbon dioxide emissions are of a global nature, while the use of pesticides in farming tends to have a more local impact. Taking into account that standards can be either mandatory or voluntary, eight different categories of environmental standards can be distinguished, as illustrated in Table 2.

Table 2
A taxonomy of environmental standards

Producer	Local	I. Mandatory process standard (maximum amount of pesticides used per acre).
		II. Voluntary process standard (organic label).
	Global	III. Mandatory process standard (maximum CO_2 emission level per plant).
		IV. Voluntary process standard (timber from renewable forests).
Consumer	Local	V. Mandatory standard (maximum level of non-recyclable waste per household).
		VI. Voluntary standard (private: recyclable package materials).
	Global	VII. Mandatory standard (mandatory CO_2 emission standard on cars).
		VIII. Voluntary standard (private: HFCs-free sprays).

[25] Effluent fees and marketable emission permits are considered to produce efficient outcomes like those associated with Pigouvian taxes (see, for instance, Cropper and Oates, 1992).

[26] Also referred to as "command-and-control" regulations, to use a more general term (Cropper and Oates, 1992). Oates et al. (1989) show that a relatively sophisticated command-and-control approach can produce results that compare reasonably well to the prospective outcome under a fully cost-effective system of economic incentives.

Two things are worth noting in Table 2. Firstly, "voluntary product standards" related to consumption externalities tend not to be regulated by the government. This is probably the case because the role of public labelling schemes is taken over by private labelling or branding schemes.[27] Secondly, voluntary process standards typically have to be combined with product labelling schemes in order to allow consumers to distinguish between the outputs of more or less environmentally friendly production processes. Through such a label, process characteristics are therefore to a certain extent transformed into product characteristics ("labelled" or "non-labelled").

The label is needed because in most cases consumers cannot recognize which production process has been applied from a simple glance at the product. Timber from renewable forests cannot be easily distinguished from other timber. The same is the case for vegetables produced according to organic production methods and others. Labels allow consumers to make such distinctions. The more difficult it is for consumers to check the veracity of labels, the more likely it is that government intervention in the definition and enforcement of the labelling policy is required, as private labelling schemes would tend to collapse due to the incentives to cheat.[28]

Environmental standards and trade

How do environmental standards affect trade flows? This depends on the type of environmental standard at issue (any of the eight cases distinguished in Table 2). In the case of standards relating to production externalities, it also depends on whether standards are applied to both foreign and domestic producers or only to domestic producers.

In the case of local production externalities, it makes sense to apply a mandatory standard only to domestic producers. An example of such a standard would be a requirement for domestic firms to install waste water treatment facilities in order to treat their water discharge. In this case, the standard raises only the costs of domestic producers. As a consequence imports may increase, and if some of these domestic firms also export to the world market, the environmental regulation may also affect their ability to compete there. But against this conclusion, Porter and van der Linde (1995) have argued that compliance by domestic firms with environmental regulations can trigger innovations which lead to an increase in the competitiveness of these firms. This implies that there may even be a gain in future competitiveness as a result of the imposition of environmental regulations. But this link between environmental standards and international competitiveness can affect the pace of standard-setting activity by governments. It has often been argued that one effect of trade liberalization is a regulatory chill or a race to the bottom in environmental standards. Governments become reluctant to tighten environmental regulations for fear that their economies will lose jobs and investment because firms might leave or potential investors might be discouraged. A more extreme reaction is also possible if governments compete to lower environmental standards so as to keep or attract jobs and investments.

Mandatory process standards applied to global production externalities would have similar trade effects to the ones described before. The main difference between this case and the one of local production externalities is that individual countries are unlikely to develop optimal policy instruments in the case of global externalities. This is because they will not take into account the impact the deterioration of the environment caused by domestic production has on individuals abroad. International collaboration is therefore desirable in the case of global production externalities. The same holds for global consumption externalities (cases VII and VIII in Table 2). In the absence of such collaboration, countries may choose also to apply mandatory process standards on foreign producers.[29] This raises two major concerns. First, the domestic process standards imposed on foreign producers may not be efficient from a global point of view, as the costs of production techniques

[27] Any type of voluntary scheme is unlikely to internalize externalities completely because consumers of the environmentally friendly good only take into account the value the environment has to themselves and will ignore the environment's value to other consumers, some of whom may not even buy the product at issue.

[28] See Brown (1999) for a discussion of similar problems when it comes to using labels to signal "child-free-labour" production methods in the carpet industry.

[29] As was the case in *US–Shrimps*, where the US limited imports of shrimp or shrimp products to those harvested with a fishing technology that avoided killing sea turtles.

differ across countries.[30] Second, the question arises as to who controls and enforces the standards applied in the production of imported goods, given that production takes place abroad. This question is particularly important if production processes do not leave traces in the traded products, as this will make it impossible to detect upon inspection at the border whether a certain environmental process standard has been applied or not.[31] If the exporter claims that the standard has been applied, the importing country may either trust the exporter or insist upon inspecting the production site abroad. The latter option raises concerns about countries' sovereignty.[32]

Voluntary process standards tend to be accompanied by a labelling policy, as consumers need to be able to distinguish between goods produced in an environmentally friendly way and other goods. Foreign producers can thus choose which production process to apply. But independent of their decision, they may be affected in any case if the labelling policy has an effect on the prices of both labelled and unlabelled products. If foreign producers decide to target the environmentally friendly market, problems of control and enforcement of process standards arise, as discussed above.

Control and enforcement issues do not arise in the case of product standards related to consumption externalities. An example of a mandatory standard relating to a global consumption externality would be a mandatory emission standard on all motor vehicles sold in the country (case VII in Table 2). In this case, the standard affects both domestic production and imports. It could be argued that *a priori* there is no reason to expect that the regulation will favour domestic firms relative to foreigners. However, to the extent that the appreciation for the environment differs across countries and results in differing standards, foreign firms could be penalized more. Products intended for export have to be re-engineered to conform to more stringent regulations in the export market than those found at home. The likelihood of trade disagreements may be higher in this second instance. Adverse trade impacts can be minimized by adequate consultation with foreign exporters during the process of developing the standards so that their interests could be taken into account.

3. HARMONIZATION VERSUS MUTUAL RECOGNITION

It was illustrated in the previous Subsection that the use of standards and technical regulations can help markets to operate effectively in a variety of ways. First, they help to overcome the problem of asymmetric information about product quality, both between suppliers and consumers, and among producers serving the same market. Second, they enhance compatibility between complementary goods in consumption and production. Third, standards may help to mitigate other instances of externalities or market imperfections where the market, left to itself, would fail to provide the optimal level of a good or service. For example, emission standards can help to deal with pollution externalities.

Since countries differ in terms of levels of development, technology, environmental requirements and preferences, it is natural that optimal national standards (that is, the specification of the type of standard that solves a market failure) differ across countries. Standards may therefore have a negative impact on trade even if they have been designed to help certain markets to operate more efficiently. National standards may impose disproportionate costs on foreign producers. Costs may also fall disproportionately on foreign producers if standards result in a lower scale of operation, for instance because the producer has to meet a different standard at home than for export markets. Governments and industries may even define national

30 In the US law relevant to *US–Shrimps*, exporters were expected to apply measures "comparable in effectiveness to United States measures". The Appellate Body and the Panel found that the "comparable in effectiveness" standard allows for "sufficient flexibility" so as to avoid a finding of "arbitrary or unjustifiable discrimination" under the Article XX *chapeau*. (See also the discussion in Section IID.) It has been argued in the literature (Howse and Neven, 2003) that the concept of policies "comparable in effectiveness" could lead to rather inefficient outcomes if it is interpreted as policies "yielding comparable results" rather than being interpreted as policies leading to comparable marginal results for any level of investment made in the reduction of negative environmental effects.

31 See also the discussion of unincorporated PPMs in Sections IIB.1 and IID.2.

32 See also the discussion in Abdel Motaal (1999).

standards with the strategic aim of creating a disadvantage for foreign competitors. To the extent that standards increase costs for foreign companies relatively more than for domestic firms, they reduce the ability of a producer to enter a foreign market.

(a) Policy options when standards differ across countries

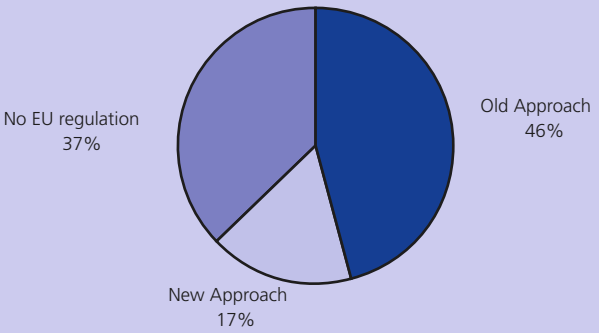
When countries open up to trade, previous standards may become suboptimal. Consider, for example, the case of two similar countries sharing a common policy objective of ensuring a certain degree of safety for car drivers. Due to country-specific differences, however, the two countries chose different technical provisions before trade. One country required the presence in the vehicle of a frontal and a side air bag, the other country required seat belts and only a frontal air bag. If both countries stick to their standards, car manufacturers who want to export will have to face the costs of adapting their product to the requirements of the destination country or alternatively, produce cars that meet both standards (e.g. by introducing both seat belts and a two-air bag system). Since the market failure is addressed equivalently by the two policy measures, both countries would be better off if they chose a common standard or (mutually) recognize each others' standard.

In the case of full harmonization both the policy objective and the detailed technical provisions required to achieve the objective are commonly defined. A country can, however, simply recognize as "equivalent" the exporting country's product standard (that is, for example, the product of the exporting country provide the same level of health protection as what is achieved by the importing country's requirements). Recognition can be unilateral or mutual. Mutual recognition implies that countries simply accept each others' standards. This policy option carries the risk of a race to the bottom if countries pursue significantly different policy objectives. In practice, mutual recognition will therefore only be observed among countries with "equivalent" policy objectives. This policy option also presupposes a fair amount of trust among trading partners. If countries, instead, prefer to control the risk of variation in policy objectives among partners, they may opt for a third approach – harmonization of essential requirements. This approach implies that countries accept (mutually recognize) each others' design/ specific technical details, given a commonly agreed policy objective (See Box 6).

Box 6: Standards within the European Union: the "new approach"

The EU's approach toward removing technical barriers to trade combines all three ways of dealing with technical barriers to trade. For the products covered by the so called "old approach" (1969) harmonization is achieved by means of detailed directives, the content of which is determined by negotiations among EU countries. Once adopted, such directives replace national standards. The "new approach" accomplishes harmonization by indications of essential safety and health requirements. The process of specification of these essential requirements in technical standards (that are then voluntary)[1] is left to European standardization bodies (CEN, CENELEC and ETSI).[2] Where technical standards are not harmonized, the principle of mutual recognition of standards applies – that is, if products are produced and tested in accordance to one countries' regulation, they are granted access into any other member country. The Chart shows the percentages of intra-regional EU merchandise trade covered by the different approaches. It appears that the "old approach" applies to

Intra-EU trade by type of policy initiatives to remove technical barriers to trade, 1998
(Percentage)



Note: calculations are based on intra-EU trade at 4 digit ISIC classification.
Source: WTO calculations on COMTRADE and Atkins (1998) and http://www.newapproach.org/Directives/DirectiveList.asp visited in December 2004.

products that represent about 46 per cent of intra-EU trade. Nearly 20 per cent of intra-EU merchandise trade is in products covered by the "new approach", the remaining 37 per cent of trade is in products where no EU directive applies (see also Box 8 in Section IIC).

1 These common voluntary standards serve the useful purpose of lowering information costs and uncertainty for manufacturers by clarifying what specifications are presumed to be in compliance with an often quite general health and safety objective.

2 CEN is the European Committee for Standardization, CENELEC is the European Committee for Electro-technical Standardization and ETSI is the European Telecommunication Standards Institute.

There are costs and benefits associated with each of these approaches. In the next Subsections the welfare and trade effects of harmonization and mutual recognition will be discussed. It is worth noting that the fact that one approach is more trade-enhancing than another does not necessarily imply that it is better either in terms of national welfare or global welfare.

(b) The welfare impact of different policy options

At a certain level of detail, it will be extremely rare that countries have identical policy objectives. Heterogeneity in terms of the level of development, culture, risk preference and other tastes will generate different policy objectives. However, these policy objectives can change when countries open to trade. With integrated markets, governments need to think not only of efficiency gains from addressing a market failure (environmental externality, for example), but also of possible efficiency losses due to forgone gains from trade, if different standards represent a barrier to trade. This national welfare consideration may lead governments to harmonize standards with their trading partner, to opt for mutual recognition or simply not to accept the other country's standard. The latter would be an optimal strategy if the gains from trade did not offset the welfare loss from not fully solving the market failure.

There is no *a priori* answer to the question whether regulatory harmonization is more desirable than regulatory competition (a corollary of mutual recognition) from a national or global welfare point of view. Some economists would favour mutual recognition on the basis that: (i) it allows each country to pick the standard that maximizes its welfare; (ii) the optimal policy is unknown, and mutual recognition would allow the market (rather than civil servants or ministers) to reveal consumers preferences; and (iii) mutual recognition exercises a disciplinary effect on national regulators, thus constraining the propensity to over-regulate for vested interests.

However, there are risks associated with mutual recognition. National welfare considerations should include the risk that mutual recognition may undermine national policy objectives. When countries with different optimal standards trade, there might be an incentive for governments (or firms) to lower a standard to provide a cost advantage to domestic firms engaged in international competition, thus compromising quality or safety and triggering a "race to the bottom".[33] Alternatively, willingness to access the market of a country with a higher standard may also push standards up in a country where this is not necessary, with negative consequences on the level of domestic product variety ("trading-up"[34]) (Vogel, 1997). Moreover, the process of reaching harmonization may be costly.[35]

Only two cases suggest themselves where economists are likely to have an *a priori* preference for the international harmonization of standards: in the presence of global (environmental) externalities and in the presence of network externalities. In the first case, cross-border externalities generate a tendency to under-regulate. For example, there would be little incentive for a country to control pollutant emissions if the

33 This obviously requires that standards are not equivalent in terms of the two countries' policy objectives. Therefore, in practice, this situation will not emerge insofar as countries will agree on mutual recognition only when they trust that the other country's standard meets their own policy objectives.

34 This presupposes an effort of countries to make their standards equivalent, so as to be mutually recognized.

35 The costly process of reaching a consensus on specific standards has led the EU to pass from the "old" to the "new approach" to standardization.

resulting emission caused acid rain to fall in another country. Yet this behaviour would be inefficient and would likely reduce global welfare (in the simplest form the sum of the welfare of each country). Cooperation is therefore necessary in order to solve the problem, whereby countries may agree on a common standard or on a core standard that increases global welfare. It is not necessarily the case, however, that a welfare maximizing solution involves a single international standard. To the extent that production technologies differ across countries, cooperation may instead lead to the use of different standards in different countries. It may be noted that mutual recognition would not solve the market externality problem in this case (Sykes, 2000 and Pelkmans, 2003).

A similar argument can be made in favour of harmonization for the case of network externalities. However, it needs to be highlighted that in this case market forces are likely to generate the desirable outcome, without need of a government intervention (see discussion above).

As Sykes (2000) argues, it is likely that a certain degree of cooperation is "almost always valuable", at least to the extent of prohibiting regulators from engaging in rent-seeking behaviour. Focusing on the EU, Pelkmans (2003 p.5) argues that the advantage of the new approach is that in "emphasizing the objective(s), rather than the detailed specifications,...national regulations... are forced to concentrate on overcoming the market failure".

(c) The trade effects of different policy options

Harmonization and mutual recognition are commonly believed to be steps towards freer trade. However, the impact of harmonization and mutual recognition of standards on trade among the countries participating in an agreement is quite complex.

On the one hand, both harmonization and mutual recognition of product standards will foster trade because they create scale economies and allow a more efficient allocation of resources. In particular, harmonization may facilitate trade more than mutual recognition, because it requires that countries adopt an identical standard. This implies that products manufactured in different countries are more similar, more homogeneous and, therefore, better substitutes from the point of view of the consumer and the producer than when products can enter the market under mutual recognition. Moreover, adoption of identical standards will improve consumer confidence in the importing country about the quality of the good produced abroad. In sum, a common standard will act as a quality signal and lower information costs for the consumer. Also, identical standards will enhance the compatibility of imported and domestically produced goods. In this sense, harmonization would make it easier for producers to match imported components with those available domestically, would reduce costs and increase trade. In the case of network industries, harmonization would allow network externalities to more readily spill over internationally, thus fostering trade. Finally, harmonization can foster trade by enhancing competition. To the extent that different standards serve as market-segmentation devices, harmonization will facilitate arbitrage and parallel trade, thus enhancing competition.

On the other hand, there are potential negative effects of harmonization on trade that could be avoided through mutual recognition of product standards. For example, harmonization imposes a cost in terms of reduced variety. Although this cost is likely to be small or nonexistent in the presence of network externalities, these costs may be significant in any of the other cases discussed above. To the extent that demand for foreign goods is driven by love of variety, a reduced degree of differentiation of production would then reduce trade. In addition, harmonization to a specific standard may imply a higher cost of compliance for some countries. If countries lack expertise that would allow them to take full part in the setting of international standards or if they lack bargaining power, harmonization can generate asymmetric compliance costs for different countries. Gains from harmonization will not be distributed equally among participating countries. In general, the impact of harmonization on the firm of a specific country "depends on how the costs of meeting the new harmonized standard compare with the benefits from economies of scale in integrated economies" (Chen and Mattoo, 2004, p.5). The problem exists both when harmonization takes place at the regional level and at the international level.

In contrast, mutual recognition allows a country to choose one standard and sell products meeting that standard to its trading partner(s). Unless consumer preferences are biased towards its partners' technical specifications, a firm can freely access its partners' markets without the added burden of harmonizing its standard with those of its partners. Gains from removing technical barriers are in this case distributed equally among countries participating in the agreement.

It is important to highlight that when the removal of technical barriers to trade takes place at the regional level, harmonization and mutual recognition might have different implications for trade with countries excluded from an agreement. To the extent that harmonization of product standards reduces the fixed costs of learning about the regulation of each member of the agreement and avoids the associated additional compliance costs, regional harmonization also benefits firms from the rest of the world. For example, an Asian manufacturer of toys might not find it profitable to export to Europe if it had to adapt its product to different safety legislation for each European country, but might find it worthwhile to export to Europe if there is an EU-wide norm. However, harmonization could also be achieved by adopting a common regional standard that systematically increases costs of compliance for firms outside the region relative to firms in the region. This situation may arise, for example, because of region-specific technological advantages or design advantages enjoyed by firms within the region.

Mutual recognition of standards within a region could also boost exports by firms located in a country outside the block, but only if the agreement is not restricted by stringent rules of origin. The advantage of mutual recognition relative to harmonization for producers outside the region is that they can pick the standard adopted by any one country in the region that better suits their production needs and advantages. In practice, though, mutual recognition agreements can be designed in such a way that third countries cannot benefit from them – by requiring, for example, that products originate in the region.

Baldwin (2000) points to the possible emergence of a two-tiered world when the removal of technical barriers to trade takes the form of mutual recognition of product standards within a region.[36] Under mutual recognition, standards are assumed to be equivalent in achieving a certain policy objective and mutual recognition requires a certain degree of trust among countries regarding their respective ability adequately to safeguard health and safety. This is more likely to occur in regional agreements among developed countries than at the multilateral level, thus excluding developing countries.

The problem of a two-tiered world is not solved, however, by removing technical barriers to trade through harmonization of product standards. Although a certain degree of coordination of standards is desirable, there are natural limits to the extent of international harmonization due to countries' different levels of development, technological advancement, endowments and preferences. Therefore, harmonization is more easily and efficiently reached among similar countries, rather than at the multilateral level.

Even if harmonization had to occur at the multilateral level, the problem exists as to whether developing countries can effectively participate in deliberations of international standard-setting bodies, as they might lack the technical expertise to influence the creation of some technical standards (see Section IIC).

(d) The role of the private sector in the international domain

Both mandatory and voluntary standards can differ across countries, thus effectively raising a barrier to trade. Such barriers can be removed through harmonization or mutual recognition. While it is evident that harmonization of mandatory standards is a government-to-government activity, international harmonization of voluntary standards could either take place through inter-governmental treaties or be left to the market.

Casella (2001) argues that harmonizing standards should not be a primary concern of governments. She claims that when economies open up to international competition, coalitions of firms will reorganize internationally and exploit economies of scale at a more disaggregated level of economic activity. There will

[36] The argument can also be extended to regional agreements of conformity assessment procedures (see below).

be more harmonization "from the bottom" (that is initiated by private industry groups), in order to avoid wasteful replication of national standards and a larger number of specialized international standard groups. The model does not rule out the possibility that the number of standards created by the market are non-optimal. Therefore, there is still space for policy intervention. Yet the role of the government that the model envisages is not that of establishing harmonization through inter-governmental treaties, but rather setting up the appropriate regulatory framework to prevent anti-competitive outcomes.

Some empirical evidence supports Casella's conclusions. First, two main non-governmental international standardization bodies exist: the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). ISO Members are national standards institutes, while IEC Members are national committees representing all electrotechnical interests in that country. Both organizations issue non-mandatory recommendations. Since they are supported by industries, they represent standards-sharing coalitions of the kind found optimal in Casella's model. Second, industry involvement in international standard setting is increasing as integration progresses. In Germany, for example, the share of resources spent by firms on standard-setting that was directed towards work within international standard-setting organizations rose from 35 per cent to 65 per cent between 1984 and 1991 (Casella, 2001). Third, in accordance with the fragmentation of coalitions predicted by the model, the number of standards institutions devoted to specific areas has been increasing over time. An example is the case of European standards organizations in telecommunications. As market integration has deepened in Europe, standards organizations have evolved from national public monopolies to an increasing number of specialized international coalitions of firms.

(e) Conformity assessment

Conformity assessment is the process whereby a product, process or service is evaluated against specified requirements. It is the technical proof that a product complies with the laws of the country where it is sold. Conformity assessment procedures differ, depending on the product. For low-risk products, the manufacturer may assume total responsibility for conformity assessment and use internal testing for the assessment. For other products, the manufacturer may be required to test his product in a designated laboratory and obtain an official certification mark.

Exporters are often faced with having to test or certify their products in each of the countries to which they are exporting. Even if countries rely on internationally harmonized standards or accept as equivalent another country's standard, they may not rely on an exporting country's conformity assessment results. This can substantially increase costs of exports in a number of ways. First of all, exporters incur the costs of redundant testing and certification for each of the destination markets. Second, they face the risk of higher transportation costs if the goods are rejected by the importing country after shipment. Third, there is a cost in terms of time required for complying with administrative requirements and inspections by the importing country's authorities. For some time-sensitive products, such as textile and clothing, the time delays associated with product testing and certification in the importing country can severely impact on profitability and the ability to penetrate the market.

In order to reduce such costs, a number of conformity assessment recognition agreements have been negotiated between and among countries bilaterally. Obviously, these agreements do not have an influence on the standards and technical regulations themselves. The impact of such agreements on the trade of participating countries is clearly positive due to a reduction in costs generated by the avoidance of duplicative tests, as well as lower transport and administrative costs, as handling time and uncertainty of delivery are reduced. Mutual recognition requires confidence in the competence of one another's conformity assessment bodies and in the methods employed to assess conformity. For this reason, agreements are often limited to accepting conformity assessment results from bodies that are recognised by the parties concerned, and do not extend to self-certification arrangements such as suppliers' declarations of conformity.

Agreements involving mutual recognition of conformity assessment procedures are likely to have trade-diverting effects on countries outside the agreement. As an example, Baldwin (2000) refers to the EU-Swiss Bilateral Trade Agreement. According to this Agreement, only goods made in Switzerland (satisfying specific

rules of origin) can circulate freely in the EU after being tested and certified in Switzerland. This privilege does not extend to products originating in third countries. Therefore, a foreign firm that wants to access both the EU and Swiss markets will have to pay twice for conformity assessment. Thus, mutual recognition of conformity assessment procedures between the EU and Switzerland raise costs for producers located in a third country relative to costs faced by European or Swiss producers, thus diverting trade. A recent empirical study (Chen and Mattoo, 2004) confirms that mutual recognition arrangements with rules of origin have a strong positive effect on intra-regional trade, but reduce imports from excluded countries by over one-third.

The issue of conformity assessment has received relatively little attention in the theoretical economic literature. This is perhaps because conformity assessment can be modelled in a relatively straightforward way as an additional transaction cost of exports. In practice, though, the issue of conformity assessment requirements and their impact on trade have given rise to the development of a complex institutional infrastructure. This will be discussed in more detail in Section IIC.

4. THE IMPACT OF STANDARDS ON INTERNATIONAL TRADE FLOWS: EMPIRICAL EVIDENCE

This Subsection contains a survey of the empirical literature on the effect of standards on international trade. From the theoretical discussion above it is clear that standards are able to deal with a number of economic problems – network externalities, information asymmetry and environmental externalities. The impact of standards on trade will likely depend on what they are used for. Ideally, therefore, this survey of the empirical literature on standards and trade should seek to confirm whether it is indeed the case that certain types of standards are trade-creating while other types are not. For example, in industries where network externalities are present, are standards inevitably trade-enhancing? Or do standards in these industries tend to bolster the market power of the standard setters and therefore limit trade? Unfortunately, a large part of the empirical literature on standards and trade does not distinguish the nature of the standards being studied. Rather, the literature has tended to rely on an index of standardization activities – usually the number of standards or the number of technical measures maintained by a country. The focus has then been on the relationship between this broad measure of standards and trade flows, or on the cost-raising impact of standards. To the extent possible, this survey of the empirical literature on standards and trade will be structured to correspond to the functions of standards identified in the previous Subsection. This can certainly be done for environmental standards, where an established literature has examined links between regulation and trade and investment flows. A similar body of work has been undertaken on animal and plant health standards (SPS measures). But where no distinction is made in regard to the nature of the standards, the survey will follow the direction in which the available empirical literature leads it.

Although the survey focuses on the links between these various standards and trade, many standards mitigate market failures and therefore involve social benefits that will not be fully captured by trade flows. In some cases, trade may even be hampered, even though it could be argued that society benefits overall from the adoption of the standard. Fortunately, some of the empirical work on SPS measures has involved a welfare analysis of these measures.

The Subsection begins by examining some recent trends in standardization activity and draws some inferences regarding the types of standards where growth has been particularly pronounced. Then the effect of standards on two key economic variables are examined. First, how much do standards raise the costs or prices of tradable goods? Second, what does the empirical literature say about the effect of standards on trade? Are standards trade-creating or trade-hampering? The economic theory examined above suggests that both forces are likely to be present. Then a closer look is taken at the question of whether harmonization and mutual recognition, either at the multilateral or regional level, can significantly reduce any trade-hindering effects of standards. Finally, the empirical evidence regarding two specific types of standards – those that manage environmental problems and those that are intended to protect human, plant and animal life and health – are examined. Each of these issues are now considered in greater detail.

(a) Measuring standardization activity

The empirical literature has tended to rely upon a rather short list of databases to measure standardization activity, such as Trade Analysis and Information System (UNCTAD TRAINS), notifications to the WTO, ISO, IEC and Perinorm. But the data are not usually classified in a way that reflects the various economic functions of standards. Information on whether these are voluntary or mandatory, national or international, can be found in some databases but not in others. While it may be possible to identify the sector to which a standard applies, it will not be clear whether all products in that sector are covered or only a subset of them. Most of the available databases also depend on the willingness of countries to provide accurate and prompt responses to questionnaires or surveys. As a result, frequently the most that one can extract from these databases is the count of standards or measures that have been adopted. However, the likely effect of standards on welfare and trade hinges far more on their functions, design and application than on their sheer number. It is important to keep these limitations in mind when examining how standards are measured in the literature.

The simple approach of counting the number of standards has been employed, for example, in studies by Swann et al. (1996), Moenius (1999) and the German standards body *Deutsches Institut für Normung* (2000) or DIN using the Perinorm dataset. An alternative approach is to count the number of tariff lines and the value of imports covered by product standards. The major drawback to both approaches is that they do not distinguish the restrictiveness of various standards. So a sector may have a large number of applicable standards, but they may have only limited effects on trade. On the other hand, another sector may have only a single regulation in place, but that measure imposes significant costs on producers or exporters. Given these caveats, these approaches nevertheless provide important information about the scale of standard-setting activity and the types of standards that are being developed.

Table 3 uses information from UNCTAD TRAINS to compile counts of tariff lines affected by technical measures in a number of markets. TRAINS categorizes technical measures into product characteristics requirements, marking requirements, labelling requirements, packaging requirements, testing, inspection and quarantine requirements, information requirements, requirements relative to transit, and requirements to pass through specified customs and technical regulations not elsewhere specified. The definition of technical measures used by UNCTAD TRAINS covers a lot of standards that tackle information asymmetry problems, although it also includes regulations involving transit and other customs formalities. Some limitations of this dataset should be noted. It is confined to government-imposed requirements and does not capture a host of product standards that have been developed and adopted by industry coalitions or firms. The coverage is incomplete and some of the data are not very recent. For example, TRAINS reports no technical measures for major trading countries like the Republic of Korea and Switzerland, while the information for Hong Kong, China is over a decade old.

Table 3
Tariff lines covered by technical measures in selected markets

Country	Number of subheadings	Share of imports covered (%)
Australia	1092	27.0
Brazil (2001)	2204	46.2
Canada (2000)	142	9.7
China	841	34.9
European Communities (1999)	116	0.6
Hong Kong, China (1994)	223	2.3
Japan (2001)	77	1.9
Republic of Korea	n.a.	-
South Africa (1999)	101	2.7
Switzerland	n.a.	-
United States (1999)	1084	31.9

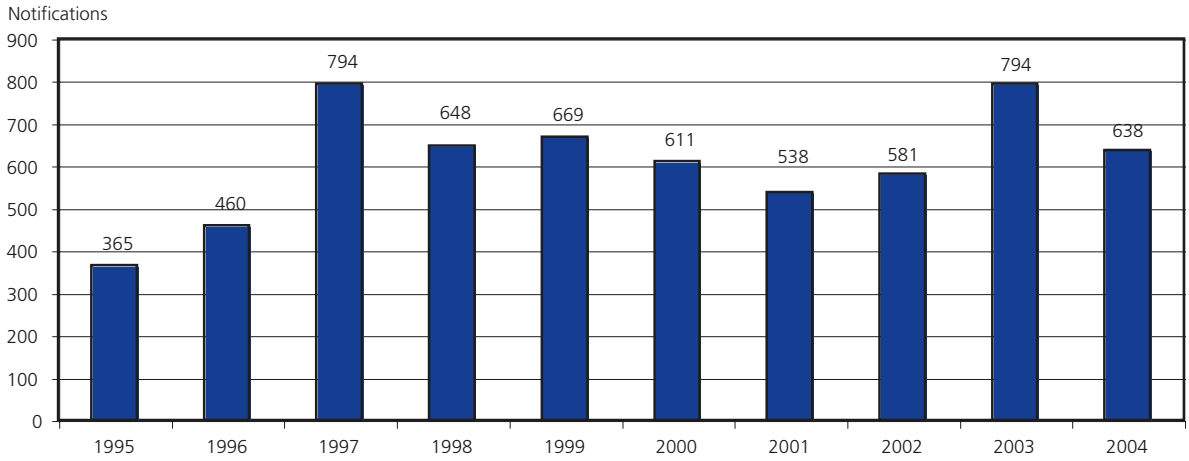
Note: TRAINS reports data at different tariff heading levels (sometimes at HS 6, 8 or 9 digit levels). The information provided in the Table has been standardized at the HS 6-digit level ("subheading") even though the tariff lines covered by a technical measure may not extend to all the tariff lines in that subheading. But since the number of these subheadings is the same for all countries who adhere to the WCO's HS 1996 convention, the numbers in the second column are comparable. The trade-off is that the share of imports covered by technical measures reported in column 3 is likely to be an overestimate.

Source: UNCTAD TRAINS and UN Comtrade.

While keeping these qualifications in mind, the Table suggests that technical measures (whatever the underlying policy objectives) can have a significant impact on trade given that they affect a large number of tariff subheadings and a large share of imports. Based on a count of tariff subheadings, Brazil, the United States and Australia have the largest number of products covered by technical measures. The share of imports covered by technical measures ranges, at the high end, from about half of total imports in the case of Brazil to about a third in the case of the United States and China. By contrast, only 2 per cent of Japan's imports and less than 1 per cent of the EU's imports are covered by technical measures. The figures for the United States, China and Brazil are several multiples of the number of products or the share of imports covered by technical measures in other large economies such as the EU, Japan and Canada.

The number of annual notifications made to the WTO Secretariat under the TBT Agreement and the SPS Agreement provides another source of useful information, since they report new measures that have been introduced by Members. Henson, et al (1999) used the number of notifications of technical measures to GATT/WTO between 1981 to 1998 as an indication of the global proliferation of technical measures. Using more recent data, Chart 1 below shows the number of notifications received by the Secretariat since 1995 on technical barriers to trade. Over the past ten years, notifications have averaged about 610 per year with peaks in 1997 and 2003. These notifications also include information about the policy objectives of the regulations. About 40 per cent of the notifications in 2004 are measures to protect human health or safety. Other reasons frequently given for new measures were prevention of deceptive practices and consumer information and labelling. This suggests that many of the technical regulations that have come into being in the past ten years are concerned with solving information asymmetry problems.

Chart 1
Total number of TBT notifications since 1995



Source: WTO (2005a) Tenth Annual Review of the Implementation and Operation of the TBT Agreement G/TBT/15.

Beyond aggregate counts, the distribution of standards by sector may provide a clue about which sectors are characterized by a higher rate of standard-setting activity. This information can assist more focused research on problem sectors and closer examination of factors behind the growing use of product standards.[37]

A third source of information comes from the Perinorm database. Perinorm is a consortium of standard-setting institutes with an extensive database on standards (see Box 7). A sectoral analysis of the total number of published technical standards up to October 2004 shows that the most active sectors in releasing standard documents are telecommunications, audio and video engineering, followed by construction material and

[37] On the basis of a cross-country analysis, Blind (2004) finds that sectors with a higher propensity for standardization (in his study the number of standards includes drafts, pre-standards and revised standards) tend to be more patent-intensive and export-intensive. He argues that sectors characterized by a higher rate of innovation are more prolific in standards because innovations make existing standards obsolete and call for the publication of a revised document. The correlation between export intensity and the quantity of standards produced is explained as follows: exports depend on the standard specifications in the destination countries. Therefore, export companies have a higher propensity to participate in the standardization process at the European and international level to exercise influence in the specification of standards, which presupposes an engagement at the national level.

building and electrical engineering (see Chart 2). For each of these sectors, the total number of standards published exceeded 30,000. On the other hand, low-technology industries, such as clothing, mining, paper and glass and ceramic industries usually report a far smaller number of standards – generally below 6,000. The smallest number of standards is found in the military engineering industry (only 649).

Box 7: The Perinorm database

The Perinorm database tracks the development of standards across a large group of primarily developed countries. Perinorm is a database developed by the British Standard Institute (BSI), Association Française de Normalisation (AFNOR) and Deutsches Institut für Normung (DIN). It contains information on about 650,000 standards, including documents of all national standardization institutes in each country covered.

The database has a system of keywords enabling a count of standards at the 3-digit industry level per country of origin. Fields in the database include country of origin, industry classification code (recorded according to the International Classification for Standards (ICS) category), dates on which the standards were introduced (and in certain cases, withdrawn), information about related documents, and international relationships among different standards. Information on the relationship among standards includes whether they are identical, equivalent or not-equivalent. These relationships are determined on the basis of ISO/IEC Guide 21 (Adoption of International Standards as Regional or National Standards). In addition, there are other regional or national codes which clarify the relationship among the product standards, such as whether they are related, modified, or necessary. Perinorm International includes data from European countries (13 EU members) and other countries like Russia, Switzerland, Norway and Turkey as well as the United States, Japan, Australia and South Africa. The database also contains information on the European and International standards that have been adopted in the domestic market.

The Perinorm database has been used in various empirical estimations to count the number of shared standards between a pair of countries. Notwithstanding the very considerable contribution the Perinorm database makes to information in this complex area, a number of problems limit the usefulness of this type of information. The primary problem is that not all countries report information about their shared standards. There is no information on the degree of accuracy either over time nor across sectors. Therefore, using Perinorm to obtain information on the count of bilateral shared standards can sometimes give misleading results. The Table below reports the number of total and shared (defined as equivalent of identical) standards for countries covered in the Perinorm database. The recorded number of zero internationally shared standards for some countries, such as Australia, Italy and Norway clearly suggests that the information is not a reliable count of the actual number of standards that these countries share at the international level.

Other problems include the risk of double counting due to the fact that a standard may be relevant to more than one sector, the fact that many standards have different classification codes across countries, and that frequently international links are not symmetric.

Moreover, even if steps were taken to solve these problems, the count of shared standards would still remain a very imprecise proxy of the extent to which technical barriers to trade have been removed. The number of harmonized standards is higher in sectors characterized by network effects or where safety requirements are needed the most. Moreover, trade can be higher in a sector when essential requirements are defined by a single standard rather than when many (shared) standards define detailed characteristics in that sector.

Number of standards by country, 1980-2004

Country	Total	Shared
Australia	8469	0
Austria	18063	15721
Belgium	12384	13
Czech Republic	25052	19511
Denmark	19644	19085
France	26309	141
Germany	29794	17087
Italy	12741	0
Japan	13496	1795
Netherlands	24463	6
Norway	12190	0
Poland	24413	15250
Russia	14686	3176
Slovakia	26106	17751
South Africa	4662	2205
Spain	17770	14094
Sweden	15904	12641
Switzerland	14691	14012
Turkey	21569	6411
United Kingdom	23094	18598
United States	32886	8848

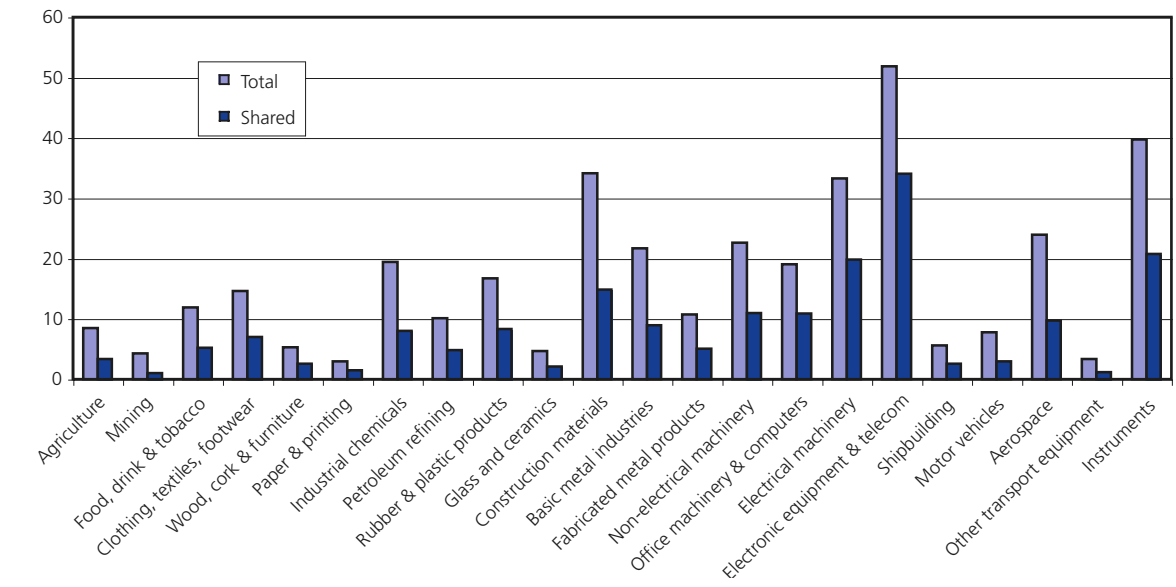
Source: Perinorm.

As expected, the number of standards is highest in industries characterized by network externalities, such as those related to electronic equipment and communication technology. Neither is it surprising to encounter a limited number of standards in the military engineering industry. Standards are a source of information and the defence industry is characterized by a strong concern for secrecy.

It is worth noting that some network industries are also more likely to harmonize their standards internationally. Chart 2 reports the total number of standards published between 1980 and 2004 by sector, and compares them with the number of shared standards – that is, the number of standards that are not country-specific but are "identical" or "equivalent" to international or regional standards or the standards set by one other country. Global network industries, such as electronic equipment and telecommunications, are deeply harmonized across countries (nearly 70 per cent of standards are shared), while strictly local industries such as stone, clay and glass are characterized by relatively more country-specific standards.

A number of salient features emerge from this look at some available sources of information on standards. First, standard-setting activity seems to be pronounced in industries characterized by network externalities. Second, insofar as technical regulations are concerned, the bulk of standards seem to relate to problems associated with information asymmetry (safety and health, consumer protection, etc.). Third, in some major markets these regulations cover a large number of tariff lines and a significant share of imports so the potential exists for these regulations to have an adverse effect on trade.

Chart 2
Number of total and shared standards by sectors (1980-2004)



Note: ICS classification has been converted to ISIC Rev. 2.
Source: Perinorm (2004).

(b) The price and cost effects of standards

One of the biggest complaints against product standards in international trade concerns the costs faced by exporters in complying with the requirements of the importing country. Two tracks have generally been followed to determine how much costs have been raised by product standards – the price-based approach and the cost-based approach. The most popular is the price-based approach, which involves comparing the domestic price of a product to the world market price, on the assumption that the percentage difference reflects the "tariff equivalent" effect of a standard. The cost-based approach examines directly how standards affect the costs of firms who need to adapt products to conform to technical requirements. Each approach presents data and methodological difficulties and neither of them is entirely satisfactory.

Under the price-based or tariff-equivalent approach, which is less data-intensive than the cost-based approach, a number of problems arise in respect of the prices selected for the calculation. Adjustments need to be made if the domestic and imported products are not perfect substitutes, if there are other regulations in place, for marketing and distribution costs, or if producers possess market power. But even with homogeneous products and perfect competition, price comparisons confuse the effect of a standard with other trade policy measures. Finally, the cost-raising effects of standards depend on the interaction with demand in the market – that is, the elasticity of demand. Hence, it is possible for an identical standard to produce different estimates of price wedges in two markets because one market is characterized by more inelastic demand than the other.

Deardorff and Stern (1997) examined evidence on the importance of various types of non-tariff barriers in OECD countries. A substantial part of the information used involved price comparisons. However, their assessment of the extent of NTBs in OECD countries had little to say about technical barriers to trade. This may be partly because, as they admit, it is one of the hardest NTBs to quantify. The authors have stressed the importance of information provided by technical experts who are familiar with the details of standards, regulations, and certification systems applied to particular products or processes. In their view, it may be possible to construct estimates of the added costs involved when: (i) higher standards are applied to imported as compared to domestic goods; (ii) regulations are enforced more stringently on imports; and (iii) imports are subjected to more cumbersome and costly certification procedures. However, the sparseness of evidence on technical barriers may also reflect the fact that these measures are less of a problem than other non-tariff measures which were highlighted in the study, such as quantitative restrictions, anti-dumping duties, and so on.

Because of the ambiguities introduced by price comparisons, the more direct approach of asking producers and traders directly about the effects standards and technical regulations through surveys or case studies have also been tried. This cost-based approach was pursued in a 1999 OECD study, surveys conducted by the European Commission and the United States Trade Representative on European and American exporters respectively and by Henson et al. (1999) and Wilson and Otsuki (2004) for a sample of developing countries. Detailed case studies on the costs faced by developing country exporters of complying with food standards have been undertaken and reported in World Bank (2005) and Unnevehr (2003). The advantage of the cost-based approach is that respondents are able to pinpoint which standards are particularly troublesome. But since a survey or a case study necessarily covers only a small number of producers and there can be some self-selection involved, the results may not be representative of the overall problems faced by a country's exporters.[38]

The OECD (1999) survey collected data from 55 firms on the costs of compliance with technical requirements in export markets and on the extent to which these impede trade. The survey covered telecommunications equipment, dairy products and automotive components in four markets – the United States, the United Kingdom, Germany and Japan. The OECD study was able to supply some information on the estimated percentage increase in production costs incurred as a result of physically adapting products to meet technical specifications. In the case of telecommunication equipment, the additional costs incurred to meet technical requirements ranged between zero and 10 per cent. For dairy products it was between zero and 15 per cent. For automotive products, the additional costs ranged more widely from zero to a high of 30 per cent. The overall conclusion was that while different mandatory technical requirements existed among the surveyed countries for each of the three product categories, meeting them did not significantly increase costs. Some significant problems were reported for a relatively small range of automotive components, such as seat belts and exhaust systems. For dairy products, problems arose due mainly to the export of certain speciality (as opposed to bulk) products.

Even though no major problems were identified, the survey did seem to suggest a different impact on small and large (multinational) firms. These differences existed both in the gathering of information about standards and the design of products. Small firms seemed to face higher costs in ascertaining the nature of the standards with which they must comply. In the area of product design, larger firms incorporate many features demanded by export markets into the initial product design. Although this means larger outlays for research and development expenditure at the start, this strategy allows for quick penetration of target markets when favourable opportunities arise and the costs can be spread over larger production volumes. For smaller firms, the initial design is tailored solely for the domestic market. Only when significant export opportunities arise are further and more costly changes to the product made to meet the standards in the target market.

The costs of conformity assessment varied significantly across the three sectors, reflecting differences in the technical complexity of the products involved. Terminal telecommunications equipment and automotive components require an initial approval of the product before any exporting can begin. Costs of external assessment varied, although it was often the case that significant internal staff costs were incurred in product testing. In the case of dairy, each individual consignment must be tested both prior to export and/or at the port of entry. Thus in the telecommunications equipment and automotive component markets, technical standards and conformity assessment procedures act as a fixed cost of market access that must be borne prior to the commencement of exports, while they act as a variable cost in the case of dairy products.

The study by Wilson and Otsuki (2004) is based on company survey data covering 689 firms in about 25 industries in 17 developing countries. On average, firms perceive that the cost of complying with a foreign regulation is higher than that of complying with domestic regulation. Standards and technical regulations are considered an impediment to exports. In fact, for the majority of firms surveyed (over 65 per cent), the costs of testing and certification are an important reason for not exporting to the Quad countries (Canada, the EU, Japan and the US). However, transportation costs and marketing and other distributional costs appear to be more important. Wilson and Otsuki also study the costs associated with duplication of testing procedures to

[38] In the case of a survey for example, questionnaires are usually mailed to the companies and not all of them respond to the survey. It is not unreasonable to assume that those who already face problems with standards would be the most likely to write back.

meet foreign requirements, even though domestic requirements have been met. The majority of firms surveyed report that they face significant duplication costs. For some countries, a high percentage of firms report that they need two tests. In Senegal, for example, over 60 per cent of firms faced a complete second test.

The conclusions by Wilson and Otsuki (2004) differ quite significantly from those reached in the World Bank (2005) report. That study involved a series of case studies covering a number of low-income countries (Ethiopia, India, Jamaica, Kenya, Morocco, Nicaragua, Senegal, Thailand, etc.) and commodity chains related to fish, horticulture, livestock products, nuts and spices. The report found that compliance costs vary enormously between countries, industries, and firms/farms within the same industry. Countries and industries that have greater foresight or have taken a "pro-active" stance are better able to adapt to the evolution of product standards. Firms and industries vary in their capacities, so a change in standards that may require only minor changes in practice in one firm or industry may require radical changes in another. Industrial structure and the possibility of what they call "collective action" is also a major explanatory variable. There are economies of scale and scope associated with various SPS functions and the ability to exploit these depends on the degree of cooperation that can be established among firms and also the leadership of public institutions. The extent of benefits from compliance varies with the type of market for the product. In some cases, consumers may be willing to pay a premium for safe products but in others there may not be much of a premia.

Why could the survey and case studies produce substantially different results on the costs of compliance? One reason may be that the case studies are able to capture the dynamic aspects of compliance – how firms, industries or even countries adjust to new regulations. Firms faced with a new requirement may experience very high costs in the very short run but adaptation, learning and investments in compliance means that costs will be lower in the medium and long run. The issue of timing may also apply to the benefits from compliance - they only accrue over an extended period of time. Hopefully, continued empirical work in this area – relying on both surveys and case studies – will close the gap.

Both the Deardorff and Stern study and the OECD survey of the same group of countries produce some consistent results regarding the relatively small effects of standards on costs and prices. Technical barriers did not emerge as a major NTB concern in the former case and the survey of OECD firms did not identify major problems in complying with regulations in other OECD markets. However, the same relatively benign results seem not to apply with respect either to smaller firms. With respect to the cost of compliance by firms in developing countries, the evidence is mixed. The survey work suggests that firms in developing countries face very high costs, sometimes almost a doubling of their cost of production, in order to meet technical requirements in major developed country markets. However, the case studies tell a more complex story where the costs of and benefits from compliance vary enormously among firms and countries and depend on a range of factors – industrial structure, possibility of collective action, strength of consumer preference for safety, etc.

(c) Standards and international trade flows

Much more formal econometric work has been undertaken to examine the connection between international trade flows and measures of standardization activity. In attempting to quantify the impact of removing technical barriers to trade on imports and exports, empirical economists have explored two approaches. One approach has tested whether country-specific standards and internationally harmonized standards have different effects on trade. The other approach has compared the impact of harmonization versus mutual recognition of product standards on international trade.

National versus harmonized standards

Theoretical arguments discussed in Subsection 3 suggest that while the impact of standardization on trade could go either way, harmonization of standards in general facilitates trade.[39] Some of the early econometric

[39] Recall, however, that to the extent that trade is driven by love for variety, harmonization could have a negative effect on trade through its variety reduction effect.

studies investigating the role of product standards in international trade include Swann et al. (1996), Moenius (1999) and DIN (2000). A common issue addressed in these studies is whether country-specific standards and internationally harmonized standards have different effects on trade. Interestingly, all studies use information on the number of shared standards provided by the Perinorm data base to proxy for internationally harmonized standards (see Box 7).

Swann et al. (1996) examines three hypotheses about the links between trade and standards. First, standards are a means for firms to upgrade quality or to reap economies of scale, thus obtaining a competitive advantage. Second is the argument that by imposing administrative burdens and increasing costs, national standards create a competitive disadvantage for domestic firms. Finally, international standards, by allowing greater compatibility of components, promote intra-industry trade. The first two propositions imply that adoption of national standards have an ambiguous effect on trade while the third implies that international standards should have an unambiguously positive effect. The authors examine the relationship between a measure of British trade performance in 83 manufacturing sectors and the number of British standards and German standards (which is a proxy for international competition in standards) in these sectors, together with a set of other economic variables. The data they employ are at the 3-digit SIC level over the period 1985-91. For data on standards, they use a count of UK standards and German standards by manufacturing sector. The econometric results they obtain show that the number of British national and international standards increases British exports and imports. Surprisingly, the trade effect is larger for national standards than for international ones. Their conclusion, broadly stated, is that the competitive advantage and intra-industry arguments are supported by the estimation results, while the competitive disadvantage argument is not. Thus, on the whole, the adoption of product standards results in greater trade between the United Kingdom and its partners. A methodological difficulty with their work is the rather ad hoc nature of the econometric specifications. Without an underlying structural model informing the regressions, there are bound to be some questions about their interpretation.

The DIN study re-examined the same three propositions as in Swann et al., but this time focusing on Germany, Austria and Switzerland, although only results for Germany will be described here. Like Swann et al., the econometric specifications are ad hoc. The study performs both cross-section and time-series regressions.[40] The cross-section results seem to provide some support for the competitiveness and intra-industry trade arguments. The number of standards in a particular sector had a positive effect on Germany's net exports, although this was true for only a third of the 36 bilateral trade relations examined. The results seem to be the same whether national or international standards were used as explanatory variables. The time-series regressions, however, seemed to support the competitive disadvantage hypothesis. The number of national standards had a negative effect on the German trade surplus. When the number of international standards was used in the regressions, they had a negative effect on imports.

Moenius (1999) used a gravity model[41] to assess the trade impact of product standards. To the extent that the gravity model has better established theoretical roots, it represents an econometric improvement over the Swann et al and DIN studies. Moenius's data cover 471 industries in 12 Western European countries from 1980 to 1995. Like the other studies, he uses standards-related data from the Perinorm database. Regressing sectoral bilateral trade volumes (4-digit SITC) on counts of bilaterally shared (or harmonized) standards using a country-pair-year fixed-effect model, he finds that shared standards have a positive and significant effect on bilateral trade. He estimates that a 10 per cent increase in the number of shared standards enhances bilateral trade by about 3 per cent. When both the count of country-specific standards and that of shared standards

[40] The difference between the two is that cross-section data comprise a series of observations made at the same time, while time-series data are a series of observations through time.

[41] Gravity models are econometric models of trade which acquire their name from their similarity to Newton's theory of gravitation. The gravity model of trade predicts that the volume of trade between any two countries will be positively related to the size of their economies (usually GDP) and inversely related to the distance between them. The gravity model has proven to be popular among empirical trade economists because of the very high explanatory value obtained, even with the use of cross-section data. For a time, gravity models were linked primarily with trade models of imperfect competition. However, recent work (Deardorff, 1998) has made it clear that the gravity model can also arise from a traditional factor-proportions explanation of trade. Hence, far from being a purely econometric tool without a theoretical basis (an early criticism against the gravity model), it can be derived from a range of trade theories.

are introduced in the regression, harmonization is still found to have a positive and significant effect on trade. Interestingly, importer-specific standards have a negative impact on imports in the non-manufacturing sectors, but have a positive impact on imports in the manufacturing sector. Moenius explains this result in terms of incomplete information. Trading partners face high information costs in the absence of standards. The presence of product standards, even if they are specific to one country, lowers information costs. While there are costs in adapting products to conform to national standards in foreign markets, if these costs are small relative to information costs, the presence of standards increases rather than deters trade. These effects dominate in manufacturing sectors, where products are more differentiated and information about market preferences is, therefore, more valuable.

There are a number of concerns that need to be highlighted about the Moenius study. First, it is not based on the standard version of the gravity model. Instead of using aggregate bilateral trade as the variable to be explained (dependent variable), the study uses bilateral trade at the sectoral level. And it omits measures of distance between countries and tariff barriers, favouring time country-pair fixed effects. Thus, it is difficult to assess the regression on the basis of a comparison of the estimated coefficients with previous studies and some results are likely to suffer from a significant bias arising from omitted explanatory (independent) variables. Second, the study does not distinguish between voluntary and mandatory standards. Empirically, they might have very different impacts on trade. Since traders are not obliged to comply with voluntary standards, the count of voluntary shared standards does not provide an appropriate measure of the number of standards actually shared. Further work in this direction may be of great importance.

The available empirical literature on the effect of standards on international trade flows is still rather limited, reflecting the difficulty of the subject and the nature of the data. The explanatory variable used to represent standards in the regressions is just the number or count of existing standards in a particular industry. Because of this specification, the literature is not able to reflect important features of standards such as their functions, importance, compliance costs, technical complexity and innovativeness. The econometric methods used are often ad hoc or are non-standard applications of models. Nevertheless some interesting results have arisen. Intra-industry trade can be spurred by greater standard-setting activity in industrial sectors, suggesting that standards play an important role in increasing compatibility. Also, the adoption of standards, even purely national ones, can increase trade. One possible explanation for this result is that standards convey information about consumer preferences to exporters.

Harmonization versus mutual recognition

Harmonization and mutual recognition of product standards are commonly believed to be steps towards freer trade. However, economic theory does not provide a clear-cut answer about which approach is more trade enhancing (see Subsection 3). The advantage of harmonization is that products produced in different countries are homogeneous and therefore better substitutes from the point of view of producers and consumers. This, in turn, may facilitate trade by improving confidence in the importing country about product quality, and by enhancing compatibility with domestically produced goods. A higher degree of product homogeneity is also likely to result in more intense competition. On the other hand, harmonization imposes a cost in terms of reduced variety. Insofar as demand for foreign goods is driven by a love of variety, a reduced degree of product differentiation would hamper trade. Unless consumer preferences are biased towards a domestic specification, another potential advantage of mutual recognition is that it allows any firm to pick a standard and still sell in the whole regional market without incurring additional costs. Harmonization to a specific standard, by contrast, may imply a higher cost of compliance for firms in certain countries, thus effectively erecting a barrier to trade.

The empirical literature on the impact of harmonization as against mutual recognition on trade is very limited. A paper by Vancauteren and Weiserbs (2003) provides a somewhat indirect estimate of the impact of harmonization versus mutual recognition on trade by looking at whether those sectors where the EU has sought to remove technical barriers to trade by harmonizing technical regulations or by applying mutual

recognition present a lower "home bias"[42] than the average. The study relies on the hypothesis that the large home bias in Europe is induced by technical barriers to trade, such as different technical regulations. Hence, to the extent that harmonization and mutual recognition of product standards remove trade distortions they should reduce the home bias.

Using a gravity model for intra-EU bilateral trade for the period 1990-98, the authors of the study estimate the home bias effect for five groups of sectors, defined according to whether the new approach, old approach, mutual recognition principal, or a combination of these three approaches applies, and whether technical regulations are significant barriers to trade. Their results show that the home bias remains substantial both for sectors where standards have been harmonized and for those where mutual recognition holds according to national laws. Moreover, a significant home bias is also found for products where no significant barriers were deemed to exist.

In other words, the study by Vancauteren and Weiserbs did not find that measures taken to remove technical barriers to trade had a significant impact on the home bias. Although the smallest home bias is found for those sectors characterized by mutual recognition (the coefficient of the home bias is equal to 2.72 for products where mutual recognition applies, while it is above 3 for sectors whose standards have been harmonized), the analysis does not allow us to say whether this is significantly smaller than for harmonization.

A number of reasons can explain the failure of Vancauteren and Weiserbs to find a significant impact from European measures to remove technical barriers to trade on the home bias. First, factors other than technical barriers to trade can explain the home bias. Second, the study groups sectors on the basis of a sectoral classification set up in a study by Atkins for the Single Market Review in 1998. This study reflected the situation in 1998, while the study by Vancauteren and Weiserbs used data for the period 1990-98. Their data therefore only partially captures the impact of a directive introduced in 1997 to harmonize standards. Finally, since the establishment of the "new approach" in 1985, any good that circulates in one country of the EU can "freely" circulate in another EU country (the burden of the proof of a standard not being equivalent to that of the importing country falls on the importing country). Therefore, given that some time had elapsed between the adoption of the new approach in 1985 and the period considered in their study (1990-98), it is understandable why they find it hard to capture the trade-enhancing impact of mutual recognition.

A recent study (Piermartini, 2005) estimated a standard gravity model[43] for intra-EU sectoral trade[44] over the period 1978-2002. The impact of harmonization on trade is estimated by introducing dummy variables indicating whether, at a certain point in time, the sector was harmonized according to the "old approach" or "new approach". A distinction between the horizontal harmonization (including, for example, compatibility standards) and vertical harmonization (covering health, safety and quality) of standards was also made. Moreover, a mutual recognition dummy was introduced, allowing estimation of the impact of the mutual recognition principle in 1985 for those sectors that have not been harmonized. Mutual recognition of product standards was found to have a positive and significant effect on intra-EU trade. Trade among a randomly chosen country pair and sector was estimated to be 1.2 times higher under mutual recognition. The results regarding the impact of harmonization on trade appeared less robust. Overall, harmonization according to the "old approach" results in enhanced trade more than the "new approach", especially when it concerned horizontal standards.

While it may be too early to draw strong conclusions regarding the relative merits of mutual recognition and harmonization in enhancing trade, given the limited number of studies and their focus on European countries, more robust and significant trade enhancing effects are found in the case of mutual recognition.

42 The term "home bias" determines the preference for consuming domestically produced goods rather than imported goods. In Europe, internal trade (consumption of domestically produced goods) has been estimated to be larger by a factor of ten than trade with other EU partners (Nitsch, 2000).

43 Standard explanatory variables include the GDP values of the trading partners, and five dummy variables which take a value of zero or one to denote whether they share a border, a common language or the same currency, and whether one of the trading partners is an island or a landlocked country.

44 Trade data in ISIC Rev.2 at 4 digit classification from Comtrade are used for the estimation.

(d) SPS measures

The focus here is on SPS measures intended to reduce the dangers posed to animal, plant and human life and health by imports. Two sets of empirical studies are considered – welfare-based analysis of SPS measures and detailed case studies which examine the trade repercussions.

The welfare-based approach to analysing these measures generally adopt a partial equilibrium framework. From the importing country's view, the main costs of imposing SPS measures are the reduction in consumer surplus[45] and expenditures on quarantine controls. The benefits include the increase in producer surplus[46] and the expected reduction in the risk of foreign pests damaging domestic agricultural production. For the importing country, the optimal SPS standard is that which achieves benefits from risk reduction and increase in producer surplus that exceeds the loss in consumer surplus and costs of quarantine controls.

This welfare-based analysis is used in Calvin and Krissoff (1998), James and Anderson (1998) and Paarlberg and Lee (1998). Calvin and Krissoff (1998) looked at the effect of Japanese quarantine measures on imports of US apples.[47] The major concern of Japanese authorities is with fire blight, a bacterial disease which is widespread in the United States. The phytosanitary protocol requires a chlorine dip and an inspection regime with three visits each season by Japanese inspectors who must certify that the apple orchard is free of fire blight. All the costs are to be borne by the exporter. The authors' welfare calculations suggest that it would take the loss of 26 per cent of Japanese apple production to justify the phytosanitary regulations, an occurrence which they characterized as "unprecedented".

James and Anderson (1998) analysed Australia's import ban on bananas. Although an import ban is not a product standard *per se,* for analytical purposes it can be treated as a standard so stringent that no foreign products can meet it. Because of the small size of the Australian banana industry, their study suggests that the consumer gains from removing the ban on Australian imports of bananas even exceeded the cost of losing the whole sector from a foreign pest.

Paarlberg and Lee (1998) examined US beef quarantine rules to guard against foot and mouth disease (FMD). Prior to the adoption of the SPS Agreement, the United States had prohibited imports of cattle, swine, sheep and some forms of meat from countries with FMD. They find that an import prohibition can be justified on welfare grounds only if it is assumed that there is a high risk of FMD from imports (defined as an outbreak of FMD per 215 thousand tons of imports).

One recurring issue in the empirical literature is the difficulty of finding reliable estimates of the risk of pests associated with imports and the size of the damage to domestic production. In the case of FMD for example, Paalsberg and Lee were not able to find US data tracing such outbreaks to imports and had to rely on British data over the 1954-81 period. The data showed nearly a thousand-fold difference in the rate of FMD incidence associated with imports, from 1 for every 215 thousand metric tons of imports during 1954-66 to 1 for every 24.7 million metric tons during the 1967-81 period.

That difficulty raises an important question about the conceptual framework used in these papers to analyse decision-making when there is uncertainty. Knight (1921) had famously distinguished between "risk" and "uncertainty". Risk refers to situations where the decision-maker can assign probabilities to the outcomes that he is faced with. Uncertainty refers to situations when probabilities cannot be assigned to the possible outcomes. The distinction is important because under conditions of risk it is possible to compute mathematical expectations of the welfare gains from removing SPS barriers. But under conditions of uncertainty, this would not be possible. The question is which of these two concepts better describes the situation faced by policymakers when confronted with dangers to the health and life of animals, plants and humans. If decision

[45] Consumer surplus measures the amount that a consumer has to pay for a product against what he would be willing to pay. A loss in consumer surplus obviously means consumers are worse off.

[46] Producer surplus measures what a producer manages to sell his product for compared to what he would be willing to sell it for. In less technical terms, producer surplus is sometimes equated to profits.

[47] This case became the subject of a WTO dispute between Japan and the United States and is discussed in Section IID.

makers are confronted by situations characterized by risk, the studies above provide important evidence that SPS measures are too restrictive. If on the other hand, they are confronted by uncertainty (in Knight's sense) then the studies have overestimated the gains from relaxing SPS measures.

MacLaren (2001) argues that a number of factors make it difficult for decision makers to assign subjective probabilities to outcomes. If there has been an embargo on imports, then governments may not be in a good position to assess the probabilities of pest entry since there is no (or little) data to go by. Scientific evidence may be incomplete or experts may disagree in their interpretation of the evidence. The decision-maker may recognize the existence of unforeseen contingencies which can significantly affect benefits and costs but which he does not think about or recognize at the time when he makes the decision. There may also be an element of irreversibility in some of the consequences of imports (e.g. a pest enters and becomes endemic) which may make decision-makers more risk averse.

There are conflicting conclusions too about the trade impact of SPS measures on developing countries. The Unnevehr (2003) study documents four cases of developing countries whose access to export markets was denied due to sanitary or phytosanitary issues, resulting in substantial costs in terms of lost sales, market share, and investments required to re-enter export trade. They included fish from Kenya, raspberries from Guatemala, shrimp from Bangladesh and horticultural crops from Guatemala, Jamaica and Mali. The paper by Otsuki et al. (2001) dealing with regulations that safeguard human health investigated the effect of aflatoxin standards in the EU on Africa-EU trade flows and health risks. They examined three regulatory scenarios: standards set at pre-EU harmonized levels (status quo), the standard set by Codex, and the new harmonized EU standard. The human health implications of strengthening aflatoxin standards come from risk assessments conducted by the Joint FAO/WHO Expert Committee on Food Additives. They then use a gravity model, which includes aflatoxin standards as one of the explanatory variables, to predict the effect on trade flows between Africa and Europe of changes in the aflatoxin standard. They conclude that compared to Codex standards, the implementation of the new harmonized aflatoxin standard in the EU would reduce health risk by approximately 1.4 deaths per billion a year, but would simultaneously decrease African exports to the EU by about $670 million.

A different picture is provided by Jaffee and Henson (2004) who argue that standards are not necessarily barriers for developing countries. They estimate the value of developing country agro-food border rejections because of SPS measures to be about $1.8 billion, 74 per cent of which is accounted for by middle-income countries. The estimated value of low-income country agricultural and food product trade rejected at the importing country border is $275 million, representing just less than 1 per cent of the agricultural and food exports of these countries.

Part of the reason why these regulations can pose barriers for individual countries but not cut significantly the total volume of trade is that where there are losers there are often winners. For example, in the case of the Guatemalan raspberries which ceased exporting to the US because of the outbreak of cyclospora (documented in Unnevehr (2003)), several of the leading firms in the industry (including both Guatemalan and international firms) shifted their operations to Mexico. Mexico's exports of raspberries now account for the majority of an expanding import trade into the United States (Calvin, 2003).

They also take issue with the Otsuki et al. (2001) study believing that it severely exaggerates the predicted effect of the new EU aflatoxin standard. The simulation proceeded from an inflated baseline. Only a small number of consignments of groundnuts were rejected by EU Member States because of aflatoxin. They suggest that the near-term "loss" of African trade due to the more stringent European Union standards has actually been in the hundreds of thousands rather than the hundreds of millions of dollars.

Rising standards serve to accentuate underlying supply chain strengths and weaknesses and thus impact differently on the competitive position of individual countries. Some countries are able to use high quality and safety standards to reposition themselves in global markets. The analysis in Jaffee and Henson suggests the importance of considering the impacts of food safety and agricultural health measures within the context of wider capacity constraints in developing countries and underlying supply chain trends.

The welfare-based literature finds that SPS measures are generally restrictive and involve a welfare loss in the importing country. The presumed health risks or losses from the introduction of pests through imports need to be extraordinarily high in order to justify some regulatory regimes in place. But questions have been raised about the appropriateness of the analytical framework employed since there may be circumstances when regulatory authorities are not able to assign credible probabilities to the outcomes and therefore are more risk averse than assumed in the papers.

There are conflicting conclusions too about the trade impact of SPS measures on developing countries. There have been cases where access to export markets was denied due to sanitary or phytosanitary issues, resulting in substantial costs in terms of lost sales and market share. But rising standards also serve to accentuate underlying supply chain strengths so some countries are able to use high quality and safety standards to reposition themselves in global markets.

(e) Environmental standards

The relationship between environmental standards and trade flows has usually focused on the pollution haven and race to the bottom stories.

The pollution haven hypothesis starts with a world where countries differ in the stringency of their environmental regulations and industries differ in their pollution intensities. The hypothesis is that these differences in regulations will induce pollution-intensive firms to locate production to less regulated countries. It also predicts that as a result of this flow of investment, exports of pollution-intensive products will increasingly come from these locations while more regulated countries will progressively become net importers of these products.

The regulatory chill or race to the bottom story focuses more on the effect of increasing economic integration on regulators' incentives to stick to, strengthen or relax environmental standards. With increased competition for footloose investments and trade, countries may be reluctant to adopt new regulations or to strengthen existing ones, for fear of scaring off investors. Worse, they may even move to weaken existing regulations to attract investments. If other countries respond in a similar fashion, a race to the bottom in environmental standards may occur.

Pollution haven

In their survey article ten years ago on the effect of environmental regulations on US manufacturing, Jaffe et al. (1995) concluded that while these regulations imposed significant costs on polluting industries, they have not affected patterns of international trade. The paper summed up what numerous studies had up to then shown – that there was little empirical evidence that differences in environmental regulations affected international trade and investment flows.

However, the pollution haven hypothesis continues to draw a large amount of research interest and this part of the empirical survey examines a number of recent investigations. Much of this recent literature subjects the available data to greater scrutiny, prefers the use of more disaggregated data and is more careful in handling heterogeneity within samples.

Smarzynska and Wei (2001) examined the investment decisions of 534 multinational firms in 24 countries in Central and Eastern Europe and the former Soviet Republics. They refined their data in several ways. Instead of using country or industry level FDI data, they used firm-level data. They also tried to account for other variables that could be correlated with laxity in environmental regulations and which may have influenced previous studies. In particular, poor quality of government institutions (i.e. corruption) will discourage FDI even as it will also be positively correlated with weak environmental regulations. With all these refinements, they found some support for the pollution haven hypothesis. Investment from pollution-intensive multinational firms is smaller for host countries with more stringent environmental regulations. But they judged the evidence to be weak, as it did

not survive various extensions and robustness checks (for example, using alternative measures of environmental regulations). The authors therefore cautioned against drawing any strong conclusions from their study.

Eskeland and Harrison (2002) examined foreign direct investment by US firms in four countries: Côte d'Ivoire, Mexico, Morocco and Venezuela. They considered whether environmental regulations in the United States were driving FDI into more pollution-intensive sectors abroad and whether US firms were more or less environmentally friendly than domestic firms. Although they found some evidence that US investors abroad located in sectors with high levels of air pollution, they conclude that the evidence was weak. They also found that foreign plants were significantly greener – using cleaner types of energy and more energy efficient – than domestic firms in the host country. Third, outbound FDI from the United States turned out to be highest from those industries where environmental regulations were low, contrary to the usual expectation.

Ederington et al. (2003) provide some explanations for the absence of the pollution haven effect in previous studies. They argue that international trade is dominated by trade among developed countries which tend to have relatively similar regulations. But if only trade between industrialized and developing economies is examined, environmental regulations have stronger effects on the pattern of trade. Increasing the stringency of environmental regulations in the United States will decrease imports from developing countries. Second, they find that polluting industries also happen to be the least geographically mobile (as measured by transport costs, the cost of setting up a new plant and agglomeration benefits from its current location). Thus, these industries find it more costly to move to jurisdictions with less stringent regulations.

Race to the bottom or regulatory chill

Esty and Geradin (1998) pointed to mainly anecdotal evidence of a race to the bottom or the chilling effects of trade on environmental regulation. Among the evidence cited were the reluctance of some countries to sign up for the Kyoto Protocol, changes in German conservation laws, the UK coating industry's 1995 victory over legislation that would have forced them to reduce their emissions of volatile organic compounds which are a major contributor to city smog and respiratory health problems.

But there is little systematic or formal empirical work to buttress these observations. In fact, the formal empirical work either shows that regulatory chill or race to the bottom effects cannot be detected, or if they exist, they are not a substantial factor preventing continual improvement in environmental indicators. Frankel's (2003) survey reveals little statistical evidence that openness to trade undermines environmental regulation through a race to the bottom. If anything, he cites favourable gains from trade in measures of air pollution such as sulphur dioxide SO_2 concentrations.

Fredriksson and Millimet (2002) test the regulatory chill effect in the case of NAFTA. They compared trends in Levinson's index of relative state compliance costs (a measure of the stringency of environmental regulations) in US states bordering Canada and Mexico and in other US states. The rationale for this stratification is that if there is a race to the bottom, then US states that border either of these countries would have acted differently than interior states during the time surrounding the ratification of NAFTA. They found that states on either border had been less responsive to changes in neighbouring states than interior US states, suggesting a mild regulatory chill. But this did not stop environmental indicators from improving for all US states during the period leading up to the ratification of NAFTA, and improvements beyond ratification for some indicators as well.

Overall, recent studies find more of a pollution haven effect than the older literature, although there is some question about the robustness of these results. Less work has been done to examine empirically the race to the bottom story, but the available study point to little or no effects. While the presumption is still that environmental standards do not have significant effects on trade and on investment flows, these new studies will likely spur further research along these lines.

5. SUMMARY AND CONCLUSIONS

The effects of standards on the direction and size of trade flows tend to be complex and need to be analysed on a case by case basis. Standards typically have an effect on both consumers and producers. They may affect the willingness of consumers to pay for product varieties meeting the standard, because they change consumers' perception or appreciation of these varieties. Standards may affect producers' costs in a number of ways. First, they may imply a fixed cost when producers switch from producing one product variety to producing another, higher quality variety. Second, they may involve a change in variable costs, for instance if it is more expensive to produce a good meeting the standard than one not meeting the standard. Third, the introduction of a standard affects production costs if it causes producers to run additional product lines. And fourth, standards will typically also generate costs related to conformity assessment procedures. Overall, the introduction of a standard is likely to affect the prices that consumers are willing to pay for certain product varieties and the prices at which producers are willing to supply those varieties. Standards will affect trade flows if they have a different effect on the demand for and supply of varieties produced abroad and varieties produced domestically. This may, for instance, be the case if foreign and domestic producers supply different varieties of the relevant good, or if standards affect their production costs differently.

The trade effects of standards will affect countries' welfare, including the welfare of the country introducing the standard. If a standard is purely designed to raise the costs of foreign producers in order to protect the domestic industry, it is very likely to reduce both trade flows and domestic welfare. But standards that reduce trade flows are not necessarily welfare reducing, in particular if they are designed in order to reduce the negative welfare effects of a market imperfection. Standards that improve consumers' information, that increase consumers' safety or that reduce the negative effects of environmental externalities, for instance, may well increase domestic welfare even if they have a negative effect on trade. As a consequence it may be in the interest of individual countries to set standards in order to raise their own welfare but which, as a by-product, reduces trade flows. Tensions with trading partners may then arise, if such a standard that is welfare-increasing from the domestic point of view decreases trading partners' welfare.

The discussion in previous Subsections has illustrated the importance of distinguishing among different types of standards. For the sake of this Report, standards have been distinguished according to their function – that is according to the policy objectives they intend to address. The cases of standards related to network externalities, imperfect information and negative production or consumption externalities have been discussed. These types of standards differ in a number of aspects that will play a role when evaluating the following three statements often used in the public debate.

Do standards decrease trade flows?

Standards are likely to increase trade flows in the case of standards targeting network externalities. Voluntary standards targeting information asymmetries (e.g. safety standards) or negative production externalities may also have a positive impact on trade, as they are likely to increase the variety of products supplied in the market. Mandatory safety standards and environmental product standards have ambiguous effects on the size of trade flows, but are likely to decrease trade if they create cost disadvantage (in relative terms) for producers exporting to the countries imposing the standard. The impact of mandatory process standards related to the environment depends on whether they are applied to foreign producers or not. If they are applied to foreign producers, trade flows may decrease. Yet such standards raise important questions concerning control and enforcement, given that production takes place abroad.

Is harmonization at the international level the best solution?

The case in favour of international standards is likely to be much stronger in the context of compatibility standards (network externalities) than in the context of the other two types of standards examined. In the case of network externalities, markets will tend to oversupply varieties when left alone. Compatibility standards therefore reduce the number of varieties in markets. This argument also holds with respect to global markets. In other words, harmonization is likely to be desirable in the case of compatibility standards.

However, it should be emphasized that in this case, market forces are likely to generate the desirable outcome, without the need for government intervention.

The case in favour of harmonization of standards is weaker when it comes to standards addressing information asymmetries (e.g. safety standards) and local environmental externalities. To the extent that countries differ, it may be preferable to have separate policy instruments for each country rather than one single policy instrument in these cases.

When standards addressing global production or consumption externalities are set at the national level they are likely to be inefficient. This is, for instance, the case for global environmental externalities. International collaboration is necessary in order to correct for such externalities. The optimal solution, however, does not necessarily involve harmonized standards, as production technologies and consumer behaviour differ across countries.

Should standard-setting be left to the private sector?

Producers will set standards in a profit maximizing way. As a consequence they automatically take consumer interests into account, but only to the extent that consumer preferences are reflected in prices. This is unlikely to be the case in the presence of production externalities and/or information asymmetries. Consumer and producer interests will diverge in these cases. Government intervention is necessary to ensure that consumer interests are taken into account. Consumer and producer interests are likely to coincide when it comes to network externalities and it therefore makes sense for compatibility standards to be set by the private sector.

Producer and consumer interests may also differ in another important domain – that of international trade. While producers may have an incentive to set standards so as to provide them with an artificial competitive advantage, this is not in the interest of consumers. It should be the aim of governments to take both producer and consumer interests into account and to ensure that standards are not used as protectionist devices.

Two other important issues arise from the discussion above that are of particular importance for the multilateral trading system:

Domestic versus global effects of standards and the role of the WTO

In the presence of market failures such as those discussed here, it is possible that policies which are optimal from a national point of view cause losses to trading partners. It is also possible that these losses outweigh the benefits going to the country introducing the policy. In other words, in integrated markets, regulatory policies that are optimal from a national point of view may not be optimal from a global point of view. The question therefore arises as to whether such policies should be considered consistent with the multilateral trading system. Given the complexity of this issue, questions also arise concerning the precise role of and the interactions between national standard setting bodies, international standard setting bodies and the World Trade Organization. These questions will be alluded to in Section IIC and Section IID.

Control and enforcement of process standards in the international domain

Production processes in one country can exert negative externalities on consumers in other countries. This can be the case because the production process affects global aspects of the environment (e.g. air pollution, maritime pollution). Whatever the justification or appropriateness of process standards, the issue of control and enforcement will be a thorny one in the international domain. If a country wishes to condition imports on compliance with a certain process standard, the question arises as to who controls and enforces this standard, given that production takes place abroad. Section IIC will discuss how international standard-setting bodies and other non-governmental organizations have dealt with this issue. Section IID illustrates that this question has also played a role in WTO jurisprudence.

The empirical evidence

Ideally, the empirical survey of standards and trade would have examined whether certain types of standards are trade creating, while other types are not. But with the exception of environmental standards and SPS-related measures, a large part of the empirical literature on standards and trade has tended not to distinguish the nature of the standards being studied. The number of empirical studies has also been limited. These limitations have to be taken into account in the recapitulation of some of the results of the empirical survey.

Standard-setting activity seems to be pronounced in industries characterized by network externalities. Insofar as technical regulations are concerned, the bulk of this activity seems to deal with various types of problems associated with information asymmetries. In some major markets these regulations cover a large number of tariff lines and a significant share of imports, so there is potential for these regulations to have an adverse effect on trade.

The cost or price-raising effects of standards do not emerge as an important NTB concern in OECD countries. OECD firms did not identify major problems in complying with regulations in other OECD markets. However, the same relatively benign results seem not to apply with respect to smaller firms. With respect to the cost of compliance by firms in developing countries, the evidence is mixed with the survey work suggesting that firms in developing countries face very high costs, while the case studies tell a more complex story where the costs of and benefits from compliance vary enormously among firms and countries and depend on a range of factors.

The available empirical literature on the effect of standards on international trade flows is still rather limited, reflecting the difficulty of the subject and the nature of the data. But some interesting results have arisen. Intra-industry trade can be spurred by greater standard-setting activity in industrial sectors, suggesting that standards play an important role in increasing compatibility. Also, the adoption of standards, even purely national ones, can increase trade. One possible explanation for this result is that standards convey information about consumer preferences to exporters.

On the relative merits of harmonization or mutual recognition of standards to facilitate trade, it is not possible to draw strong conclusions given the very limited empirical studies available, most of which are focused on EU members. But early evidence suggests that more robust and significant trade-enhancing effects are found in the case of mutual recognition.

The welfare-based literature finds that SPS measures are generally restrictive and involve a welfare loss in the importing country. The presumed health risks or losses from the introduction of pests through imports need to be extraordinarily high in order to justify some regulatory regimes in place. But questions have been raised about the appropriateness of the analytical framework employed since there may be circumstances when regulatory authorities are not able to assign credible probabilities to the outcomes and therefore are more risk averse than assumed in the papers. There are conflicting conclusions too about the trade impact of SPS measures on developing countries. There have been cases where access to export markets was denied due to sanitary or phytosanitary issues, resulting in substantial costs in terms of lost sales and market share. But there have been other cases as well where, by adopting higher standards, countries are able to find an important niche and improve their position in the global marketplace.

On environmental standards, recent studies find more of a pollution haven effect than the older literature, although there is some question about the robustness of these results. Less work has been done to examine empirically the race to the bottom story, but available studies point to little or no effects on the behaviour of regulators. So the presumption is still that environmental standards do not, in general, have significant effects on trade and on investment flows.

C INSTITUTIONS AND POLICY ISSUES

This Section explains how standardization and conformity assessment work in practice and describes the relevant characteristics of standardization and conformity assessment infrastructures in various regions of the world. It starts with a discussion of the standardization process and considers where standardization takes place, how it is organized and who participates in the process. Subsection 2 discusses the organization of conformity assessment at the international, regional and national levels and describes the ways in which conformity assessment requirements may impact on trade.

As mentioned in Section IIB, available databases on standards are not suitable for an economic analysis of the linkages between standards and trade. To a large extent, this also applies to the analysis of the linkages between standardization and conformity assessment infrastructure and trade. Data provide only a partial picture of the standards world, they are hardly comparable across countries, and they are not always reliable. Assessing standardization activity in a particular country and analysing its effect on trade is thus very difficult. Similarly, in the absence of estimates of the costs involved for governments to sustain conformity assessment infrastructure at the national level and to participate in international cooperation efforts, estimating the benefits from avoiding redundant conformity assessment procedures has been difficult.

1. STANDARDIZATION

When considering how standards are prepared and adopted in different regions and countries and how this affects trade, it is necessary to distinguish between types of standards in terms of how they have been developed. First, a distinction needs to be made between de facto and institutional standards. Institutional standards are those defined by committees and formally adopted, while de facto or informal standards are those that are not defined by committees, but rather are proprietary designs that win a position of market dominance. This Section will focus mainly on how institutional standards are developed.[48] A second useful distinction is between voluntary and mandatory standards, as discussed at some length in the previous Section. The way these two types of standards are developed can be different, and as much as possible both cases will be considered. Unfortunately, available data do not differentiate standards according to their *raison d'être*, their economic effects, or whether the standards relate to products, services or processes, mainly because the development processes associated with standards are generally not differentiated according to those criteria.

The way in which the formal standardization process is organized and the role assigned to various institutions differs significantly among regions and countries. First, standards are drawn up at the national, regional and international levels and the degree of "vertical" integration between those levels differs from one region/country to the other. Second, the degree of "horizontal" integration of the standardization bodies also differs among countries. In some countries, the standardizing process is very centralized at the national level, with one single body in charge of developing both voluntary and mandatory standards. In other countries, a large number of organizations produce voluntary standards, some of which become mandatory by being referred to in technical rules and regulations drafted by government agencies.

The participation of various stakeholders in the standardization process also varies among bodies and between countries. In some cases the only standardizing body is a government agency and all standards it produces are mandatory. In others, the role of the government is restricted to developing mandatory regulations, and to supporting the standardizing process, especially where voluntary standards will be referred to in technical regulations. Also, the participation of consumers, importers, exporters, producers, etc. can vary considerably from one body to another and among countries.

[48] For a survey of the literature on market processes creating de facto standards, see Swann (2000).

This Subsection looks more closely at how standards are prepared and adopted. It first examines the role of national, regional and international standardizing bodies. It then describes the standardization process and considers the various ways in which it can be organized, focusing in particular on the role of the public and private sectors, consumers and civil society. Building on this description of the institutional aspects of the standardization process, the issue of developing country participation in the international standardization process, an issue of particular importance from both a trade and development perspective, will be examined more closely.

(a) Where are standards set?

With the expansion of trade and the increasing integration of national economies, the standards development process organized by national, regional and international standards institutions has progressively evolved. The role of international bodies has gained prominence. Regional bodies have been created or developed and in many countries, national institutions have been reformed. The national standardization infrastructure in most industrialized countries is now integrated into the network of international standardization activities. However, a considerable number of low income and transition countries have not followed the trend. Their national institutions are not part of the international network.

While standardization activities at the international level, in particular the formal ones, are relatively easy to describe, the regional and national levels are considerably more complex. The World Standards Services Network provides comprehensive lists of international and regional standardizing bodies including links to their webpages. At the national level, useful sources of information are the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC), who publish directories of their national member bodies together with basic information on, for example, their resources and activities, the organizations to which standardization is delegated, the technical areas in which the bodies participate in standardization and the number of standards published.[49] Unfortunately, as explained below, this information only provides an incomplete picture of standardizing activities at the national level.

International level

Of the 49 international standardizing bodies listed by the World Standard Services Network[50] ISO, the IEC and ITU are the most important. As a network of national standards institutes of 148 countries, ISO is the world's largest developer of standards. Its scope extends to all fields except electrical and electronic engineering, the IEC's domain, and telecommunications, that of the ITU. The expansion of membership in both ISO and IEC over recent decades reflects the growing importance of international standards. While ISO and the IEC are non-governmental bodies, the ITU is part of the United Nations and its members are governments. IEC's full and associate Members, who currently number 65, are national committees – one for each country – which are required to be fully representative of all electrotechnical interests in the country concerned. ISO also liaises with 30 or so international standards-developing bodies outside the ISO/IEC system. Each of these bodies works in a specific area, usually with a UN mandate.

ISO and IEC standards are voluntary, but some are referred to in technical regulations and some become de facto mandatory. A certain number of their standards – mainly those concerned with health, safety or the environment – have been adopted in some countries as part of the regulatory framework, or are referred to in legislation for which they serve as the technical basis. Although voluntary, some ISO and IEC standards become a market requirement, as has happened in the case of ISO 9000 quality management systems, or of dimensions of freight containers, bank cards or electric batteries.

ISO and IEC together produce about 85 per cent of all international standards, and the other specialized bodies account for the rest. In 2004, ISO published 1247 international standards and standards-type documents, bringing the total number of international standards it published to 14,900 as of the end of 2004. The two main sectors of ISO standardization activities are materials technologies and engineering technologies, each of which accounts for about

[49] See Appendix Table 1 at the end of this Section.

[50] See Appendix Table 2 at the end of this Section.

a quarter of the total number of published standards. The IEC published some 397 standards and standards-type documents in 2004 and now counts more than 5,300 standards and standards-type documents in its catalogue, covering the fields of electricity, electronics and related technologies. Since the 1980s, ISO has started developing so called "generic management system standards". The ISO 9000 (quality management) and ISO 14000 (environmental management) standards are among ISO's most widely known and successful standards ever.

The WTO Agreement on the Application of Sanitary and Phytosanitary Measures encourages the use of international standards, guidelines and recommendations developed by WTO Member governments in other international organizations. These organizations are the joint FAO/WHO Codex Alimentarius Commission ("Codex") for food safety; the World Organization for Animal Health (previously the Office International des Epizooties "OIE") for animal health and zoonoses; and the FAO International Plant Protection Convention ("IPPC") for plant health. Most of the WTO's member countries are also members of these international bodies.

The Codex Alimentarius Commission was set up in 1963 by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) to develop food standards, guidelines and related texts such as codes of practice under the Joint FAO/WHO Food Standards Programme. The main purposes of this Programme are to protect the health of consumers, to promote coordination of all food standards work undertaken by international governmental and non-governmental organizations, and to ensure fair trade practices in food trade. Membership of the Commission is open to all Member Nations and Associate Members of FAO and WHO. In 2004, it had 171 member nations and one member organization. The Codex develops standards for food additives, veterinary drug and pesticide residues, contaminants, methods of analysis and sampling, and codes and guidelines of hygienic practice. Codex develops both quality and safety standards.[51] On January 2005, the list of current official standards adopted by the Codex Alimentarius Commission included 214 standards, 52 recommended codes of practice and 45 principles and guidelines.[52]

At the time of the SPS negotiations in 1986, the IPPC was identified as the relevant international agreement for phytosanitary matters. However, at that time it had neither the mandate to develop international standards nor an international secretariat. The FAO, which had adopted the IPPC in 1951, thus established its Secretariat in 1992 and adopted the New Revised Text of the IPPC in 1997.[53] As of November 2004, the IPPC had 129 contracting parties. The goal of the IPPC is to secure action to prevent the spread and introduction of pests affecting plants and plant products, and to promote appropriate measures for their control.[54] The scope of the IPPC extends to items capable of harbouring or spreading pests, such as storage places, conveyances and containers. The Convention is legally binding. However, the standards that are developed and adopted are not. By the end of 2004, the IPPC had adopted 21 International Standards for Phytosanitary Measures (ISPMs) on issues ranging from pest risk analysis for regulated non-quarantine pests to guidelines for regulating wood packaging material in international trade. These standards can be reference standards, concept standards or related to a specific commodity, pest or measure.[55]

In 1924, twenty-eight states reached an "international agreement" to establish the OIE. The Agreement was ratified three years later.[56] The WOAH (previously OIE) produces four publications which contain comprehensive international standards and references for animals – the Terrestrial Animal Health Code, the Aquatic Animal Health Code, the Manual of Diagnostic Tests and Vaccines for Terrestrial Animals, and the Manual of Diagnostic Tests for Aquatic Animals. The aim of the Terrestrial and Aquatic Animal Health Codes is to assure

51 Codex has also developed guidelines for assessing the safety of Genetically Modified Organisms (GMO) food products.

52 Codex also established more than 2000 maximum pesticide residue limits which can be considered as standards. See http://www.codexalimentarius.net/web/standard_list.do?lang=en.

53 By the time of the SPS negotiations, the IPPC was implemented through the cooperation of member governments and regional plant protection organizations. When two-thirds of its contracting parties have ratified the 1997 amended IPPC text, it will come into force. Current information on the IPPC, including information relevant to International Standards for Phytosanitary Measures (ISPMs), can be found at http://www.ippc.int.

54 IPPC has also developed guidelines on how to assess the risks from living genetically modified organisms (LMOs) and from invasive species.

55 As of November 2004 the ICPM had adopted one reference standard which is updated annually (ISPM 5 Glossary of phytosanitary terms), one commodity specific standard (ISPM 15 Guidelines for regulating wood packaging in international trade) and 19 concept standards.

56 Current information on the OIE can be found at http://www.oie.int.

the sanitary safety of international trade in live animals, their genetic material and animal products. The codes describe health measures to be used by the veterinary authorities to avoid the transfer of agents pathogenic for animals or humans, while avoiding unjustified sanitary barriers. The purpose of the Terrestrial and Aquatic Manuals is to contribute to the international harmonization of methods for the diagnosis, surveillance and control of the diseases listed in the Codes. Standards are described for laboratory diagnostic tests and the production and control of biological products (principally vaccines) for veterinary use across the world. The standards published represent a consensus among the veterinary authorities of WOAH Member Countries. WOAH has recently begun work on standards for animal welfare. The WOAH's financial resources are derived principally from regular annual, as well as voluntary, contributions from member countries.

Over the past 20 years, the role of NGOs in the development of international standards has gained importance. Growing public awareness of environmental and social issues has given rise to a number of standard setting, certification, and labelling initiatives, some led by NGOs and others led by the business sector. As discussed below, NGO interest in ISO has increased considerably since ISO started developing generic management system standards in the 1980s. At the same time, an increasing number of NGOs have started developing standards themselves. The ISEAL Alliance, for instance, is an association of leading international standard-setting, certification and accreditation organizations that focus on social and environmental issues.[57] ISEAL has eight full members and two associate members. The full members are: Fairtrade Labelling Organizations (FLO), the Forest Stewardship Council, the International Federation of Organic Agriculture Movements, the International Organic Accreditation Service, the Marine Aquarium Council, the Marine Stewardship Council, the Rainforest Alliance, and Social Accountability International. The associate members are: the Global Ecolabelling Network, and Chemonics International.

Box 8: NGOs as standardizing bodies: Fairtrade Labelling Organizations

The past decade has seen the proliferation of environmental and social labels along with increasing public awareness about issues in both domains. In this area NGOs have proven to be effective in promoting, leading and coordinating standardization and labelling initiatives and they have been competing with traditional international organizations.

Among the many examples of NGO-driven standardization efforts, fair trade is one of the most prominent. According to FINE[1], fair trade can be defined as "a trading partnership, based on dialogue, transparency and respect that seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions to, and securing the rights of, marginalized producers and workers – especially in the South." Although the concept was introduced 40 years ago, the diffusion of fair trade products remained marginal until recently. Officially founded in 1999 in an effort to unify the different labelling initiatives, and to increase the reach and impact of fair trade, Fairtrade Labelling Organizations International (FLO hereafter) is widely recognized as the leading fair trade standard setting and certification organization. FLO is made up of 19 National Members (e.g. Max Havelaar in France and Switzerland, TransFair in Canada, Germany and the US, FairTrade in Japan), representing 20 nations. Their role is to promote and market FLO-labelled products through various channels in their respective countries.

FLO standards

Standards developed by FLO apply to a range of agricultural products (e.g. coffee, fresh and dried fruits, flowers, rice) and, for the time being, to one manufactured product (sport balls). These products are typically, but not exclusively, produced in developing countries. Standards set both minimum (to be met immediately) and progress (to be met in the future) requirements mainly for production processes, which include labour conditions (largely based on ILO standards) and environmental and social impact, as well as for product characteristics and performance.

57 See http://www.isealalliance.org/about/index.htm

When a stakeholder sees the need for a new standard or a revision of an existing one, the FLO Standards & Policy Committee initiates a research phase during which all relevant stakeholders are consulted. Then, based on its observations, the Committee drafts a proposal for discussion. Next, a final draft is published in line with the ISEAL Code of Practice on Standards Setting.[2] Finally, the draft goes to the FLO Board of Directors for ratification.

In addition, to ensure the dedicated portion of the price paid by consumers for a Fairtrade Product effectively reaches the producer, FLO exercises control over the whole supply chain by certifying trading companies willing to respect the Fairtrade Trading Standards. These standards regulate the relation between traders and producers (payment of a minimum price covering costs of sustainable production and living, payment in advance if necessary, signing of long-term contracts). One of the key actors in this 'Fairtrade chain' is the licensee, defined as a company, usually a retailer, that has entered into a License Contract with a FLO National Member for the use of a Fairtrade Label on the product for final sale to consumers.

Certification

While some NGOs acting as standardizing bodies (e.g. Forest Stewardship Council, Marine Stewardship Council, International Federation of Organic Agriculture Movements, Fair Labor Association) outsource certification to accredited bodies, FLO created its own certification body, the FLO Certification Unit, which has since become a limited company, FLO-Cert Ltd. When a producer is interested in becoming Fairtrade certified he addresses a request to FLO. FLO then runs a preliminary check to determine whether the producer meets the minimum requirements set by the standards. If the producer meets the requirements, FLO performs an inspection visit on which the Independent Certification Committee will base its decision to attribute the Fairtrade label. To formalize the commitment, a contract is signed between the producer and FLO.

FLO sets initial certification fees to be paid by producers, according to their size (in terms of employees) and their nature (plantations or cooperatives). The fee ranges from €2,000 to €5,200. The fee for certification renewal depends on the volume sold in the previous year and the kind of product. As of May 2004, there were 389 certified producers, 350 registered traders and 550 licensees.

Metric tons of FLO-labelled products sold

	2000	2001	2002	2003	2002/03 growth	2000/03 growth
Bananas and fresh fruit	22819	29072	36641	52999	45%	132%
Cocoa products	1153	1453	1656	3473	110%	201%
Coffee	12818	14432	15779	19895	26%	55%
Honey	961	1071	1038	1164	12%	21%
Juices	711	966	1387	1890	36%	166%
Sugar	357	468	650	1164	79%	226%
Tea	931	1085	1266	1989	57%	114%

Source: FLO, September 2004.

For more details, see the following links:
– Fairtrade Labelling Organisations International: www.fairtrade.net
– ISEAL Alliance: www.isealalliance.org
– European Fair Trade Association (EFTA): www.eftafairtrade.org

1 FINE is a network formed by four organizations, namely FLO, IFAT, NEWS! and EFTA, in order to share information and to coordinate lobbying and awareness-raising efforts in the area of fair trade.

2 The ISEAL Alliance is an association of leading international standard-setting, certification and accreditation organizations that focus on social and environmental issues.

Regional level

At the regional level, emphasis in trade negotiations is progressively shifting from conventional barriers towards standards. In most regions, initiatives aimed at reducing the trade-restrictive impact of technical barriers have been implemented or announced. Integration in the area of standards and technical regulations is probably most advanced in Europe. Before the creation of the European Union, each country imposed its own technical requirements. Differences between national laws, standards, and conformity assessment procedures made trade difficult, contentious, and expensive. As discussed in the previous Section, a new regulatory technique and strategy was laid down by the Council Resolution of 1985 on the New Approach to technical harmonization and standardization (see Box 9). This New Approach was designed to harmonize the health, safety, and environmental requirements of Member States into one European-wide legislative package. Secondly, with regard to conformity assessments, a new integrated scheme, the so-called Global Approach, was adopted. Thirdly, a new, integrated, European system of standardization was established to eliminate the technical barriers resulting from the differences between the national standards of the 15 Members.

Box 9: The new approach to technical harmonization and standardization in Europe

In the European Union, new barriers to trade resulting from the adoption of diverging national technical standards and regulations can be prevented through a series of provisions laid down by Directive 98/34/EC. Those provisions involve the obligation to notify draft technical regulations to the Commission and to other Member States, and standstill periods of various lengths to allow for objections. National technical regulations are subject to the provisions of Articles 28 and 30 of the Treaty establishing the European Community. The regulations prohibit quantitative restrictions or measures having equivalent effect. Case law of the European Court of Justice, especially the "Cassis de Dijon" case, provides the key elements for mutual recognition. Products legally manufactured or marketed in one country should in principle move freely throughout the Community. Barriers to trade which result from differences between national legislation may only be accepted if national measures are necessary to satisfy mandatory requirements such as health, safety, consumer protection and environmental protection. Restrictions on the free movement of products which may be acceptable under Article 28 and 30, can only be eliminated through technical harmonization on Community level. However, regulating and harmonizing laws for every product with specific, highly technical requirements for each proved to be an impossible task.

The New Approach to technical harmonization and standardization, introduced in 1985, established four main principles. First, legislative harmonization is limited to essential health and safety requirements that products placed on the EU market must meet if they are to benefit from free movement within the EU. Second, the technical specifications of products meeting the essential requirements set out in the directives are laid down in harmonized standards. Third, application of harmonized or other standards remains voluntary, and the manufacturer may always apply other technical specifications to meet the requirements. Fourth, products manufactured in compliance with harmonized standards benefit from a presumption of conformity with the corresponding essential requirements.

The New Approach governs the families of products listed below:

- Appliances burning gaseous fuels (90/396/EEC)*
- CE marking directive (council directive amending other directives) (93/68/EEC)
- Construction products (89/106/EEC)
- Electromagnetic compatibility (89/336/EEC)
- Energy efficiency requirements for household electric refrigerators, freezers, and combinations thereof (96/57/EC)
- Equipment and protective systems in potentially explosive atmospheres (94/9/EEC)
- Explosives for civil uses (93/15/EEC)

- Interoperability of trans-european high-speed rail system (96/48/EC)
- Lifts (elevators) (95/16/EC)
- Low voltage equipment (73/23/EEC)
- Machinery, safety of (98/37/EC)
- Marine equipment (96/98/EC)
- Medical devices: active implantable (90/385/EEC)
- Medical devices: general (93/42/EEC)
- Medical devices: in vitro diagnostic (98/79/EC)
- Non-automatic weighing instruments (90/384/EEC)
- Packaging and packaging waste (94/62/EC)
- Personal protective equipment (89/686/EEC)
- Precious metals (not formally proposed) (Com(93)322)
- Pressure equipment (97/23/EC)
- Pressure vessels, simple (87/404/EEC)
- Radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (1999/5/EC)
- Recreational craft (94/25/EC)
- Toys, safety of (88/378/EEC)

For products that are not governed by New Approach Directives, there are essentially two regulatory levels. Technical requirements differ for each of them. There are the "old approach" regulations, which have technical specifications integrated into the annexes. Some of these products are regulated on a product-by-product basis. Other products are unregulated at the EU level, but may be regulated at the national level and are governed by Member State laws.

All manufacturers, domestic or foreign, are obliged to meet all the essential requirements pertaining to their product. The law does not distinguish between European manufacturers and manufacturers of other countries.

The point of the New Approach Directives was to eliminate differences among national laws that caused barriers to trade. But differences in national standards and testing and certification procedures were the root causes of barriers to trade, and it followed that a new, integrated scheme for technical harmonization had to be implemented as well. The new scheme was embodied in two Decisions: the Module Decision and the regulation on CE Marking. The policy was called the Global Approach. Finally, conformity assessment can be carried out with or without the use of standards. This last principle is important to manufacturers of new or innovative products for which standards do not yet exist, and ensures that standards annexed to New Approach Directives (which are voluntary) do not become *de jure* obligatory.

For more details, see the Guide to the Implementation of Directives Based on New Approach and Global Approach, (http://europa.eu.int/comm/enterprise/newapproach/legislation/guide/legislation.htm)

or

Delaney and van de Zande (2000) A guide to EU standards and conformity assessments, NIST Special publication 951, (http://ts.nist.gov/ts/htdocs/210/gsig/eu-guides/sp951/sp951.htm)

* Directive number.

The responsibility for European standardization lies primarily with the European Committee for Standardization (CEN), founded in 1961 and the European Committee for Electrotechnical Standardization (CENELEC), founded in 1959. The European Telecommunications Standardization Institute (ETSI) was established in 1988 for standardization in telecommunications. CEN and CENELEC consist of the 28 standardization organizations

of the European Union and EFTA. ETSI, on the other hand, is open to all organizations which are interested in the standardization of telecommunications. The three organizations develop European standards that must be transposed into national standards. Note that this does not make European standards mandatory. European Standards only become mandatory if they are referred to in legislative texts. Although most are initiated by industry, a significant number of standards have been developed to support European legislation. Reference to standards in legislative texts is seen as a more effective way of ensuring that products meet the essential health and safety requirements of legislation, rather than the writing of detailed laws (Box 9).

By November 2004, the total number of European Standards and approved documents published by CEN amounted to 10,331, with another 6,772 documents in preparation (end December 2003). The total number of active European standards published by CENELEC was 4,377 (end of 2002), while the corresponding figure for ETSI was 1,798 (end of 2003). The three institutions also produced a small number of standards that are not European Standards.

In other parts of the world, initiatives aimed at developing regional integration of standardization activities have achieved mixed results. In Africa, for instance, the African Regional Organization for Standardization (ARSO) was established in 1977. ARSO, an inter-governmental organization, currently has 24 member states. The objectives of ARSO are to promote standardization activities in Africa, to elaborate and harmonize regional standards, to promote social, industrial and economic development and provide consumer protection and human safety by advocating and establishing activities concerning standardization in Africa. ARSO also seeks to promote common views among its members and to coordinate participation at the international level in the field of standardization. In 2002, ARSO had published around 400 African regional standards, but progress in recent years has been limited.[58] Work on regional harmonization of standards has, however, been successfully initiated in the Southern African Development Community (SADC). In addition, the East African Community has notified a number of regional standards to other WTO Members and is harmonizing standards within the community.

Regional and international standardization activities tend to be closely connected in most regions. ISO and IEC have both recognized a number of regional standards organizations. Recognition is based on a commitment by the regional bodies to adopt ISO/IEC international standards – whenever possible without change – as the national standards of their members and to initiate the development of divergent standards only if no appropriate international standards are available for direct adoption. ISO's ten partner organizations represent Africa (1), the Americas (1), the Arab States (1), Asia and the Pacific (2), the Commonwealth of Independent States (1), and Europe (4). Several hundred other regional organizations liaise with ISO technical committees without being formally recognized by ISO. They are mainly regional associations of producers such as the American Association of Cereal Chemists (AACC), the European Association of Aerospace Industries (AECMA-STAN), and the European Association of Manufacturers of Quality Metal Expansion Joints, Metal Bellow and Metal Hoses (AEO).

National level

The role of national standardization institutions and the number of standards they produce differs significantly among regions and countries. First of all, both the demand for standards and the capacity to implement standardization infrastructure and activities depend on various factors, many of which are correlated with the country's level of development. The demand for standardization services increases with the level of prevailing scientific, technical and business capacity, the level of industrialization, the degree of economic diversity, the importance of export markets, and the evolution of domestic consumer needs.[59] It also depends on country specific factors such as country size, the form of industrialization, the degree of concentration of industrial sectors, and prevailing administrative and political structures and cultural norms.

On the supply side, the availability of resources is clearly a principal determinant. However, standardization requirements can be addressed in different ways. A variety of alternatives exist for establishing or enhancing national

[58] Opening Remark on the 12th ARSO General Assembly by H.E. Mr. Girma Biru, Minister of Trade and Industry, Ethiopia, Addis Abbaba, 2004.

[59] See Henson (2004).

standardization capacity in the form of a national standards body. Existing organizations, such as government departments, professional bodies, and industry and trade organizations can be used. Industrial and trade practices already established and applied in the country can be built upon, whether these are formally constituted through legislation or have developed less formally. Standards of neighbouring countries, trading partners or international standards can also be used. Finally, regional standardization infrastructure can be developed.

At a given level of development, national standardization systems may differ significantly with regard to their degree of centralization, formalization, and participation by the government. Chart 3 sets out four alternative approaches to standards development at the national level, all with a different mixture of government versus private sector involvement. The North American model for standards development is very decentralized and market-oriented. Over 600 organizations in the United States develop and implement national standards. A large number of private sector standards-developing institutions co-exist with the numerous regulatory agencies of the US Government. In the Canadian system, both the private sector and the central government are actively involved. In Western Europe, standard development activities have traditionally been much more centralized. As explained above, the European Commission has the responsibility for harmonizing standards of EU Members when possible, or with setting out "essential requirements" that products must meet.

The diversity of standardizing systems among developing countries reflects the diversity of approaches in Chart 3, combined with the diversity related to different levels of development. In many countries, the traditional approach to standardization adopted in industrialized countries in the past still prevails. In others, a new approach better suited to address greater levels of industrialization and internationalization progressively replaces the old one. The differences between the traditional and the new approaches are summarized in Table 4. The traditional approach focuses primarily on domestic concerns with little or no consideration of standards in export markets. Standards institutions are generally found in the public sector with little or no participation of the private sector. Standards are mostly mandatory. Institutions are rather static, inflexible and bureaucratic. The new approach focuses more on the specific concerns of industry and commerce. Standards must comply or be compatible with international norms and the testing and certification elements need to be recognized internationally. Standards institutions must be flexible, dynamic and efficient, so as to respond in a timely fashion to changes in demand for standards.

Table 4
Traditional and new approaches to standardization

Traditional approach	New approach
Key objectives:	
• Weights and measures	Domestic and external focus
• Health and safety	Extended infrastructure
Static structure	Flexible and dynamic structure
Domestic focus	Public-private sector activity
Public sector activity	International recognition
Regulatory focus	Voluntary standards

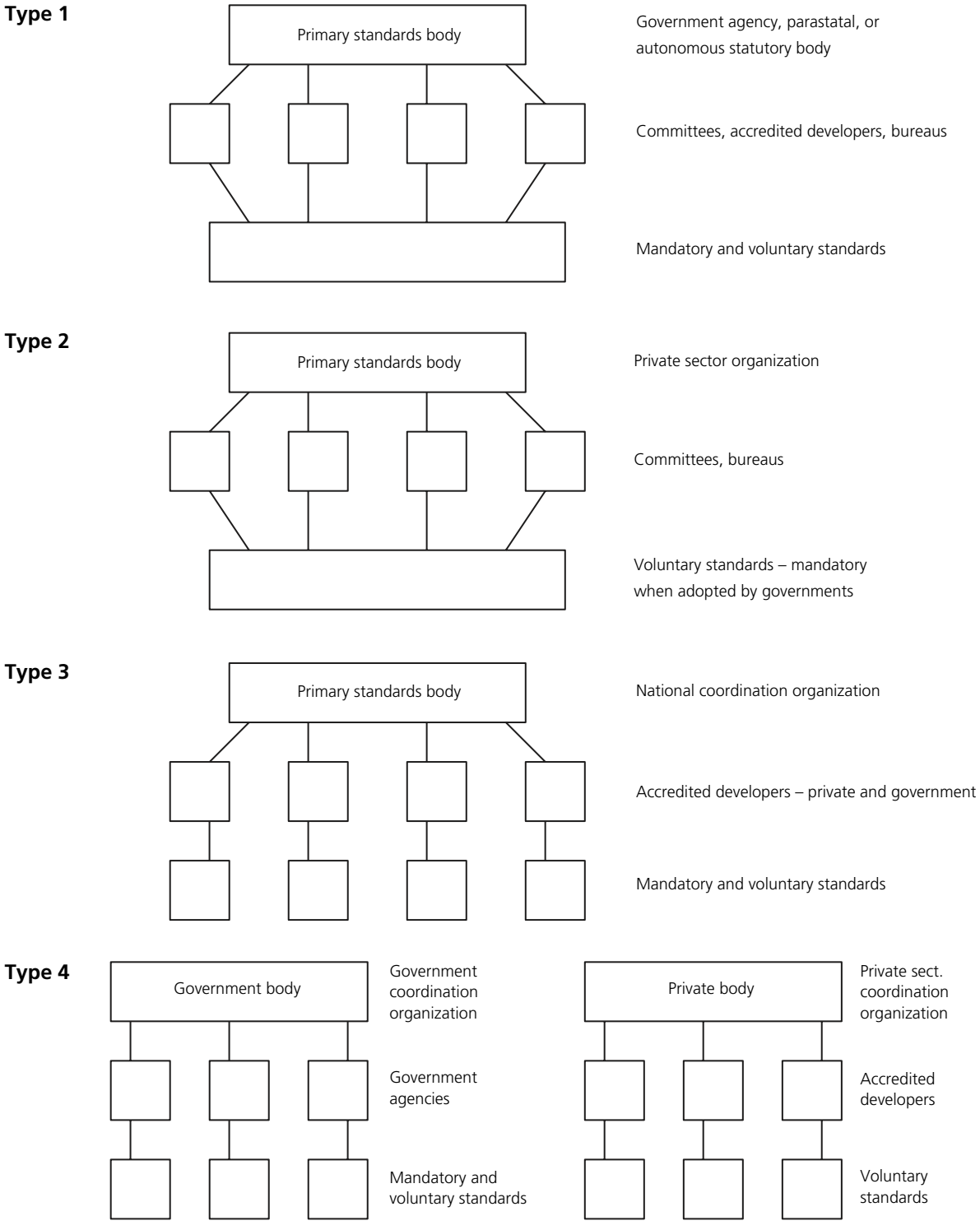
Source: Henson (2004).

Comparable cross-country information on national standards systems is limited. The International Organization for Standardization (ISO) publishes a Directory of ISO Member Bodies. The last issue of the Directory, which was published in 2003, provides information on ISO's 97 Member Bodies, 35 Correspondent Members, and 15 Subscriber Members. Chart 4 shows the number of each type of Member by region. A Member of ISO is the national standards body "most representative of standardization in its country". It follows that only one such body for each country is accepted for ISO membership. A Correspondent Member is usually an organization from a country that does not yet have a fully developed national standards activity. Correspondent Members do not take an active part in ISO's technical work and have no voting rights, but they are entitled to attend meetings as observers and to be kept fully informed about the work of interest to them. Finally, Subscriber Members are from countries with very small economies. They pay reduced membership fees that nevertheless enable them to keep up to date on international standardization activities.

Information in the ISO Directory provides an incomplete description of most national standards systems.[60] Where the system is completely centralized with the ISO Member body in charge of developing all standards,

[60] Information in the Directory is provided by ISO members who fill out a standard questionnaire. The questionnaire is designed to structure the information so as to enhance comparability. However, ISO warns readers that caution should be exercised in making comparisons as some questions might have led to different interpretations.

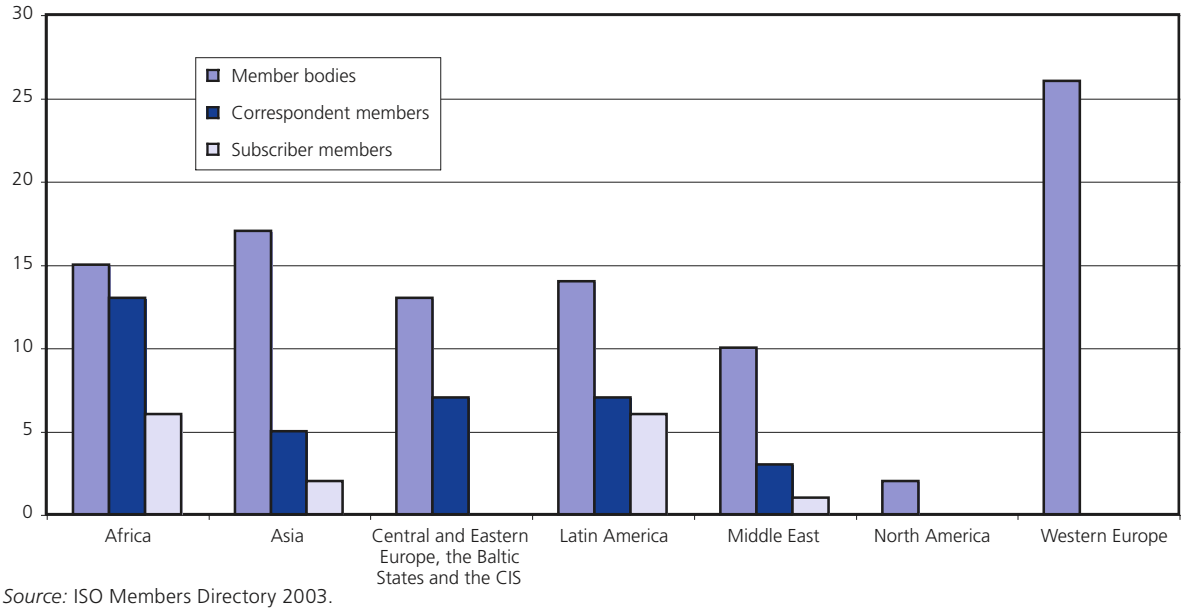
Chart 3
Alternative approaches to standards development



Source: R.B. Toth Associates, in Stephenson (1997).

whether mandatory and voluntary, the description can be fairly comprehensive. However, where the standardization process is decentralized and not entirely coordinated by the ISO Member body, and/or where the ISO Member body is not responsible for issuing technical regulations, the picture is incomplete. While a considerable amount of theoretical economic analysis has focused on de facto standards, systematic empirical information on such standards is typically limited. Standard setting by NGOs is another phenomenon that is not well documented.

Chart 4
Number of ISO Members by categories and by region



Source: ISO Members Directory 2003.

Table 5 provides basic information on standardization activities by ISO Member bodies by region. The average number of staff employed by ISO Members varies significantly among countries, even in the same region. AFNOR, the French Member body, employs 630 persons while the British Standards Institution employs 5175. The low figures for staff and total number of standards published for North America reflect the limited centralization of the systems in this region. In reality, more than 600 organizations develop voluntary standards in the United States.[61] About 150 of them are consortia which develop de facto standards. Most are private sector organizations – professional and technical organizations, trade associations, research and testing bodies, building code organizations, and others. At the national level, the United States maintains about 100,000 standards in an active status. This figure includes Federal Government standards developed to meet procurement and regulatory needs.[62] Trade associations represent the largest category of non-government standard developers. Many standards-developing organizations follow American National Standards Institute criteria in order to have the consensus standards they develop approved as American National Standards. There were approximately 14,650 approved American National Standards in 1999.

Table 5
Staff, related bodies, and standards published by ISO Members, averages across ISO member bodies by region

	Average number of staff directly employed by ISO Member	Average number of organizations to which standards development work is delegated	Average total number of standards published by 31/12/2002
Africa	186	41	1281
	(28)	(7)	(27)
Asia	319	296	5052
	(21)	(10)	(23)
Central and Eastern Europe, Baltic States, CIS	220	102	12598
	(19)	(15)	(19)
Latin America	124	10	2085
	(23)	(7)	(25)
Middle East	276	4	1916
	(12)	(7)	(12)
North America	83	99	2143
	(2)	(2)	(1)
Western Europe	398	29	15407
	(25)	(15)	(26)

Note: Number of observations in parenthesis.
Source: ISO Members Directory 2003.

61 See De Vaux (2001).

62 As of 1991, the total of US government standards (federal procurement and regulatory) stood at around 52,000, while the number of private sector voluntary consensus standards numbered around 42,000. See Toth (1991).

(b) How are standards set?

As already mentioned, standards are developed in different ways. This Subsection focuses mainly on the development process of voluntary, consensus-based standards and in particular on the formal/institutional procedure used by ISO and many of its Member bodies.[63] Mandatory standards (technical regulations as well as sanitary and phytosanitary measures) which are legal instruments that are elaborated by governments, are discussed in less detail. De facto industry standards are created by market processes that have been analysed in detail by economists.[64]

Voluntary, consensus based standards

The two main documents which regulate standardization procedures used by ISO, the IEC and most of their Members, are ISO/IEC Guide 59, *Code of good practice for Standardization* and the WTO's *Code of Good Practice for the Preparation, Adoption and Application of Standards* in Annex 3 of the Agreement on Technical Barriers to Trade (TBT). In addition, the ISO/IEC Directives, which cover the procedures for the technical work, and the rules for the structure and drafting of International Standards, are important reference documents. ISO and IEC have published independent supplements to the main Directives, which include procedures that are not common to the two organizations. All forms related to the process of standards development are given in the respective Supplements to the ISO/IEC Directives. As explained in Section IID below, the WTO TBT Agreement requires WTO Members to ensure that their central government standardizing bodies accept and comply with the Code in Annex 3, and to take reasonable measures to ensure that local government, non-governmental and regional standardizing bodies do the same. As of February 2003, 139 standardizing bodies from 101 Members have accepted the Code of Good Practice – among them, 71 central governmental standardizing bodies, 59 non-governmental standardizing bodies, two statutory bodies, two parastatal bodies, three non-governmental regional bodies, one central governmental/non-governmental body, and one autonomous body.[65] The Code aims to ensure that technical regulations and standards do not create unnecessary obstacles to trade. Note that other organizations have elaborated codes of good practice for the development of standards. The ISEAL Alliance, for instance, has developed a Code of Good Practice for Setting Environmental and Social Standards.[66]

The development of formal voluntary consensus standards is a process that consists of several distinct but closely related activities. The first stage is the identification of the various needs for standards and the prioritization of those needs given the resource constraint faced by the standardization infrastructure. The second stage is the development of the standard, usually through the establishment of a technical committee involving all parties interested in the area. The third stage corresponds to the adoption of the standard either by consensus or by vote. The fourth and last stage is the publication and promotion of the standard. Ideally, the process should be such that it can satisfy the needs of users as rapidly and efficiently as possible.

Prioritizing the needs, which can be identified in a variety of ways, is essential to ensure the most efficient use of resources. The process of needs identification can be more or less formal. The national standards body usually consults and communicates with users, government, etc. It may organize a formal consultation process and/or may accept unsolicited proposals for new standards. An important issue at this stage as well as at later stages is participation, which is discussed in more detail in the next Subsection. Producers who have clear priorities and are usually better organized than consumers typically play the leading role. In some industrial countries, governments actively promote the participation of consumers by funding consumer organizations. Once the needs are identified, they must be prioritized. Economic and social priorities will differ among countries. Poorer countries, for instance, may prioritize standards that facilitate access to export markets over standards that address minor food safety risks.

63 ITC and Commonwealth Secretariat (2004) describes the procedures for the establishment of standards of ISO, IEC, ITU, the International Organization of Legal Metrology, the World Health Organization, the Codex Alimentarius Commission, the World Organization for Animal Health, and the International Plant Protection Convention.

64 The greater part of the mainstream economics literature on standards has been theoretical. See Swann (2000).

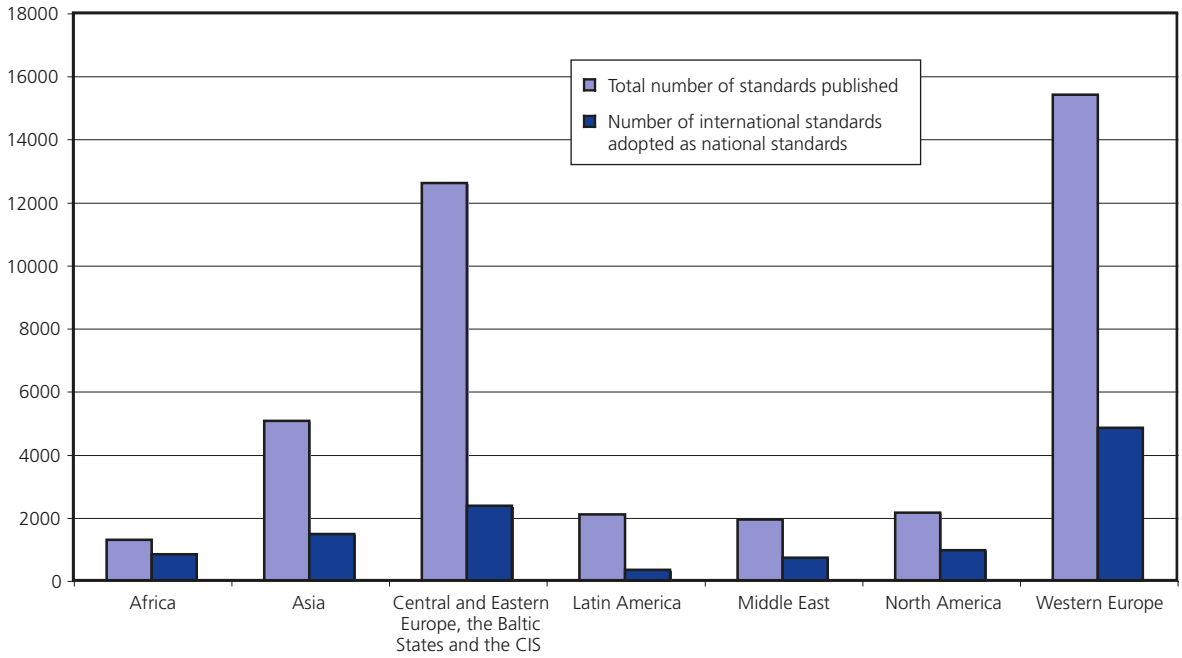
65 See WTO document G/TBT/CS/2/Rev.9.

66 See http://www.isealalliance.org/documents/pdf/P005_PD3.pdf and Dankers (2003) for a discussion of social and environmental standards.

In setting priorities, standardizing bodies need to take into account the possibility of adopting or adapting regional or international standards, or of proposing the development of new standards at the regional or international levels. As already mentioned, some countries are well integrated into the international standardizing system and a principle of "subsidiarity" applies. In Europe, for instance, adoption of European standards is mandatory for national member bodies and European standards organizations transpose the international standards into European standards. Indeed, more than 30 per cent of the European Standards adopted by CEN and more than 70 per cent of those adopted by CENELEC are identical to ISO and IEC International Standards, respectively, and many more are closely related. Furthermore, European standardization projects have absolute priority over national ones, as according to a so-called obligatory standstill agreement, no national standardization proceedings may be started in the areas in which European standards are to be established.[67] In ASEAN Member States, there is an agreement that national standards in selected priority areas should be aligned with international standards. In Malaysia, for instance, national standards are harmonized with international standards wherever possible. Thirty-eight percent of Malaysian standards are aligned with international standards and this proportion is rapidly growing as more standards are revised and new standards are developed.

Smaller and poorer countries also seek to keep within the guidelines of the WTO and increasingly adopt regional or international standards.[68] Contrary to expectations, countries with scarce resources and limited capacity do not necessarily have the largest share of adopted international standards. In fact, resource constraints seem to restrict poor countries' integration into the international standardization system as much if not more than they restrict their own standardization activities. As discussed below, integration into the international system involves a certain level of participation in the international standardization process, as well as the setting up of a standardization infrastructure. Developing one's own standards in isolation can be less resource intensive. Another relatively cheap solution may be to adopt the standards of your main trading partner. In Namibia, for instance, the manufacturing sector relies on South African standards. Manufacturers do not know whether these South African standards are identical to international standards but assume that they are equivalent.[69] Chart 5 below shows the average number (across countries) of international standards adopted as national standards by region.

Chart 5
Total number of standards published and number of international standards adopted by national standard bodies (31/12/2002), averages by region



Source: ISO Members Directory 2003.

67 See Blind (2004).

68 See the case studies in ITC and Commonwealth Secretariat (2003 and 2004).

69 See ITC and Commonwealth Secretariat (2004).

At the international level, industries or business sectors that feel the need for a standard communicate their requirements to the appropriate ISO or IEC national member body, which then proposes a new work item. If the proposal is accepted by a majority of the participating members in the ISO or IEC technical committee concerned, the work item is assigned to that committee.[70] At the European level, the application for a new standardization project can only be submitted by the Member organizations or committees of CEN/CENELEC, by the European Commission, the EFTA Secretariat or European specialist organizations. In Germany, applications for standardization are submitted by enterprises or groups of enterprises and accepted or rejected by the relevant technical committee, but only after having been examined by the standardization institute. In South Africa, requests come from industry or government, although persons or organizations submitting the relevant motivation may also propose standards.[71] They are approved (or rejected) by the Standards Approval Committee, based on an assessment of market relevance, cost of development and a recommendation from the appropriate national Technical Committee. The final decision as to which route to follow when a new standards project comes under consideration is taken by the responsible committee. However, Standards South Africa is committed, wherever possible, to encouraging committees to adopt international or regional standards, since this will ultimately result in wider standardization, with all its benefits, on a global scale.

The most common method for developing standards is through the establishment of technical committees involving all parties interested in the area. These technical committees are responsible for preparing draft standards that are acceptable to all parties and can be submitted for approval. Because the drafting and consensus-building process can be lengthy, the temptation to limit consultations is considerable. However, the success of the standard depends largely on the participation of all interested parties. ISO standards, for instance, are developed by technical committees comprising experts from the business sectors which have asked for the standards, and which subsequently put them to use. Those experts, which participate as national delegations, meet to discuss, debate and argue until they reach consensus on the technical content.[72] Once consensus is attained, the text is finalized for submission as a draft International Standard. Altogether, there are 190 active Technical Committees in ISO today, the technical work of ISO, which is highly decentralized, is carried out in a hierarchy of some 2,940 technical committees, subcommittees and working groups.[73] In the IEC, each member National Committee handles the participation of delegates from its country. Some 179 technical committees and subcommittees, and about 700 project teams / maintenance teams, carry out the standards work. The great majority of the working group experts come from industry, while others from commerce, government, test and research laboratories, academia and consumer groups also contribute.

The final decision regarding adoption of the standard can be taken either by vote or by consensus. In the case both of ISO and IEC, the draft international standard is submitted twice to all the individual organization's member bodies for voting and comment – first at the enquiry stage, then at the final approval stage. The text is approved as an international standard if at both stages, a two-thirds majority of the participating members of the technical committee are in favour and not more than one-quarter of the total number of votes cast are negative. Similarly, a draft European standard is first released for public comment. During the public commenting stage, anyone who is interested may comment on the draft. These views are collated by the National Standards Bodies and sent to the CEN Technical Committee for consideration. European Standards are then adopted by the National Standards Bodies which make up CEN through a system of weighted votes. The final stage of the process is the publication, distribution and promotion of the standard. In the European case, the last stage also entails the transposition of the European Standard at the national level.

The philosophy of standardization by committee and consensus is the same in the EU as it is in the United States. Technical experts and others participate voluntarily, and without compensation. The makeup of committees may be organized differently and roles may vary, but they generally follow a pattern that includes input from producers, users, government, and academia. In both jurisdictions, committees are fairly autonomous, with processes for the creation of subcommittees, drafting standards, disseminating draft

70 See the detailed procedures at http://www.iso.org/sdis/directives.

71 See http://www.stansa.co.za/pdf/Standards_2003.pdf

72 In order to participate in the work of Technical Committees, a national member body informs ISO Central Secretariat whether it intends to act as a Participating or Observing member. See the discussion on participation below.

73 As of January 2005, see ISO website: "List of technical committees".

documents for comment, voting, and appeals. Decisions are reached by consensus. Standards organizations provide management, administrative, and logistical support for standards activities. They also provide for the editing, printing, publishing, sale, and distribution of standards documents.[74]

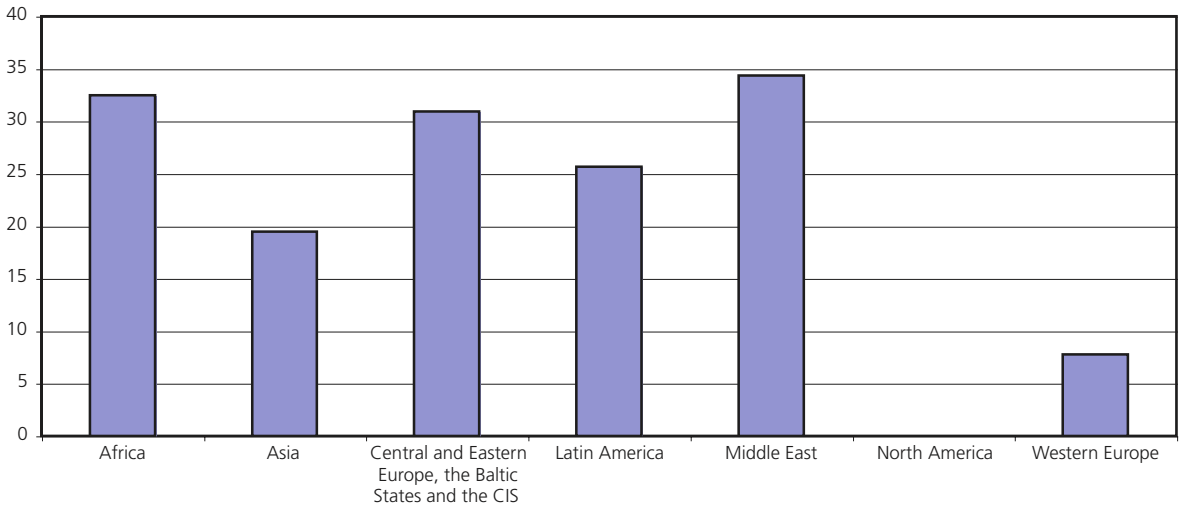
The whole process can be time consuming, although the IEC has recently succeeded in reducing delivery time for half of its standards to less than three years and, in Europe, CEN has embarked on a programme which aims at delivering most European Standards in that time. To respond to the needs of standards users working in fast-changing sectors, and to face the challenge of informal standards, ISO and IEC have developed streamlined procedures which can be used at the discretion of those technical committees for which speed of standards development is a paramount consideration, and to rationalize the set of deliverables. In this streamlining effort, both organizations have introduced new deliverables that inevitably reduce levels of transparency and consensus, but which seem to respond to market requirements in some sectors.

Mandatory standards

The WTO Agreement on Technical Barriers to Trade and the Agreement on Sanitary and Phytosanitary Measures discipline the preparation of mandatory standards, technical regulations and sanitary and phytosanitary (SPS) measures. Section IID below discusses the relevant provisions in those two Agreements in some detail. At this stage, it is useful to mention that both WTO Agreements encourage governments to base technical regulations on international standards and to play a full part, within the limits of their resources, in the preparation by appropriate international standardizing bodies of the relevant international standards. In the case of Switzerland, for instance, the government may decide to support financially or otherwise the development of such standards or to mandate national standardizing bodies to defend their national interests in international standardizing bodies.[75]

While in many countries, mandatory standards and technical regulations are typically developed by governmental agencies distinct from the standardizing bodies, in other countries standardizing bodies develop both voluntary and mandatory or even only mandatory standards. Chart 6 below shows the percentage share of mandatory standards in the total number of standards developed by standardizing bodies, by region. In a small number of countries, mainly in Africa, the CIS and the Middle-East, the share of national standards with a mandatory status exceeded 50 per cent of the total number of standards published at the end of 2002.[76]

Chart 6
Share of mandatory standards in total number of standards developed by national standard bodies, average by region



Source: ISO Members Directory 2003.

74 See Delaney and van de Zande (2000).

75 See Art 11 of the Swiss Federal Law on Technical Barriers to Trade (Loi fédérale sur les entraves techniques au commerce) at (http://www.admin.ch/ch/f/rs/946_51/a11.html).

76 See ISO Members Directory 2003.

It is interesting to note that voluntary standards sometimes become de facto mandatory. In the United States, for example, wholesalers or retailers sometimes refuse to sell non-standard products because they do not wish to bear the responsibility in cases where such products create problems.

(c) Who sets the standards?

The issue of participation in the standard-setting process is crucial. In this Subsection the participation of producers, consumers and other stakeholders will be discussed. Participation by developing countries in the international standard setting process is addressed in Subsection (d), while transparency and national treatment – both aspects of crucial importance from a trade perspective – are discussed in Section IID below. While participation at the regional and national levels are considered, the focus is on standard setting at the international level, and in particular in ISO. As explained below, ISO's expansion beyond technical standards for specific (mostly manufactured) products or technologies into the development of "process" standards has substantially extended the range of stakeholders interested in participation.

The discussion in Section IIB identified two main reasons for government involvement in standardization. First, governments are responsible for issuing technical regulations and making certain standards mandatory. Second, depending on the problem standards are supposed to solve, public intervention is warranted. This is because governments are expected to take into account the interests of all economic actors when setting standards, whereas private companies will be driven by the aim of maximizing profits. Uneven representation in the standardization process can lead to short-sighted standards and there is doubt that a producer-led standardization process can give full account to customer interests, a result that has been pointed out frequently in the economic literature (Casella, 2001). This is particularly important from a trade perspective, as producers might have an incentive to use standards to create artificial competitive advantage.

Where government intervention is warranted to defend consumer interests, it can take different forms. Most of the time, governments do not possess the information needed to develop standards and thus rely on information provided by producer and consumer representatives. Their intervention may thus take the form of support to consumer participation in private or non-governmental standardization bodies. Formal standard setting by the government has been seen as slow and inefficient, which can be a significant handicap if standards affect the pace of innovation.

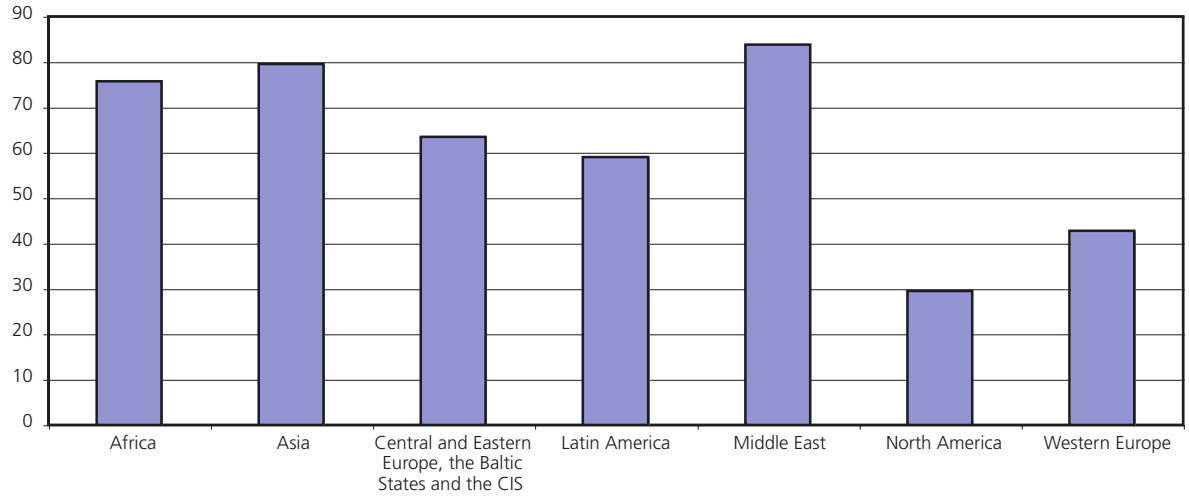
In practice, the separation between public and private standard setting is not always clear-cut. As has been seen, the organization of the process of standardization varies widely across countries. In general, regulations concerning safety, health and the environment are issued by governments. Often, however, the specific measures that satisfy the objectives of government regulations are spelled out in technical standards developed by private organizations. In European countries, the government refers to the privately developed standards in regulations. In the United States, local authorities, which typically lack the technical resources necessary to formulate the standards, often adopt privately developed standards.[77]

At the international level, the separation is similarly not well defined. ISO occupies a position between the public and private sectors. On the one hand, many of its member institutes are part of the governmental structure of their countries or are mandated by their governments. This would typically be the case in most developing countries where the national standardizing body has the legal status of a government department or a government statutory body.[78] On the other hand, other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations. This would typically be the case in developed countries, where the standardizing body has the legal status of a private non-profit organization. Chart 7 shows the share of government subsidy in the total revenue of national standardizing bodies.

[77] See Casella (2001).

[78] See ISO Members Directory 2003. A recent survey of ISO Members in developing and transition countries conducted by ISO revealed that 86 per cent of those National Standards Bodies were governmental bodies.

Chart 7
Government subsidy in percentage of total revenue of national standardizing bodies, average by region



Source: ISO Members Directory 2003.

Producers play a leading role in the development of international standards but consumers have the possibility to influence the process. At the proposal stage, consumer participation depends on national provisions. As mentioned above, proposals for the development of new standards must be submitted to ISO through one of ISO's national members. In most countries applications for standardization are submitted by enterprises or groups of enterprises and accepted or rejected by technical committees based on various criteria. At the development stage, the technical committees which elaborate the standards comprise experts on loan from the industrial, technical, and business sectors which have asked for the standards, and which subsequently put them to use. These experts may be joined by others with relevant knowledge, such as representatives of government agencies, testing laboratories, consumer associations, environmentalists, and so on. The experts participate as national delegations, chosen by the ISO national member for the country concerned.[79] In addition, since 1978, ISO has had a specialized Committee on Consumer Policy (COPOLCO). This Committee, as well as two others – on conformity assessments and developing country matters – have been created to provide strategic guidance on cross-sectoral issues to the technical committees, which by necessity are specialized and specific. Through its Committee on Consumer Policy, ISO undertakes to study how consumers can benefit from standardization, to promote consumers' input into the development of standards, both nationally and internationally, to encourage the exchange of experience on standards work of consumer interest, and to channel consolidated views from consumers both on current projects and on proposals for new work in areas of interest to them.

The question of NGO participation arises at the national, regional and international levels. In the present context, NGOs can be defined as non-profit organizations that operate independently of government or business structures and have non-commercial objectives related to environmental, consumer interest or sustainable development.[80] This Subsection focuses on the participation of all NGOs other than non-governmental national standards bodies in the ISO standardization process. There are two main ways in which NGOs can participate in ISO work, which are not mutually exclusive. First, they may be allowed or requested to participate in national delegations. Rules and procedures for the participation of NGOs in national delegations are developed at the national level and differ country by country. Second, due to the decentralized nature of ISO' work, NGO participation is generally through direct participation in the technical committees as "liaison" organizations or, to a lesser extent, as experts acting in an advisory capacity. ISO currently liaises with approximately 600 international and regional organizations through its technical committees. Most of those are non-governmental bodies specializing in a specific technical field. Only 42 organizations, however, have a formal liaison organization (L-organization) status. Although L-organizations have no formal voting rights, technical committees are expected to seek full and formal backing of those L-organizations actively involved in the work.

79 As mentioned above, national member bodies indicate to ISO's Central Secretariat whether they intend to act as Participating or Observing members in Technical Committees.

80 ISO, NGO Task Group Report 2001.

Most of the 42 L-organizations are environmental and public interest NGOs registered with Technical Committee (TC) 207. ISO/TC 207, one of the largest technical committees, was created in 1993 to develop the ISO 14000 Environmental Management standards. Because TC 207 is one of the only technical committees which deals with issues of specific importance to environmental and public interest NGOs, it is the only technical committee to have experienced significant NGO demand for improved procedures for NGO participation. In 2000, ISO/TC 207 created an NGO Task Group to examine the role of NGOs in the technical committee and the barriers to their effective participation.[81] The Task Group, which operated from 2001 to 2003, produced a list of 14 recommendations.[82]

A recent study by Morikawa and Morrison analyses available information on stakeholder participation in TC 207. The analysis fails to detect any meaningful effects of the various initiatives in terms of increased NGO attendance at TC 207 annual plenary meetings. Over the last seven years, industry, standards organizations, and consultants/registrars have been the major participants in these meetings, whereas NGOs were consistently the least represented stakeholder group at every plenary meeting.

Based on a review of relevant documentation and interviews, Oberthür et al. (2002) assessed the participation of NGOs in ISO and other international environmental organizations. Regarding the impact of NGO participation, they conclude that "[E]nvironmental NGO (ENGO) participation in TC 207 has had a discernible impact in a number of areas where the support of the ENGO community is required in order for the relevant standard to be effective. For example, in the context of environmental labelling, interviewees noted that ENGOs had been effective in reorienting the objectives and language of the relevant standards to reflect community value and concerns. In this context, ENGOs have had relative bargaining power because TC 207 members recognize that their support is required to make the standard effective and that they are in a position to develop their own set of standards that will compete with the ISO product. [...] Interviewees noted that ENGOs have had a lesser impact in areas that have a direct impact on industry operations, such as environmental management systems."[83]

Broad participation is also encouraged in the three SPS-related international standard-setting organizations as well as in some of the regional standardization bodies. Representation in the Codex is on a country basis. Delegations may include representatives of industry, consumers' organizations and academic institutions. A number of inter-governmental organizations, including the WTO, and international NGOs also attend in an observer capacity. Although they are "observers", the Codex Alimentarius Commission traditionally allows such organizations to comment at every stage except in the final decision, which is the exclusive prerogative of member governments. The Codex Executive Committee which acts as the executive organ of the Commission is composed of a chairperson, three vice-chairpersons and seven regional representatives (Africa, Asia, LAC, Europe, Near East, North America and South-West Pacific).[84] OIE Specialist Commissions comprise members experienced in veterinary science and regulatory issues, elected by the OIE International Committee and drawn from all OIE regions. The OIE increasingly seeks expert advice from outside government, including individuals and expert groups from industry, academia and government. Participants in IPPC expert working groups are phytosanitary experts nominated by countries or regional plant protection organizations and accepted by FAO for their individual expertise. The IPPC secretariat also seeks to ensure that experts are nominated and selected from different geographic regions. Participants in Interim Commission on Phytosanitary Measures (ICPM) business meetings and consultations are nominated by governments. IPPC Expert Working Groups do, at times, seek outside expertise from industry or academia to aid their deliberations.

81 The NGO Task Group produced two documents: The Guide to NGO Participation in TC 207 and the N590 document entitled "Increasing the effectiveness of NGO participation in ISO TC207".

82 See ISO document N590.

83 Oberthür et al. (2002), p. 174.

84 The technical/scientific input for Codex standards comes from the FAO/WHO Joint Expert Committee for Food Additives, the FAO/WHO Joint Expert Meeting for Pesticide Residues and a new joint body for microbiological contaminants. These are comprised of experts nominated by countries and chosen on their own merits by FAO/WHO, and can include governmental or NGO experts plus observers.

European standards are drafted by experts in specific fields, but industry, trade federations, public authorities, academia and NGO representatives are invited to contribute to the standardization process. The usual route for participation is through the National Standards Bodies. These Bodies have a duty to send balanced delegations to represent the national interest in a standardization project. Interest groups organized at the European level – representing environmentalists, consumers and small and medium-sized enterprises amongst others – also have the opportunity to contribute to the development of standards. Moreover, once the draft of a European Standard reaches a mature stage, it is released for public comment.

Participation in less formal standardization processes is variable. On the one hand, market processes creating de facto standards are closed. They clearly do not involve the direct and explicit participation of governments or consumers. As explained in Section IIB above, the economic literature has shown that under this kind of process there is almost invariably one winner, so there is an element of natural monopoly and thus a risk of market failure.

(d) Participation of developing countries in international standard-setting

A priori, both the demand for standards and the capacity to develop standardization infrastructure and activities depend to a large extent on factors correlated with a country's level of development. Demand for network externality standards (compatibility/interface) that emanates from producers clearly increases with the level of industrialization and development of the country. Similarly, demand for information asymmetry standards and environmental standards, tends to increase with the level of income and development. On the supply side, setting up a full fledged standardization infrastructure with all the responsibilities generally assigned to such infrastructure is very costly and takes time, and without much involvement from the private sector, developing country governments bear all the responsibility. Standardization infrastructure in developing countries has thus often been non-existent or relatively basic. Where national standardizing bodies have existed, they have tended to be governmental, only weakly linked to markets and almost exclusively inward oriented.

For various reasons discussed in Section IIB, the importance of standards not only for developed countries but also for middle and low-income countries has clearly increased in recent years and at the same time, the approach to standardization has evolved. The role of international standardization in particular has become more significant. These changes have put pressure on governments in developing countries to reform existing standardization infrastructure or develop new infrastructure. The new approach to standardization requires standardizing bodies to focus on the development of voluntary rather than mandatory standards, to become more responsive to markets, to rely more heavily on international standards and to participate more actively in international standardization. The next Subsection considers some problems faced by developing countries in the area of conformity assessment, while this Subsection addresses issues in the area of standards development.

As part of an in-depth study of the problems faced by standardizers in developing countries, ISO conducted a survey of ISO members in 110 developing and transition countries.[85] The survey results, published in 2002, revealed the persistence of two related problems. First, only a minority of standards and technical regulations were based on international standards. In 70 per cent of respondent countries, more than half the standards were not based on international standards and in 61 per cent of the countries, more than half the mandatory technical regulations were not based on international standards. Second, the level of participation of respondent countries in international standardization work was still very low. Forty-two per cent of the respondent countries were not registered as members of any ISO technical committee and 52 percent of the respondent countries had not attended any meetings of these technical committees in the last two years. Forty-eight per cent of the respondent countries did not even follow the work by correspondence. The main reason given for low participation was lack of funds at both industry and standardizing body level and lack of awareness and expertise in standardization.

[85] Seventy-one per cent of the 110 ISO Members answered the questionnaire. See El-Tawil (2002).

Improving participation of developing countries in international standardization is crucial. This has been recognized for several decades and, as discussed below, numerous initiatives have been undertaken to improve the situation. From a WTO perspective, harmonization and international standards play a key role in the agreements aimed at ensuring that standards do not create unnecessary obstacles, but rather facilitate the conduct of international trade.[86] Low participation in international standardization is part of the reason why only few developing country standards are based on international standards. More generally, if the level of standards that is optimal for developing countries differs from the level that is optimal for developed countries, the level of the "harmonized" international standard will have to be negotiated and both parties should be represented in the negotiations.

Developing countries may not necessarily be interested in the development of every single international standard. Countries with only a narrow industrial production and export base for instance, are likely to have a stake in only a subset of all compatibility standards developed at the international level, at least in the short-run. In the case of information asymmetry standards, low income countries may again be interested in only a subset of all standards developed at the international level. One may also expect more interest in food and more generally agricultural standards than in industrial standards. Developing countries' participation should thus vary depending on the institutions and the committees. With this qualification in mind, the available evidence on regional participation in international standard-setting bodies is considered.

There are several sources of information on the level of participation of developing countries in international standardization work. Some information is readily available from the standardizing bodies themselves and has been used in various studies. Other studies have used surveys of standardizers or case studies. Morikawa and Morrison (2004), using information on participating members (P-members) in Technical Committees (TCs), which is readily available on the ISO website supplemented with information on the location of TC secretariats and chairmanships by region, largely confirm the finding of the ISO survey mentioned above that participation of developing countries is still generally low.[87] Information on P-members – the most influential actors in the ISO system – in TCs only provides a partial description of the level of participation. Other important dimensions would include participation in TC working groups, where standards are deliberated, actual attendance at ISO meetings, the number of delegates at those meetings, and whether the country plays a leadership role.[88]

Participation by ISO members in Technical Committees in which developing countries have a genuine interest provides a more detailed picture. Particular attention has been devoted to ISO Technical Committee 207, which was created in 1993 to develop the ISO 14000 Environmental Management standards. Using data on annual TC plenary meeting attendance over the period 1997 to 2003, Morikawa and Morrison (2004) show that Africa, South and Central America and Central and Eastern Europe are under-represented at TC 207 meetings compared to their share of P-membership. However they also show that, probably due to the fact that four out of seven meetings were hosted in Asian countries, Asia sent significantly more delegates than its P-membership share would suggest.

In a joint effort to assess the impact of past initiatives to improve participation in international standardization and to learn from experience, ITC and the Commonwealth Secretariat conducted a series of six case studies in various developing countries. The six selected countries are at different levels of development. Malaysia was selected to represent countries where institutions engaged in standardization activities are relatively well developed. Jamaica, Kenya, Mauritius and Uganda were chosen because they had already made some progress in establishing the framework. Finally, Namibia was selected as typifying countries where work on standardization is at a nascent stage. Participation in both the bodies producing standards used in SPS measures and those producing standards used in technical regulations was considered.

86 See the preambles to both the Agreement on Technical Barriers to Trade and the Agreement on the Application of Sanitary and Phytosanitary Measures.

87 See ISO website: Technical Committee List: http://www.iso.org/iso/en/stdsdevelopment/tc/tclist/TechnicalCommitteeList.TechnicalCommitteeList.

88 See Morikawa and Morrisson (2004).

Several lessons can be drawn from the six case studies. First, more advanced countries like Malaysia are able to participate in the work at all levels in the international standardization organizations in which they have an interest. However, even such countries cannot participate in all the working groups or technical committees in which they have an interest. In general, the participation of all the countries in the case studies is limited to attending the meetings of the apex bodies of these organizations. Second, most of the countries in the case studies do not appear to have at present the expertise needed for participation in the work at the technical level on the formulation of standards. Thirdly, participation in standardization activities, particularly at a technical level, is greatly facilitated if industry and interested business firms assist the agencies responsible for participating in the technical work, by carrying out background research and analytical work. With regard to technical assistance aimed at improving developing country participation, these considerations suggest that actions at the national level are needed to complement action taken by the international standard-setting bodies. Moreover, simple funding of developing country participation is insufficient, as most countries lack the analytical and technical capacity to participate effectively.

Technical assistance

Improving the participation of developing countries in standardization activities at the international level ranks among the main priorities for technical assistance in the area of technical regulations and sanitary and phytosanitary measures.[89] However, developing countries' needs in this area are considerable. The entry into force of the WTO TBT and SPS Agreements in 1995 have created new challenges and opportunities for developing countries and brought to light the need for assistance. Article 12 of the TBT Agreement, for instance, recognizes that developing countries may face special problems, including institutional and infrastructural problems, in the field of preparation and application of technical regulations, standards and conformity assessment procedures. Members are therefore enjoined to provide technical assistance. More generally, public and private capacity in developing countries needs to be strengthened to protect human health, animal health, and the phytosanitary situation, and to gain and maintain market access in the presence of rapidly evolving official and commercial requirements in the major markets.

Sizeable financial resources have already been devoted by donor countries to provide assistance in this area. Several databases on TBT-related and SPS-related technical assistance have been established in the last decade by the international institutions with the help of donors. In the SPS area, the Standards and Trade Development Facility (STDF) was established to facilitate collaboration in enhancing the expertise and capacity of developing countries to implement SPS standards.[90] In the TBT area, the ISO Database of technical assistance projects in the areas of standardization and related matters was established in 2001 to promote coordination of standards-related technical assistance projects and to enhance effectiveness in the design and implementation of such projects.[91] These databases are complemented by other databases such as the WTO-OECD Doha Development Agenda Trade-Related Technical Assistance Capacity Building Database (TCBDB), the Trade-Related Technical Assistance Database and the Database of Technical Assistance Programmes of the Free-Trade Area of the Americas.

In an effort to assist developing countries in their participation and use of international standards, ISO have approved a 2005-2010 Action Plan. This plan consists of workshops on various aspects of international standards development and the use of those standards as the basis for building internationally recognised technical infrastructures. In-country and regional training will be undertaken to assist developing countries that wish to take up chairmanships and secretariats for the international technical committees that develop international standards. There is also an emphasis on the physical resources and human resource knowledge required to effectively use the information technology that is now employed as the basis for standards development. Box 10 provides information on technical assistance relating to sanitary and phytosanitary measures.

89 See ITC and Commonwealth Secretariat (2003).

90 See http://stdfdb.wto.org/

91 See WTO document G/TBT/W/207 for an overview of the existing databases on TBT related technical assistance.

Box 10: SPS-related technical assistance

Increasing awareness among governmental officials in developing countries and helping answer SPS Agreement implementation questions is a key objective of WTO technical co-operation activities. Such assistance typically takes the form of national seminars and regional workshops targeted at SPS practitioners in developing countries. For regional activities, WTO also harnesses the particular expertise of the three standard-setting organizations by inviting lecturers from the OIE, IPPC and Codex to these activities. Since 1999, SPS technical assistance activities organized by the WTO Secretariat have included 35 regional and 34 national workshops.

Because the Codex, OIE and IPPC develop the standards that are recognized by the SPS Agreement, participation in the meetings and deliberations of these organizations is critically important to ensure that the standards developed reflect international consensus. To enhance the participation of developing countries in standards-setting meetings and activities, in training programmes and in regional technical consultations on standards and their implementation, the Codex, OIE and the IPPC have established trust funds. Contributions by donor agencies and member countries are expected to support these trust funds. The OIE provides financial support for the participation of Chief Veterinary Officers of its member countries in OIE standards-setting activities. Similarly, although funding for the travel and subsistence of participants in IPPC business meetings is normally the responsibility of national administrations, in the past the IPPC secretariat has ensured that funds are available for developing country participants before organizing such meetings.

All three organizations have developed training programmes, including conferences, seminars and workshops, to enhance national capacities on matters covered by the SPS Agreement. Computerized training resources also help address some of the training needs of member countries. For example, the FAO and the WHO have developed a CD-ROM training package that provides guidance to member countries on how to implement risk analysis principles in relation to food safety. The IPPC developed a diagnostic tool, the Phytosanitary Capacity Evaluation (PCE), to help countries address their current capacity and identify needs for assistance. The PCE is available on CD-ROM and can be downloaded from the IPPC website. The PCE has contributed to the establishment of baseline information for gauging the capacity gaps between the current phytosanitary situations and what would be needed to meet international standards requirements.

2. CONFORMITY ASSESSMENT

(a) Introduction

As was seen in the Section IIB, exporters may be required to adapt their production to conform to a standard in the importing country (thus, producing a number of different varieties of the same product in smaller batches for each market). Or they may be able to produce to a harmonized standard that is used both in their own and in the importing market or in several importing countries. Or else they may be able to manufacture a product in accordance with domestic requirements that are considered equivalent in the importing country. Each of these scenarios has different cost and efficiency implications. Yet there is an additional cost component common to all. In many cases, authorities in the importing country or importers themselves are not willing exclusively to rely on foreign manufacturers' own declarations or reports/certifications by foreign third parties that the required specifications have been met. Whatever the standard might be – national, harmonized or recognized as equivalent – assurance of compliance may be sought from domestic bodies in the importing country.

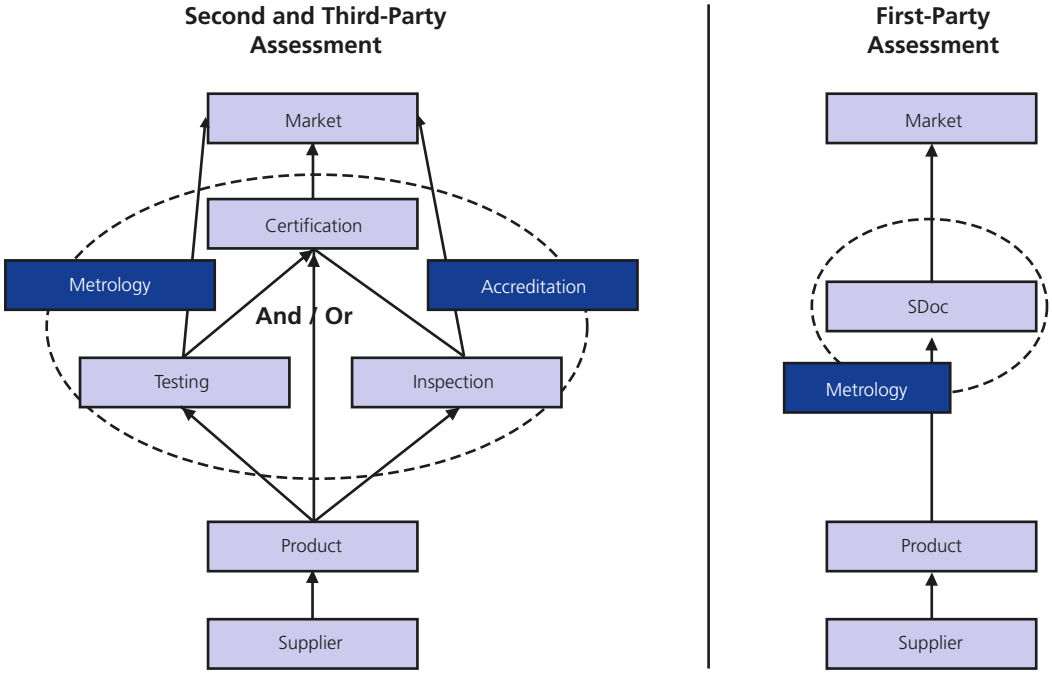
Clearly, this can result in an unnecessary obstacle to international trade if foreign providers possess the competence to give the required level of assurance in a cost-effective manner. As argued earlier, attestation of conformity with a standard should be carried out only once in the most cost-effective manner and, subsequently, be recognized everywhere. A complex network of institutions has developed over time to establish trust in the competence of foreign conformity assessment activities. The "architecture" of compliance control that is relevant for international trade is now examined. What steps are involved in developing a "chain of confidence" from the supplier in the exporting country to the buyer/government in the importing country? How are testing laboratories, inspection bodies and certification institutions in different countries and regions organized, and how can international recognition of conformity assessment results be obtained? What role do accreditation and international standards on conformity assessment play in this regard?

The different types of institutions that make up the technical infrastructure of conformity assessment will first be considered. Then a look will be taken at the number of existing conformity assessment systems at the regional and global level, before illustrating that the way conformity assessment is organized by different countries can affect international trade and lead to the negotiation of mutual recognition agreements (MRAs).

(b) Types of conformity assessment

The infrastructure of conformity assessment is multidimensional. Different means of determining a product's compliance with technical specifications feed into one another, are combined in various ways and involve a variety of actors at the national and international levels. In a narrow sense, conformity assessment refers to testing, inspection and certification as well as a supplier's declaration of conformity – that is, activities that deal with the characteristics of the product itself and that are of direct concern to the buyer and supplier. However, a wider definition includes the areas of metrology, which is an important prerequisite for the proper conduct of all other forms of conformity assessment involving measurements, and accreditation (the evaluation of the competence of any institution involved in conformity assessment). The latter activities are demanded by conformity assessment bodies in order to accord recognition for the quality of the services provided.

Chart 8
The technical infrastructure of conformity assessment



A supplier's declaration of conformity is made on the basis of a self-assessment by the supplier (although data may be obtained also from testing and inspection bodies) and is therefore referred to as first-party assessment. Second-party assessment is carried out by the purchaser or by testing/inspection bodies on his behalf. Third-party assessment must be independent of both the supplier and purchaser. This is always the case for certification bodies and may be the case for testing/inspection bodies if these are hired by a certification body or regulator. An overview of conformity assessment types and activities is given in Chart 8. Each activity will be further discussed below.

Testing and inspection

The main technique to determine the characteristics of a product is the testing of individual specimens or samples. Testing is often undertaken by specialized laboratories involving the use of sophisticated instruments. Its results only apply to the sample tested and usually cannot be extended to the whole product batch. A related form of assessment – often combined with it and not always clearly distinguished from testing – is the inspection of products, usually by visual means or simple instruments, such as scales. With the expansion in commercial relationships around the globe and the increased complexity of products, inspection activities carried out by specialized third-parties have flourished (ISO, 1998). Inspection relies heavily on the subjective judgement and experience of the inspector, whereas testing generally is carried out according to objective and standardized procedures by highly trained staff. Both inspection and testing may be performed by the manufacturer, the customer, regulatory authorities or by commercial service organisations hired on behalf of any party (ILAC, 1996). Depending on the type of tests/inspection carried out, commercial bodies may be held liable for their reports on the products examined.

Certification and quality systems registration

Certification goes beyond testing and inspection in several respects. Processes or product characteristics are assessed against a specific standard, whether mandatory or voluntary, which is not necessarily the case for testing and inspection. A formal attestation ("certificate") that the product meets the required standard or customer specifications (beyond the inspection or laboratory test reports) is provided and/or the right to use a certification mark on the product/packaging is licensed to the producer. Certification gives additional confidence on account of the systematic intervention of a competent third party that is always independent of either the purchaser or the manufacturer (WSSN, 2004). This is particularly important when the seller or buyer wishes to communicate compliance with a standard to a larger public or governmental authorities, for instance, in response to health and safety concerns. Certification bodies normally have expertise in specific product areas and use inspection, testing, evaluations of manufacturer's quality management systems and combinations of those activities in order to "both assess samples of the product and ... monitor production. ... [A] certification body may also periodically retest samples of product purchased in the market. ... Certification bodies may engage external inspection bodies and laboratories or use their own resources to provide inspection and testing facilities" (ILAC, 1996: 7). In other words, certification institutions are further characterized by the fact that, typically, they employ not only their own technical facilities, but also the services of external laboratories and inspection resources. They also provide for ongoing surveillance and, in case deficiencies are uncovered, may revoke their certificate/mark.

Certification is often based on type approval and not on 100 per cent testing of every individual item.[92] Consequently, liability for failure of certified products is not normally accepted by those bodies. In order for a certification body to reach more widespread recognition – which is the case, for instance, for Underwriters Laboratories in the United States and its "UL" mark – a lot depends on its perceived expertise and actual track record. Given that a reputation builds slowly, but is quickly destroyed, many certification bodies, when licensing foreign manufacturers to use their mark, at most delegate on-site inspection to a body located in the country of manufacture, but almost always require the necessary testing to be carried out under its direct control or supervision and in its own country (ILAC, 1996).

[92] ISO has identified eight commonly used certification types, most of which relate to type testing in combination with other elements, such as market or production surveillance or assessment of quality systems. There is also one type relating to assessment and surveillance of quality systems only, another to batch testing, i.e. of a statistical sample, and the final type is 100 per cent testing (ISO, 1998).

Aside from certifying product characteristics, certain bodies also attest to the conformity of systems, for example, an organization's quality management system to the relevant model of the ISO 9000 series of management system standards. This activity is referred to as quality systems "registration". Proper quality control mechanisms are expected to reduce production errors and, hence, variations in product quality. This implies that the actual compliance of any individual product with the required technical specifications cannot be guaranteed, but that the likelihood of defective elements within a product type is minimized. Periodic audits are carried out by the independent registrar in order to ensure that a registered quality system continues to deliver products of consistent quality with minimal variation. Quality systems registration is a rather practical form of assurance in recurrent high-volume transactions, such as those between manufacturers and suppliers of inputs. Once a sample of the required input has been approved by the manufacturer (or a certification body) or co-designed by the purchaser and supplier, the customer should be confident that the same quality can be reproduced consistently if the supplier's quality system is registered according to a recognized standard.

Supplier's declaration of conformity

Instead of a second-party or independent third-party verification of conformity, it may sometimes be sufficient if a supplier gives written assurance that a product conforms to specified requirements (ISO, 1996). "Supplier" must be understood broadly to refer to either the manufacturer or else distributor, importer, assembler etc. (ISO, 1998), whoever may be held responsible for placing a product on the market. The declaration should be based on either the supplier's own testing and inspection or the results of third-party institutions. It may have a specific format mandated by law in order to ensure that, based on the information provided in the declaration, recourse can be taken by the purchaser under the importing country's product liability laws. Supplier's declarations are not normally admissible in areas where defective products pose serious health, safety or environmental risks.[93] Other factors may be considered by governments in addition to the nature of the risks involved, such as the particular characteristics and the infrastructure of a given sector. In the United States, for instance, supplier's declarations of conformity are used for motor vehicles and motor vehicle equipment despite the high risk inherent in the sector (WTO Secretariat, 2005b). Other product categories allowing for supplier's declaration of conformity, which have been brought to the attention of the Committee on Technical Barriers to Trade (TBT) by various WTO Members, include disposable lighters, electrical products, electromagnetic compatibility (EMC) and telecommunication terminal attachment equipment (TTE), electronic safety equipment, electronics, equipment for use in potentially explosive atmospheres, machinery, medical devices, personal computers (PCs) and PC peripherals, personal protective equipment, recreational crafts, steel profiles for power transmission towers, telecommunications, toys, vehicle catalysts and vehicular natural gas (WTO Secretariat, 2005b).

Metrology

Of crucial importance for establishing confidence in any measurement results are the use of appropriate techniques and correct calibration[94] of testing or inspection instruments. Calibration ensures "traceability" of results to a reference standard with stated uncertainties in the level of precision. Usually, traceability involves a "chain of comparisons" by means of which measurement results are related to successively higher levels of reference standards and, ultimately, to a "primary" standard.[95] Such tasks are carried out by metrology

93 The perception of risks in a given sector may vary by country.

94 Calibration refers to the determination of metrological characteristics of an instrument through direct comparison to a standard. The calibration report specifies the relationship between the values indicated by a measuring instrument and the corresponding values realized by the standard. It therefore provides an indication of the accuracy and reliability of the instrument and of its consistency with other measurements. Based on the precision that may be obtained, the instrument can be considered "fit" for certain applications while not being suited for others (EUROMET, 2000).

95 For instance, the meter is defined as the length of the path travelled by light in a vacuum during a time interval of 1/299792458 of a second. It is realised on the primary level – i.e. by a National Metrology Institute or a specifically designated laboratory – by the wavelength from an iodine-stabilised helium-neon laser. Of course, other laboratories will not determine a "meter" with this type of laser. At lower accuracy levels, material measures like gauge blocks are used. The accuracy loss needs to be known in order to determine the suitability of a gauge block for certain measurement tasks. In this case, traceability is commonly established by using optical interferometry to determine the length of the gauge blocks with reference to the above-mentioned laser light wavelength (EUROMET, 2000).

institutions, such as calibration laboratories. Their work underpins all other forms of conformity assessment, as the adequate functioning of measurement instruments and their proper use by conformity assessment bodies are key elements in building confidence in the work of those organizations.

Accreditation

An organization performing any of the functions described above may seek to record its competence in a given field on a more permanent basis. This is achieved through accreditation with an authoritative body giving formal recognition of the competence of an organization to carry out specific tasks.[96] Accreditation is particularly important when users, be it regulating authorities or purchasers/suppliers, are not in a position to evaluate themselves the competence of a conformity assessment provider. This may be due to the technical complexities involved and, additionally, in international trade due to the spatial separation between a conformity assessment body in the exporting country and the importer. Accreditation bodies are always independent of both the supplier and the purchaser of a product.

Accreditation bodies must have first-class technical expertise although they do not themselves deal with verification of product specifications. Their task is to rate the organizations carrying out such functions. Usually, a set of good practices are provided or endorsed by an accreditation institution of how a testing, inspection or other body is supposed to conduct its business. In order to be accredited, adherence to such guidelines must be demonstrated. While accreditation bodies have their own assessors and may employ additional expertise from external sources to gather information on the competence of applicant institutions, part of the underlying facts are usually collected via peer assessment.[97] Depending on the country, accreditation of testing facilities, calibration laboratories, inspection bodies and quality system/product certification bodies is undertaken by specialized accreditation bodies or a single organization. Accreditation is commonly seen as a governmental responsibility or, at least, as requiring endorsement by the government, whereas inspection, testing, certification, etc. in many parts of the world are mostly commercial activities.

Accreditation of laboratories has the longest tradition, as the availability of objective and accurate test data is an essential element in compliance control that "underpins much of the value of the other [forms of conformity assessment]. ... Laboratory accreditation organizations ... evaluate laboratories against quality system elements but also use peer assessors to evaluate specific technical competence taking into account the technology involved, the particular test methods to be covered and the skills required of individuals working in the laboratory. Accreditation is granted to laboratories for specific products or specific test methods or both" (ILAC, 1996: 8-9). Many laboratory accreditation entities have extended their scope to include inspection bodies as well. Accreditation organizations for product or quality systems certification bodies or both are a relatively recent phenomenon. Here, accreditation testifies to the competence of the certification body in verifying the properties of a product as well as the transparency of its operations.

(c) Harmonization of conformity assessment and international and regional systems

A well-functioning technical infrastructure at the national level does not automatically lead to "one-stop conformity assessment" in world trade. Confidence in the work of conformity assessment bodies in other countries needs to be established through multilateral cooperation. To that end, a variety of international and regional fora have been established, most notably at the accreditation level. Their main objective is to facilitate mutual recognition agreements (MRAs) between members, i.e. the acceptance of conformity assessment results obtained by foreign bodies. Harmonization in the area of conformity assessment is crucial in order to facilitate such efforts and, hence, reduce the duplication of assessments in different countries.

[96] As was stated in the introduction, accreditation institutions are sometimes not considered to be conformity assessment bodies as such, as they necessarily have to be an "outsider" in order to perform third-party attestation of the competence of conformity assessment bodies. Accreditation is, however, listed as a conformity assessment activity in the TBT Agreement. Similar divergences of views exist in regard to calibration and other metrology activities that are a prerequisite for carrying out various types of conformity assessment. See, for instance, ISO (2004). These kinds of nuances are not relevant for the purposes of this report.

[97] Sometimes accreditation and peer assessment are portrayed as alternatives.

Harmonization

The international standards/guides on conformity assessment, developed most notably by the ISO Committee on Conformity Assessment (CASCO) in conjunction with representatives of the IEC, seek to establish unified principles that, if followed by a conformity assessment body, increase the confidence that users can have in its competence. These principles are largely process-oriented. They establish best practices that require conformity assessment bodies to be consistent and transparent in their operations and candid about their actual competence. This represents an important difference from ISO or IEC standards on products, for instance, which contain detailed technical specifications that are often directly built into national regulations. There are guides for each field of conformity assessment, which have been or are in the process of being transposed into international standards in the ISO/IEC 17000 series, i.e. converted into more prescriptive documents establishing clear "checklists" of criteria to be fulfilled (see Table 6).

Table 6
List of CASCO guides and standards

List of CASCO guides and standards by field of application		
Vocabulary, principles and common elements of conformity assessment	**ISO/IEC 17000**: 2004	Conformity assessment - Vocabulary and general principles
	ISO PAS 17001: 2005 Final Draft PAS approved, due to be published by end of June 2005	Conformity assessment - Impartiality - Principles and requirements
	ISO PAS 17002: 2004	Conformity assessment - Confidentiality - Principles and requirements
	ISO PAS 17003: 2004	Conformity assessment - Complaints and appeals - Principles and requirements
	ISO PAS 17004: 2005 Final Draft PAS approved, due to be published by end of June 2005	Conformity assessment - Disclosure of information - Principles and requirements
	ISO PAS 17005: 2005 Final Draft PAS approved, due to be published by end of June 2005	Conformity assessment - Use of management systems in conformity assessment - Principles and requirements
Code of good practice for conformity assessment	**ISO/IEC Guide 60**: 2004	Conformity assessment - Code of good practice
Writing specifications for use in conformity assessment	**ISO/IEC Guide 7**: 1994	Guidelines for drafting of standards suitable for use for conformity assessment
Testing/calibration	**ISO/IEC 17025**: 2005 (Awaiting publication due in May 2005)	General requirements for the competence of testing and calibration laboratories
	ISO/IEC Guide 43-1: 1997 Reconfirmed in 2002	Proficiency testing by interlaboratory comparisons – Part 1: Development and operation of proficiency testing schemes
	ISO/IEC Guide 43-2: 1997 Reconfirmed in 2002	Proficiency testing by interlaboratory comparisons – Part 2: Selection and use of proficiency testing schemes by laboratory accreditation bodies
Inspection	**ISO/IEC 17020**: 1998 Reconfirmed in 2002	General criteria for the operation of various types of bodies performing inspection
Supplier's Declaration of Conformity (SDoC)	**ISO/IEC 17050-1**: 2004	Conformity assessment - Supplier's declaration of conformity - Part 1: General requirements
	ISO/IEC 17050-2: 2004	Conformity assessment - Supplier's declaration of conformity - Part 2: Supporting documentation
Product certification	**ISO/IEC Guide 23**: 1982 Reconfirmed in 2003	Methods of indicating conformity with standards for third-party certification systems
	ISO/IEC Guide 28: 2004	Conformity assessment - Guidance on a third-party certification system for products
	ISO/IEC Guide 53: 2005	An approach to the utilization of a supplier's quality system in third-party product certification
	ISO/IEC Guide 65: 1996 Reconfirmed in 2000	General requirements for bodies operating product certification systems
	ISO/IEC Guide 67: 2004	Conformity assessment - Fundamentals of product certification

Table 6
List of CASCO guides and standards (cont'd)

List of CASCO guides and standards by field of application		
System certification	**ISO/IEC Guide 62**: 1996	General requirements for bodies operating assessment and certification/registration of quality systems
	ISO/IEC Guide 66: 1999	General requirements for bodies operating assessment and certification/registration of environmental management systems (EMS)
Certification of persons	**ISO/IEC 17024**: 2003	General requirements for bodies operating certification of persons
Marks of conformity	**ISO Guide 27**: 1983 Reconfirmed in 2003	Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity
	ISO/IEC 17030: 2003	General requirements for third-party marks of conformity
Accreditation	**ISO/IEC 17011**: 2004	Conformity assessment - General requirements for accreditation bodies accrediting conformity assessment bodies
Mutual Recognition Arrangements (MRAs)	**ISO/IEC Guide 68**: 2002	Arrangements for the recognition and acceptance of conformity assessment results
Peer assessment	**ISO/IEC 17040**: 2005	Conformity assessment - General requirements for peer assessment of conformity assessment bodies and accreditation bodies

List of CASCO projects under way		
Writing specifications for use in conformity assessment	**ISO/IEC Guide 7**: 1994 New Work Item Proposal for revision of ISO/IEC Guide 7 expected in early 2005	Conformity assessment - Guidelines for drafting specified requirements suitable for use for conformity assessment
System certification	**ISO/IEC 17021** [CASCO WG 21] Revision of Guide 62:1996 and ISO/IEC Guide 66:1999, with the new standard being applicable for audit and certification of all types of management system. DIS vote approved on ISO side but not IEC side. Will be released for 5-month DIS2 ballot by June 2005	Conformity assessment - Requirements for bodies providing audit and certification of management systems
Sector specific *Greenhouse Gases*	**ISO 14065** [Joint CASCO-ISO/TC 207 WG 6] WD prepared and will released for a CD consultation after the next WG meeting in March 2005	Greenhouse gases - Requirements for validation and verification bodies for use in accreditation and other forms of recognition

Source: ISO Communication QS-CAS-PROC/13, March 2005.

The relevant ISO/IEC standards require certification bodies to operate in a non-discriminatory fashion, i.e. be accessible to any applicant, to be impartial and free from any commercial, financial or other pressures which might influence the results of the certification process, to safeguard the confidentiality of information provided by applicants, and to have appropriate procedures in place to deal with appeals, complaints and disputes brought by any party involved. Further details are provided on what type of information should be gathered and how the assessment team should conduct its work to observe due process, including in post-certification surveillance. The body must fulfil certain legal requirements to ensure control over the use of certification marks and prevent misleading use (Fukuda, 1999). Similar requirements are specified in the respective documents for accreditation bodies.

ISO/IEC standards for testing laboratories and inspection bodies contain both "management" requirements of a more organizational nature and technical requirements stipulating proper documentation of calibration methods and method validation, equipment, measurement traceability, sampling methods etc. However, even the latter requirements are kept sufficiently general to ensure best practice, while giving leeway to the

individual institution to apply specific methods. A stylized example of how ISO testing standards may be applied in practice is provided on the ISO webpage: "A major manufacturer regularly orders large supplies of raw materials from overseas countries. Before the materials are shipped, samples are analysed by local testing laboratories to confirm that they conform to grades stipulated in the contracts between the manufacturer and its suppliers. As the contracts refer to grades defined in internationally agreed ISO standards, there is less room for error and disagreement. The analyses themselves are carried out according to ISO test method standards and the organizational processes of the local laboratories conform to another ISO standard giving the general requirements for the competence of testing and calibration laboratories."[98]

International and regional systems

A number of international and regional systems have developed over time with the objective of establishing networks of conformity assessment bodies whose competence can be relied upon by all members. Cooperation at the accreditation level has proven particularly important in order to minimize the number of bilateral coordination efforts that confidence-building in another country's conformity assessment infrastructure would otherwise require. If agreement between accreditation organizations is reached, certificates from all certification bodies or test results from all laboratories accredited in one country are accepted by the other signatories without the need for further contacts at the level of certification or testing bodies. Of key importance in facilitating multilateral MRAs between accreditation bodies are the International Laboratory Accreditation Cooperation (ILAC), which operates as a forum for accreditors of laboratories and inspection bodies, and the International Accreditation Forum (IAF), which fulfils this function for accreditors of certification bodies (ISO, 1998). ILAC and IAF seek to assist in creating and multilateralizing MRAs among its members. IAF has managed to establish a "multilateral" MRA among a range of its members with the help of regional groupings, such as the European co-operation for Accreditation (EA) and the Pacific Accreditation Cooperation (PAC), and ILAC has developed a "global" MRA among all its 46 full members.[99] The latter arrangement promotes usage of ISO/IEC standards and guides relevant to accreditation, since the acceptance of each member's accreditation work is facilitated if common procedures are followed and reliable documentation provided in accordance with internationally agreed requirements.

The ILAC Mutual Recognition Arrangement, for instance, specifically requires that each signatory accreditation body maintains conformity with ISO/IEC Guide 58 ("Calibration and Testing Laboratory Accreditation Systems – General Requirements for Operation and Recognition") and ensures that all accredited laboratories comply with ISO/IEC 17025 ("General Requirements for the Competence of Testing and Calibration Laboratories") (ILAC, 2004). The arrangement has been built upon existing regional arrangements. Each "recognized Regional Cooperation Body" is responsible for maintaining the necessary confidence in accreditation bodies from their region. Currently, the European co-operation for Accreditation (EA) and the Asia Pacific Laboratory Accreditation Cooperation (APLAC) are the only regions whose MRAs and evaluation procedures are recognized by ILAC. The Inter-American Accreditation Cooperation (IAAC) and Southern African Development Cooperation for Accreditation (SADCA) are in the process of refining their MRA evaluation processes for future recognition by ILAC. Bodies that are not currently affiliated with a recognised region may apply directly to ILAC for evaluation and recognition. Continued confidence in the work of MRA signatories is ascertained through periodic peer evaluations undertaken by a team composed of other members.

In order to help members to establish and extend MRAs and to ensure that members only accredit competent and impartial conformity assessment bodies, ILAC and IAF also engage in a number of complementary activities. In particular, they provide their own documentation. Both ILAC and IAF produce guidance material for member organizations on how to apply relevant ISO/IEC standards, as well as guides and documents that address the operation of conformity assessment schemes in specific areas, such as ILAC Guide G7:1996 on "Accreditation Requirements and Operating Criteria for Horseracing Laboratories". In order to help accreditation bodies in their duty to periodically monitor the performance of accredited institutions and ensure their continued competence, ILAC has also developed a guide on proficiency testing programmes and assists members in their implementation, i.e. in holding inter-laboratory comparisons of test results obtained

98 See http://www.iso.org/iso/en/comms-markets/conformity/iso+conformity.html, accessed on 17 February 2005.

99 As at 2 February 2005. See at http://www.ilac.org, accessed on 17 February 2005.

from samples with properties known by the organizer. IAF has a programme in place to assist low and medium income economies to create their own accreditation bodies. Finally, both fora facilitate the exchange of information between accreditation bodies, undertake and coordinate training of assessors and other personnel, and liaise with other relevant institutions, such as ISO.

There are also cooperation arrangements between bodies in other areas of conformity assessment. For instance, the scheme for the acceptance of test reports dealing with the safety of electrical and electronic products (IECEE-CB Scheme) is a multilateral agreement among participating IEC member countries that allows the so-called National Certification Bodies, (NCBs, i.e. certification institutions designated by IEC members) to issue "CB Test Certificates" whenever a sample of electrical products has been tested and found to be in conformity with the relevant IEC standards by one of the almost 180 CB testing laboratories.[100] In other words, a manufacturer utilizing a CB test report issued by one of these organizations can obtain national certification in all other member countries of the CB Scheme. Participating developing countries include Argentina (2 CB test laboratories), China (16), India (13), the Republic of Korea, (3), Malaysia (1), and South Africa (1). Between laboratories and inspection bodies, arrangements sometimes take the form of pledges to subcontract each other on a reciprocal basis for tests of individual components of more complex items in international trade.

A lot of international collaboration is also going on in the area of metrology. The Inter-American Metrology System (SIM), for instance, unites national metrology organizations from all 34 member nations of the Organization of American States (OAS) with the objective of achieving equivalence among national measuring standards and calibration certificates issued by national metrology laboratories.[101] Given the interrelated nature of conformity assessment activities, MRAs at one level, say between different metrology institutions, may facilitate the conclusion of MRAs in the testing or certification area for sectors that depend strongly on precision measurement.[102]

Regional cooperation efforts often precede wider international engagement, not least since neighbouring countries may also be principal trading partners. In particular, regional coordination in the development of conformity assessment infrastructure may help to address in a cost-effective manner the problem of a complete absence or insufficiency of relevant institutions at the national level for some of the smaller or poorer countries in the region. Rather than each country attempting to have certification, inspection and testing facilities for all relevant sectors, countries in a region may seek to foster a network of laboratories with specialized skills and equipment. A regional accreditation system may contribute to forming such a network, while at the same time increase competition among laboratories with similar activity profiles to the benefit of customers. Since the technical competence of accredited facilities should be the same, customers will choose those offering the best value for money. Regional cooperation can also avoid duplication at the level of metrological reference standards and equipment, and thus increase traceability of measurement results.

Regional cooperation currently takes place in Europe, the Asia-Pacific region, the Americas and Southern Africa, and is mainly geared towards multilateral recognition of national accreditation bodies. In Europe, the EA, merged in 1997 from the European co-operation for Accreditation of Laboratories (EAL) and the European co-operation for Accreditation of Certification (EAC), comprises EU members. Members of EA are the nationally recognised accreditation bodies of the member countries or accession candidates of the European Union and EFTA. In order to be part of the individual multilateral recognition agreements (called "MLAs" by the EA and some other institutions) for either certification body, laboratory or inspection body accreditation, a peer evaluation must be passed successfully. The certificates and reports issued by organisations accredited by national accreditation bodies are then accepted in all the MLA countries. In addition, the signatories of each MLA have negotiated a number of bilateral agreements with accreditation bodies elsewhere. For instance, members to the EA Testing MLA have concluded bilateral recognition arrangements with NATA (Australia), IANZ (New Zealand), SANAS (South Africa), SAC (Singapore), INMETRO (Brazil), ISRAC (Israel), HKAS (Hong Kong, China) and AZLA (United States).[103]

100 See http://www.iecee.org, visited on 22 February 2005.

101 See http://www.sim-metrologia.org.br/whoweare/sm_whoweare.html, accessed on 22 February 2005.

102 There are many other equally important international initiatives, which cannot be discussed here.

103 See http://www.european-accreditation.org, accessed on 18 February 2005.

APLAC is open to laboratory accreditation bodies in any Asia Pacific Economic Cooperation (APEC) economy (and others if agreed by members). It is recognized by APEC member economies as a Specialist Regional Body, assisting with the work of the APEC Sub-committee on Standards and Conformance. The list of APLAC Members is almost identical to that of APEC, with the exception of Chile, Peru and Russia, which are members of APEC but have not yet applied for APLAC membership, and India, that is member of APLAC but is not an APEC member.[104] Similarly, the Pacific Accreditation Cooperation (PAC) operates as a forum for accreditation of certification bodies in the APEC region. Like the EA, APLAC and PAC seek to transform the existing network of bilateral agreements between members into multilateral arrangements. This is not always an easy task given the different levels of development in member countries. For instance, PAC's Multilateral Recognition Arrangement (MLA) for Accreditors of Product Certification Systems comprises only few members (JAS-ANZ (Australia and New Zealand), SCC (Canada) and EMA (Mexico)).[105] Both APLAC and PAC include developed and developing countries, with the former often providing support to raise technical competencies in the latter. For instance, Australia's National Association of Testing Authorities (NATA) provides a number of training programmes to other APLAC members.

Membership of the IAAC, which covers North America, most South and Central American countries, as well as some Caribbean island states, also comprises countries at different levels of development. A number of training activities and internship programmes with the more advanced members are regularly organized, for which additional funds are obtained from regional organizations (in particular the Organization of American States, OAS). IAAC's members are accreditation bodies for certification/registration bodies, inspection bodies and testing/calibration laboratories. Like in the other regional systems, members of IAAC's MLAs are required to demonstrate (through peer evaluations) conformity with pertinent ISO/IEC standards and guides (and related IAF or ILAC guidance documents) and conformity of all accredited bodies with the relevant ISO/IEC standards and guides. IAAC MLA members also regularly participate in the assessment/re-assessment and surveillance visits of conformity assessment bodies performed by other IAAC MLA member accreditation bodies.[106]

Similar to the other regional bodies, one of the principal goals of SADCA is to foster MRAs between qualifying institutions in SADC member countries. However, within SADCA, only South Africa and Mauritius currently have a national accreditation organization and, therefore, have taken on special leadership and training responsibilities in the meantime. Only three other countries have expressed the intention to establish their own national accreditation infrastructure (Gilmour and Loesener, 2003). In light of this, SADCA seeks to define a suitable accreditation infrastructure, enabling organizations in SADC member states to access accreditation services from recognised national accreditation bodies. It is also foreseen that a regional accreditation service, SADCAS, will be formed through which conformity assessment bodies can obtain region-wide accreditation directly. It is also hoped that SADCA activities will stimulate the creation of a pool of internationally acceptable accredited laboratories and certification bodies (for personnel, products and systems, including quality and environmental management systems) in the SADC region.[107]

(d) Conformity assessment and international trade

Conformity assessment is not a trade barrier as such. It is indispensable, since compliance with certain technical specifications may be mandated by either the government in the importing country or customers in order to ensure safety, quality or compatibility. The degree of flexibility that suppliers have to demonstrate conformity with required specifications has a direct impact on their cost competitiveness.

When demanding proof of conformity, customers will balance the benefits of higher levels of assurance against the practical or legal consequences of non-compliance they may suffer. If a supplier can easily be switched (and possible downtime costs for consumers of intermediate goods are low) or if the legal consequences or

104 See http://www.ianz.govt.nz/aplac/aboutaplac/about_general_info.htm, accessed on 18 February 2005.

105 See http://www.apec-pac.org/sections/pacmla/files/MLA%20Signatories%20-%20Product.doc, accessed on 18 February 2005.

106 See http://iaac-accreditation.org/Mla.html, accessed on 18 February 2005.

107 See http://www.sadca.org, accessed on 18 February 2005.

inconveniences for the buyer are minor and product liability claims against the supplier easy to enforce, a customer may be satisfied with a supplier's declaration of conformity, perhaps in connection with a certified quality management system. At the same time, a supplier may offer higher levels of assurance, for instance by having a batch of products tested by an accredited laboratory, if the additional costs are less than his expected gain in reputation or the costs of liability insurance.

Regulators usually require a minimum level of assurance, defined by law. Conformity with government-mandated specifications shall be the focus of this Section. Depending on the regulatory standard pursued, the government may require conformity assessment to be carried out by specific authorities or mandate the conduct of certain activities, such as 100 per cent testing, or even precise procedures (e.g. spraying of every good X with chemical detergent Y for Z amount of time). When only designated bodies are allowed to conduct the required conformity assessment procedures, a duplication of efforts or increased costs for exporters are a likely result. If exporters are free to choose conformity assessment institutions, government confidence in the body conducting the mandated assessment is a key issue. In order to avoid unnecessary barriers to trade, governments generally encourage cooperation between conformity assessment bodies and lend their support to mutual recognition efforts, sometimes through active involvement in MRA negotiations.

A level playing field between competitors, both domestic and foreign, is ensured if any product or service found to be in conformity with a given standard in one country may be put on the market in any other trading partner as well. The assessment of conformity with regulations may become a barrier to trade when products have to undergo unnecessary re-testing, re-inspection or re-certification in order to gain access to individual export markets,[108] or when prescribed activities/procedures are overly burdensome for foreign producers in order to reach a given level of assurance. Hence, the degree to which conformity assessment acts as a trade barrier hinges critically upon the flexibility provided to exporters in choosing conformity assessment providers, activities and procedures. But even if the importing country is rather flexible as to where and how conformity is demonstrated, transaction costs for foreign suppliers can be significant, depending on the availability and cost-effective provision of relevant conformity assessment services and their international recognition. Problems in relation to the first point vary with the stringency of underlying regulations and the level of risk associated with a product and tolerated by the importing country. Deficiencies in regard to the latter issues are primarily to be addressed by the exporting country and are related to its level of development, industrialization and diversification.

The degree of trade restrictiveness of conformity assessment requirements is a function of both elements combined. The factors in the exporting country that may influence the availability and international recognition of conformity assessment institutions, such as private or public sector provision of conformity assessment services will first be discussed. Then to what extent conformity assessment requirements by the importing countries can pose problems for exporters will be illustrated. The role of MRAs will be highlighted as well as the difficulties that may result from incompatibilities among national conformity assessment structures.

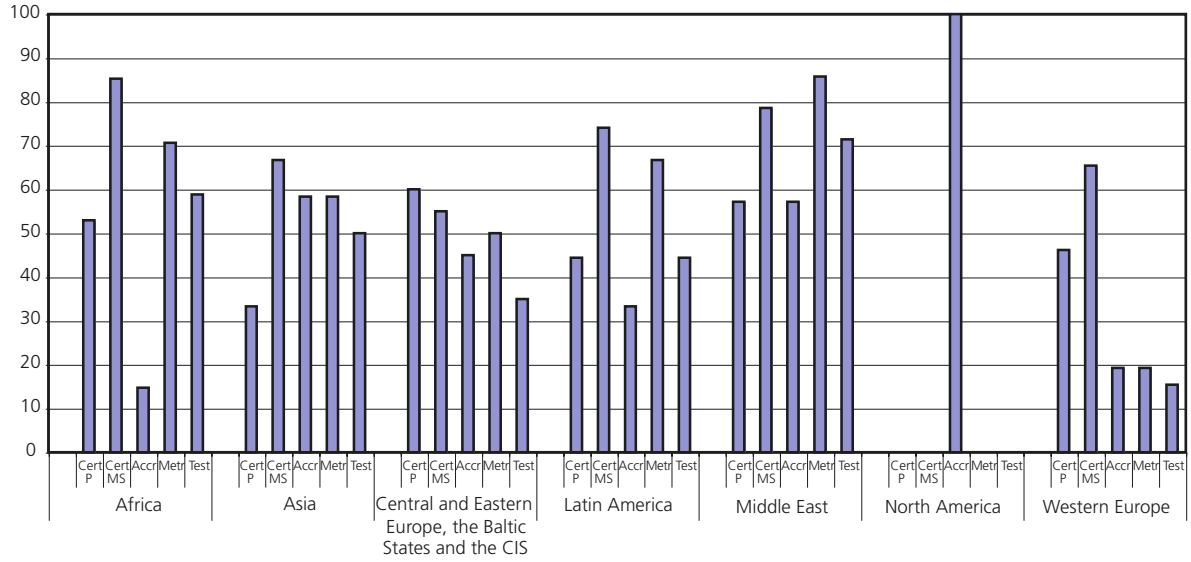
Provision of conformity assessment services and international recognition

In small developing countries, conformity assessment-related (and standards-related) activities are often centralized and government-driven. A single governmental organization may be responsible for writing standards, providing metrology services, certification and accreditation, and sometimes even testing facilities. Commercial provision of conformity assessment services may be low due to restrictive policies, the small size of the domestic market, high costs of inputs and scarce human resources. The availability of conformity assessment services then crucially depends on the human and financial resources at the disposal of the government and its awareness of the needs of exporters. For international recognition, centralized arrangements may cause problems if impartiality, objectivity, non-discrimination and avoidance of conflicts of interest, as stipulated by the relevant ISO/IEC standards on conformity assessment, are in doubt. From Chart 9 it can be seen that in Africa, the Middle East and Asia, and slightly less so in Latin America, the

[108] Of course, in individual cases, re-testing etc. in the importing country may be necessary, for instance, if potential environmental effects are directly related to the area where, say, an imported plant will be grown.

national standardizing body that is a member of ISO, also provides other conformity assessment services, most notably certification and metrology services. This stands in strong contrast with North America, where the standardizing body's additional activities are confined to accreditation. The low numbers on accreditation in other regions may also give an indication that, particularly in Africa, accreditation frequently does not exist at all at the national level. Finally, the comparatively small shares of standardizing bodies in the developed regions, North America and Europe, that also conduct testing activities supports the assumption that testing services are available from a variety of other sources.

Chart 9
Share of standardizing bodies conducting type of conformity assessment procedure



Source: ISO Members Directory 2003.

Accreditation bodies must have a degree of authority and, therefore, are normally government-owned or a private body with close affiliations to the government. According to Gilmour and Loesener (2003), in China, India, Japan, Jordan, Malaysia, Tunisia and the United States, accreditation is carried out by a Ministry. In Brazil, Colombia, Egypt, New Zealand and Singapore the national accreditation body is a Statutory Authority. In Argentina, Australia, Canada, Cuba, France, Mexico and South Africa accreditation is entrusted to a not-for-profit organization. Responsibility for accreditation may not always be as clear-cut as presented in this Report. In the United States, for instance, the accreditation system is both in public and private hands and continues to be highly decentralized: the Occupational Safety and Health Administration (OSHA), for example, accredits laboratories as competent to test and certify products used in the workplace and only accepts certification from accredited bodies as demonstrating compliance with its regulations. But there are also private accreditation programmes established by industry, such as the National Aerospace and Defense Contractors Accreditation Programme (NADCAP) that accredits laboratories and quality systems of suppliers in these industries (National Research Council, 1995).

Decentralized and private sector accreditation can pose a problem with many trading partners that understand accreditation as implying governmental involvement and authoritative and official decisions on the competence of accredited institutions. In order to facilitate mutual recognition, the National Institute of Standards and Technology (NIST), which is a federal agency within the US Commerce Department's Technology Administration, operates a programme to officially "recognize" private accreditors.[109] NIST also runs centralized accreditation programmes itself, such as the National Voluntary Laboratory Accreditation Programme (NVLAP). Although accreditation is voluntary and on a fee-basis, fulfilment of a number of regulations, for instance on asbestos, require testing by a NVLAP-accredited laboratory. The costs for laboratories to become accredited consist of one-off fees and recurrent payments both on an annual basis and, in addition, whenever on-site inspections are due. A laboratory wishing to be accredited for commercial

[109] This means that, in the United States, governmental "recognition" represents an additional level in the conformity assessment infrastructure "above" accreditation.

product testing is charged $4,030 annually, plus a $500 application fee in the first year. To this, variable on-site assessment fees must be added, ranging between $1,600 and $2,900 for some specifically identified products.[110] The fee structure is similar in other accreditation bodies, such as India's National Accreditation Board for Testing and Calibration Laboratories (NABL), which is an autonomous body under the aegis of the Department of Science and Technology of the Government of India and the sole accreditation body for testing and calibration laboratories. Here, a testing laboratory seeking accreditation for up to two product groups per field of testing pays a non-refundable application fee of Rs.10,000 and the same amount annually from the date of accreditation. Re-assessments must be carried out every three years at a rate of Rs.1,000-1,500 per day plus overhead charges of Rs.5,000.[111] The annual fee of Rs.10,000, for instance, converts to just $205 at the official exchange rate and to $1,136 in terms of purchasing power parity, which is still lower than the fees charged by NVLAP.[112] Both NVLAP and NABL are open to applications from foreign laboratories. They are also both signatories to the ILAC MRA, i.e. recognize each other's accreditation systems. As a consequence, test results from laboratories accredited by either one body should be accepted in both countries.

Where developing countries have not established a national accreditation body, domestic conformity assessment institutions must seek accreditation in individual export markets. If ILAC membership is taken as an indication of the availability of national accreditation bodies, developing countries in the Western Hemisphere are relatively well represented by Argentina, Brazil, Chile, Cuba, Ecuador, El Salvador, Guatemala, Mexico and Trinidad and Tobago. OAS (1996) and OAS (1997) also mention the existence of national accreditation bodies in Colombia, Costa Rica and Peru and plans for their establishment in Bolivia and Panama. A similar situation exists in developing Asia, where Hong Kong, China; China; Chinese Taipei; India; Indonesia; the Republic of Korea; Malaysia; Pakistan; the Philippines; Singapore; Thailand and Viet Nam have national accreditation bodies that are members of ILAC. Conversely, the lack of accreditation capacity in Africa is conspicuous, with only five countries (Egypt, Mauritius, Morocco, South Africa and Tunisia) featuring among ILAC members.

Testing laboratories or inspectors are normally for-profit service providers hired by clients (to verify conformity to stated specifications), suppliers (to cross-check against their own tests and support manufacturer's declarations of conformity with regulations) and other conformity assessment institutions, such as certification bodies, often for highly specialized tasks. Annual data collected by the US Bureau of the Census shows the importance of the testing laboratories services sectors (NAICS 54138) both in terms of size and rapid growth in recent years (see Chart 10). In the last two years for which data are available, the sector has grown around 11 per cent annually, generating more than $9 billion in revenues. These values largely underestimate the revenues generated in the third-party testing sector, as more testing laboratories are classified under engineering services. The growth of the third-party testing sector can also be expected to stimulate increased activities in the other layers of conformity assessment, both at the private end and as far as the need for government oversight is concerned.

Similar developments may be assumed to take place for inspection services. On-site/pre-shipment inspection is widespread in private business transactions, especially for low-value added bulk commodities, such as barley, maize, rice or wheat, where transport costs are substantial and refusal at the port of destination would result in important losses. This has given rise to the development of multinational inspection companies (increasingly also providing other conformity assessment services). For instance, the Société Générale de Surveillance (SGS) offers an on-site grain grading programme, which allows for continuous tracking of quality and quantities placed in different silos. These consistent, high-tech tracking operations are likely to make it easier to blend grains in accordance with the minimum contractual specifications and to be less costly at the time of loading

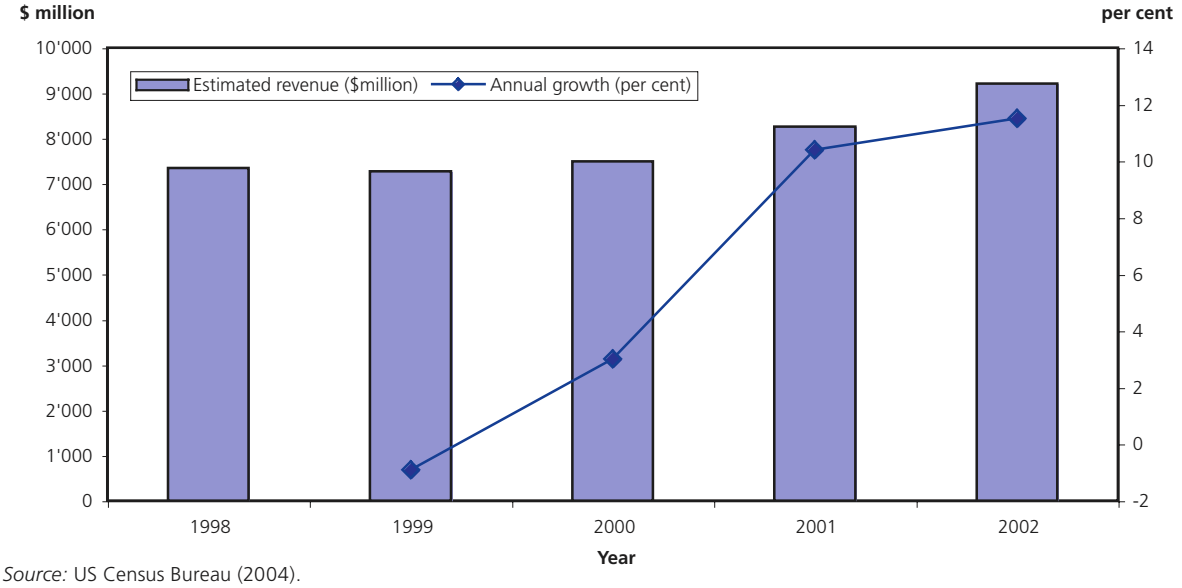
110 An on-site assessment is conducted before initial accreditation, during the first renewal year, and every two years thereafter. To the total cost, varying annual proficiency testing fees must be added, which are to be paid directly to an outside testing service provider. See NIST (2004).

111 Additional charges must be foreseen for travel, boarding and lodging of assessors and for possible extensions of the existing accredited scope per field of testing during NABL's annual surveillance activities. See NABL (2004).

112 Exchange rate information is for the year 2002. See Word Development Indicators (WDI) 2004 by the World Bank. Available at http://www.worldbank.org/data/wdi2004. The comparison of fees is quite crude and also strongly depends on how broadly product categories are defined for which a testing laboratory is accredited.

onto trucks, trains or vessels.[113] SGS is present in more than 130 countries world-wide, including many of the least-developed countries.[114] But in relation to "sensitive" products subject to strict regulatory requirements, exporting country governments may also take on the responsibility for inspection in order to prevent non-conforming commodities from being shipped. This seems to occur particularly in regard to exports of foodstuffs to countries with stringent SPS requirements: for instance, the Export Inspection Council of India (with almost 59 Export Inspection Agencies across the country) carries out inspections of black pepper for export to the United States, based on the standards and requirements of US Food and Drug Administration (FDA) and issues corresponding inspection certificates for use by US authorities.[115]

Chart 10
United States laboratory testing services, revenues



Source: US Census Bureau (2004).

There are both private and public certification bodies. On the private side, many profit-oriented testing laboratories take the additional step of becoming a certifier of products for a particular range of standards. For instance, MET Laboratories, Inc. is a widely-accredited third party laboratory that certifies regulatory requirements internationally in the areas of electrical, electronic and telecommunication products.[116] A number of private certification bodies also work on a not-for-profit basis, often developing and certifying to their own standards. One of the oldest such institutions is the Underwriters Laboratories (UL) with more than 600 published standards in the area of consumer safety, and the well-known "UL" mark that is licensed to be placed on certified products or their packaging. More recently, such bodies have emerged in the environmental field, such as Forest Stewardship Council (FSC) accredited certification bodies, which award the FSC logo on products from certified forest operations.[117] Public sector certification is concentrated in areas of public interest, especially in relation to health, safety and environmental regulations. For instance, the US Department of Agriculture offers certification of fresh fruit and vegetables against grading standards it has developed. Participation by producers is voluntary, albeit widespread for its practical advantages, including easier marketability of certified products. Grading is paid for by user fees and is voluntary except for commodities that are regulated for quality.[118]

[113] The SGS was founded in the 19th century as a grain shipment inspection house and today offers inspection, verification, testing and certification services. SGS has 39,000 employees and operates a network of about 1,000 offices and laboratories around the world. See http://www.sgs.com/about_sgs/in_brief.htm, accessed on 21 February 2005.

[114] See http://www.sgs.com/contact_us.htm, accessed on 21 February 2005.

[115] See http://www.eicindia.org/eic/inspection/blackpepper.pdf, accessed on 21 February 2005.

[116] For up-to-date information see the directory of 'Conformity Assessment Testing Laboratories' at the American Council of Independent Laboratories (ACIL). Website accessed on 3 February 2005 (http://www.acil.org).

[117] The FSC insists that it is not a certification body itself, but an accreditation forum for forest certifiers, as it does not itself certify forest operations or manufacturers and does not develop standards, but only provides a framework for standards development at the national or regional level through a multi-stakeholder consultative process.

[118] See the Fresh Products Branch, Fruit and Vegetable Programs, Agricultural Marketing Service at the US Department of Agriculture. Website accessed on 3 February 2005 (http://www.ams.usda.gov/fv/fvstand.htm).

Finally, the metrology infrastructure of a country usually comprises both public and private institutions. The most common model consists of a government-endorsed national measurement institute (NMI) and a network of accredited calibration laboratories (Gilmour, 1998). NMIs provide the primary metrology standards used in the economy – usually a prerogative of governments – but not every NMI needs to maintain standards for every possible measurement unit. A lot depends on the nature and diversity of the industrial structure. For high-technology sectors, the availability of essential reference standards is vital. For instance, the US semiconductor industry invests several billion dollars per year in metrology projects that also depend on access to a comprehensive system of traceable measurement standards provided by the National Institute of Standards and Technology (NIST) (Semerjian and Watters, 1998). But also countries, such as Slovenia, that are relatively "small" in terms of the number of measurements performed, need to ensure the availability of traceable reference standards at the national level, as accuracy is demanded for most industrial measurement tasks (Drnovsek and Topic, 1998). According to the Drnovsek and Topic study, Slovenia does not have a centralized NMI, such as NIST. Rather, it has a system of laboratories in place that transfer standards that are traceable to the international level to lower level laboratories, but do not realize SI units themselves. Apparently, the additional uncertainties introduced by such transfers are minor and do not, for the moment, warrant additional investment to achieve a higher level of metrological capabilities. However, in such cases, close collaboration with other metrological organizations becomes all the more important, and Slovenian metrology institutions have maintained close ties to NIST since their establishment, as well as to various European bodies and international organizations, such as the Bureau International des Poids et Mesures (BIPM) and the International Organization of Legal Metrology (OIML).

Many organizations at the international, regional and bilateral levels are active in providing technical assistance to developing countries in order to help them upgrade their conformity assessment infrastructure. As noted above, international and regional systems for conformity assessment, such as ILAC, APLAC, etc. have their own training programmes and facilitate the exchange of experiences and the conduct of bilateral training activities between members. Organizations with a wider mandate, such as the United Nations Industrial Development Organization (UNIDO) and the World Bank, are also active in the area of conformity assessment. UNIDO, in the context of assisting developing countries to enhance their industrial competitiveness, also helps to identify conformity assessment needs and possible donor funding. For instance, a $2.3 million project in Sri Lanka, largely financed by Norway, supported testing laboratories, metrology infrastructure and environmental management systems. UNIDO assisted in upgrading the equipment and skills of six testing laboratories (one rubber testing, one textile testing, two microbiology and two chemical laboratories) and in obtaining international accreditation. In addition, a new industrial metrology laboratory compliant with the relevant international standards was established. Assistance was also provided to the Sri Lanka Standards Institution (SLSI) to launch the national ISO 14000 certification scheme. Twenty auditors were trained and ten pilot companies guided to develop an ISO 14000 scheme. Since the completion of the project, all the requisite garment testing has been carried out in Sri Lanka and the test results accepted by EU counterparts (OECD/WTO, 2003).[119]

[119] A search for more examples on conformity assessment-related technical assistance, both national and regional, can be performed through the Doha Development Agenda Trade Capacity Building Database (TCBDB) established by the WTO jointly with the OECD. See http://tcbdb.wto.org/index.asp?lang=ENG. On the WTO website, there are also links to other databases on TBT-related technical assistance. See http://www.wto.org/english/tratop_e/tbt_e/tbt_tech_link_e.htm. Finally, the WTO jointly with the World Bank, the World Animal Health Organization (OIE), World Health Organization (WHO), and Food and Agriculture Organization (FAO) have established the Standards and Trade Development Facility (STDF) Database, which provides information on SPS-related technical assistance and capacity building projects (see the earlier discussion in Subsection IIC.1). See http://stdfdb.wto.org. The WTO manages or participates in a range of technical cooperation programmes in collaboration with other international agencies that may contain conformity assessment components, such as the Integrated Framework, in collaboration with ITC, IMF, World Bank, UNCTAD and UNDP and the Joint Integrated Technical Assistance Program (JITAP), which are specifically for Least-Developed Countries (LDCs). The WTO has also recently concluded a Memorandum of Understanding with UNIDO comprising a conformity assessment module that has already led to several concrete outcomes in some of the nine pilot countries. For instance, with the participation of interested importing countries, such as the EC and Switzerland, progress was made on the fulfilment of SPS requirements for Amazon nuts in Bolivia and potatoes in Egypt. For more on WTO technical assistance see http://www.wto.org/english/tratop_e/devel_e/teccop_e/tct_e.htm

In seeking assistance to build conformity assessment infrastructure with the ultimate goal of reaching international recognition, developing countries understandably focus on sectors of particular export interest to them. In addition, sectoral conformity assessment needs usually receive priority, where the requirements by importing nations are particularly inflexible and the hiring of foreign service providers is neither cost-effective nor practical. Many developed countries that for obvious reasons do not wish to lower their standards and the required level of conformity assurance, provide assistance on a bilateral basis to suppliers in the developing world. For instance, the Canadian Food Inspection Agency (CFIA), a governmental body tasked with enforcing food safety and nutritional quality standards and carrying out necessary inspections, collaborates with Chilean representatives on a "Food Safety Enhancement Program" with the objective of improving on-farm food safety in Chile and giving official recognition to its on-farm programmes.[120] Some of these projects can also have positive spill-over effects – after successful implementation, they lead to increased exports to third countries as well. For example, the EC had imposed restrictions on Kenyan exports of Nile perch. Subsequent up-grading efforts of fish-processing facilities (including the introduction of HACCP procedures) prompted the European Commission to recognize the controls in place as equivalent, and enabled Kenya fish exporters to gain access to new export markets in the United States, Japan and Australia (Jaffe and Henson, 2004).[121]

Conformity assessment requirements and goverment-to-government MRAs

While the provision of conformity assessment services at the national level poses problems, especially for developing countries, rigid prescriptions on conformity assessment by importing country governments[122] can be challenging even for countries with a well-developed conformity assessment infrastructure. Exporters may face extra costs due to: i) difficulties in obtaining information on conformity assessment requirements and admissible providers; ii) additional conformity assessment activities to those carried out domestically or a duplication of procedures; iii) procedures that are more costly to exporters than domestic producers owing, for instance, to higher transport and communication costs; and iv) administrative delays caused, for instance, by test reports and other documentation that may be refused, remitted for further clarification or, even when admissible, less familiar to importing country authorities.

Requirements in relation to any conformity assessment activity can affect trade in any of these four ways.[123] Common examples are the non-acceptance by the importing country of a supplier's declaration of conformity in a sector, where this is possible in the exporting country. For instance, supplier's declaration of conformity is commonly accepted in the motor vehicles and motor vehicle equipment sector in the United States, but not in many other countries. Conversely, it is used for electrical products in the European Communities, but has not been mentioned, for example, by the United States or Brazil in their submissions on product categories where supplier's declaration of conformity is permissible (WTO Secretariat, 2005b).

In relation to testing/inspection, importing countries may not accept foreign reports and require (re-) testing/ inspection by designated bodies. These may be bodies in the importing country that conduct the assessment upon arrival of the product or go to the exporting country, or selected bodies in the exporting country in which the importing country regulator has confidence. For instance, Mauritian inspection and test certificates regarding food safety requirements for canned tuna have, for some time, not been accepted in South Africa and so the canned tuna had to undergo re-testing and re-inspection there. Ultimately, an agreement was reached that the

120 See STDF Database at http://stdfdb.wto.org/trta_project.asp?ctry=25&prjcd=CAN-CFIA-33, accessed on 24 February 2005.

121 See also in the respective bulletins of the Centre for the Development of Industry (CDI), a joint Africa, Caribbean, Pacific (ACP)-European Union (EU) institution created in the framework of the Lome Convention; http://europa.eu.int/comm/development/body/publications/courier/courier171/en/91_en.pdf, accessed on 24 February 2005.

122 Of course, buyers can also make burdensome prescriptions on how and where specifications they require from the exporter are to be assessed. As noted earlier, this discussion concentrates on conformity assessment requirements by governments in relation to mandatory regulations.

123 The discussion here focuses on conformity assessment activities in the narrow sense, i.e. not on accreditation and metrology. The reason for this is that a lack of confidence in the metrological capabilities of foreign countries may translate into non-acceptance of test reports, certificates, etc. By the same token, refusal to accept conformity assessment results from bodies accredited by a foreign accreditation institution may be due to a lack of confidence in the competence of these bodies. If the workings of the accreditation system are at issue, these may be overcome in the course of MRA negotiations, which are discussed further below.

Department of Veterinary Services and the Mauritius Standards Bureau would seek accreditation by South Africa as an inspection body and testing laboratory respectively (ITC and Commonwealth Secretariat, 2003: 61). Especially in the case of food safety, it is often compulsory that tests and inspections be conducted before shipment in order to prevent the spread of diseases. This not only involves substantial costs for the exporter if inspectors have to be brought in from abroad, but may, in certain cases, prove impossible, at least in the short-term. The absence of inexpensive testing/inspection services can thus forestall the possibility to export, even though requirements could actually be fulfilled. For example, mangos from Jamaica, due to the possible presence of fruit flies, are only allowed into the United States if they underwent hot water treatment in special facilities not currently available in Jamaica (ITC and Commonwealth Secretariat, 2003: 58). Pre-shipment testing is sometimes also required in regard to technical requirements, such as maximum pesticide residue limits for fresh fruit and vegetables.

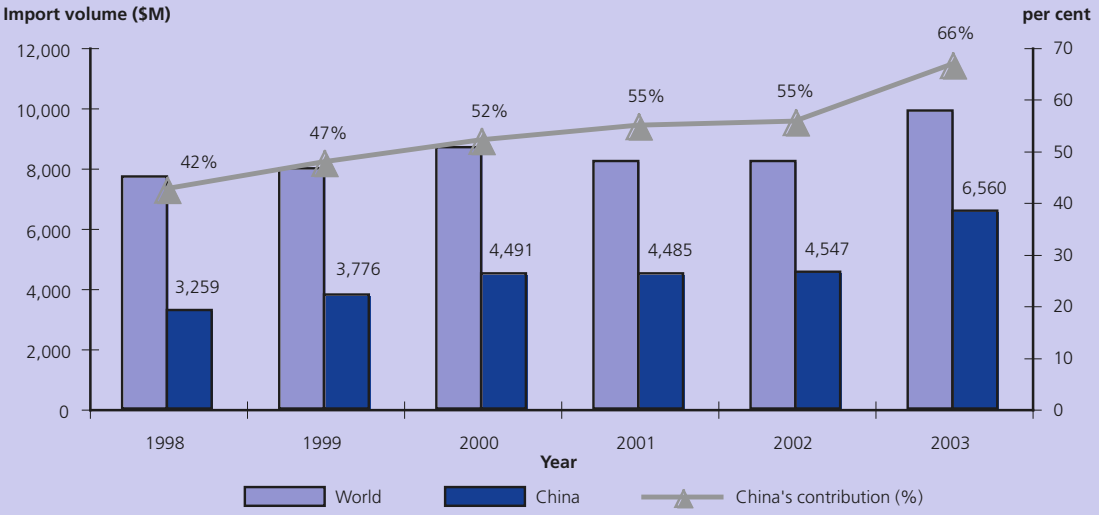
If certification is required, the mark of the exporting country may not be accepted by the importing country, which may insist on the use of its own certification programme before market clearance can be given. For instance, the "Global Approach", developed as a complement to the EC's New Approach to standardization (see earlier Box 9), describes various conformity assessment activities ("modules") and designates the bodies operating the individual procedures. For all modules, these so-called "notified" bodies have a special role in carrying out assessments, gathering documentation from suppliers or exerting oversight over other third-party institutions. Only notified bodies may ultimately give final approval in the regulated sectors, including the right to affix the "CE mark" on the product, without which products subject to "essential requirements" under the "New Approach" may not be put on the market. This means that, for many countries, depending on the required conformity assessment procedure, product samples have to be shipped to the EC for testing and certification by a notified body or expenses must be paid for EC inspectors to conduct necessary inspections or quality system registrations on-site. There is also the possibility that laboratories in the exporting country are subcontracted by EC certification bodies and forward their test data to the notified body for evaluation and final product approval (National Research Council, 1995). A brief description of the "Global Approach" and an example of how exporters deal with it is given in Box 11.

Box 11: The EC's "Global Approach to Testing and Certification" and the Toy Directive

As a complement to the EC's New Approach (see Box 9 above), the "Global Approach to Testing and Certification" and its "CE" mark ("Conformité Européenne", French for European Conformity) were created to ensure conformity of a product with applicable Directive(s). Directives contain "essential requirements" to be achieved in terms of product safety, etc., but do not stipulate the technical solutions for attaining them. Those are specified by European harmonized standards whose adoption is voluntary, but products meeting these standards automatically benefit from a presumption of conformity with the essential requirements set out in the Directive. Products covered by one of the Directives must bear the CE mark to gain marketing approval. The CE mark must be affixed on 21 types of products (as of January 2005) in all the 28 Member States of the European Economic Area (EEA). Manufacturers may choose among eight conformity assessment activities ("modules") to demonstrate compliance. Each Directive specifies which module or combination of modules is admissible, which may vary in relation to the perceived risks of the covered products. The modules are "Internal production control" (Module A), "EC type-examination" (Module B), "Unit verification" (Module G) and "Full quality assurance" (Module H), of which modules A, G and H refer to attestations that both the design of a product and produced units conform to the provisions of the applicable Directive. Module B refers to design only and may be combined with one of four modules referring to production: "Conformity to type" (Module C), "Production quality assurance" (Module D), "Product quality assurance" (Module E) and "Product verification" (Module F). Modules D, E and F, while normally used in combination with module B, may in special cases (for example, when dealing with certain products of very simple design and construction) be used on their own (European Commission, 1993a). The extent to which EC-accredited conformity assessment bodies, so-called "notified bodies" that have the exclusive right to award the CE mark, must be involved varies between the modules. The modular approach will be illustrated below in relation to toys.

The Toys Directive 88/378/EEC was introduced in 1988 as a means to protect the health and safety of children. It identifies essential requirements to protect children from general risks (protection against health hazards or physical injuries) and particular risks (physical and mechanical properties, flammability, chemical properties, electrical properties, hygiene and radioactivity). In addition, the Directive requires the compilation of a Technical File which contains all the details regarding design, manufacture and operation of the toy as well as test data and results, on the basis of which conformity with the Toys Directive is assessed. There are currently eight European harmonized standards (the "EN 71" series) pertaining to the Toys Directive. Toy manufacturers are legally responsible for ensuring that their products meet the essential requirements set out by the Directive (depending on the type of toy, e.g. electric toys, other Directives may apply as well). While free to choose production techniques, the manufacturer benefits from the presumption of conformity in case the technical solutions specified by the European standards are followed. In that case, the manufacturer may pursue a self-declaration of conformity on the basis of the Technical File (Module A). If the European standards are not followed or followed only in part, a "notified body", accredited by the competent authorities of a Member State, verifies the Technical File, tests a sample of the toy and, if successful, issues an EC type-examination certificate to the manufacturer (Module B in combination with Module C). In both cases, the manufacturer must keep the Technical File available for future inspection. Once toys have been properly CE marked, they enjoy free circulation in the EEA. Member States are responsible for performing sample checks on toys being sold in their markets to verify their continuing conformity. Although "notified bodies" must reside in Europe, some have affiliates in third countries to assist local manufacturers. However, only in a few countries, with which the EC has concluded a Mutual Recognition Agreement (MRA), the actual certification can be carried out by local "designated bodies" in lieu of EC "notified bodies". This is the case, for instance, with the United States. Also, when the manufacturer is not a registered business in a EC Member State, a European Authorized Representative (EAR) must be designated who will keep the Technical File, serve as a contact person, provide information to competent authorities, and bear the legal responsibility. Alternatively, a distributor or an agent in Europe may act as the regulatory representative. The practical aspects of how to demonstrate conformity with the Toys Directive as a non-EC producer seems to be of increasing importance given the growth of toys imports from outside the EC, especially from China, in recent years.

European Union toy imports from Non-EU countries



Source: UN COMTRADE.

A frequent conformity assessment requirement relates to the certification of management systems. Commonly, registration with an accredited body according to international standards, such as the ISO 9000 series on quality management or the ISO 14000 series on environmental management systems, must be demonstrated. While such proof of good business practices is normally demanded by purchasers (and in the case of powerful buying associations may become *de facto* mandatory requirements), governments may also include prescriptions on management guidelines in some of their regulations. A case in point is the Hazard Analysis and Critical Control Points (HACCP) System, developed by the Codex Alimentarius Commission (see Box 12) and referenced widely in countries' food regulations. For instance, the European Communities have put in place Directive 93/43/EEC concerning the hygiene of foodstuffs, mandating the use of HACCP principles and encouraging the development of guidelines to good hygiene practice "where appropriate, having regard to the Recommended International Code of Practice, General Principles of Food Hygiene of the Codex Alimentarius" (European Commission, 1993b: Article 5.2). HACCP principles are increasingly important for developing countries, given the importance of the food-processing sector in many of them and the extensive use of HACCP as part of food regulations, especially in the developed world. The implementation of HACCP can be challenging in terms of required skills and infrastructure, as process controls and third-party certification have to take place locally. This is confirmed by case studies conducted for Jamaica, Kenya, Malaysia, Mauritius, Namibia and Uganda by the ITC and Commonwealth Secretariat (2003), which cite compliance with SPS measures as being of primordial concern to their exporters.

Box 12: International food safety standards and HACCP

There are a number of international food safety standards, mainly developed by the FAO/WHO Codex Alimentarius Commission (CAC). Observance of international standards by developing countries, while costly initially, is often necessary to maintain market access and reduce the rate of rejection of unsafe or spoiled products in export markets.

In order to fulfil hygiene requirements, the CAC recommends a Hazard Analysis Critical Control Point (HACCP) approach. Developed in the 1960s by NASA, HACCP is a risk management tool at the firm level that relies on preventive measures, rather than a unique control of the final good, in order to eliminate contaminants at critical areas in the food production and distribution process. Under HACCP, food-related businesses are responsible for analysing how hazards may enter the product, establishing effective control points for those hazards and monitoring and updating the system to assure high levels of food safety. HACCP must be carried out in the exporting country. The burden of implementing HACCP lies with individual firms, but in order to achieve international recognition, the conformity assessment infrastructure must exist to deliver and renew certifications and perform periodic controls.

Already wide-spread in industrialized countries, HACCP has become increasingly popular in other countries. Adoption of and compliance with HACCP principles constitute a necessary, and sometimes even sufficient, condition for meeting international standards set by the CAC. Conformity with HACCP principles must then be certified by a domestic certification body and importing countries may require this body to meet the relevant ISO/IEC standards and/or the CAC "Guidelines for the Design, Operation, Assessment, and Accreditation of Food Import and Export Inspection and Certification Systems." CAC also developed guidelines on applying HACCP systems for small and less-developed businesses. An importing country may still insist on carrying out its own inspections in the exporting country. For example, when the EC imposed a ban on shrimp exports from Bangladesh for food safety reasons, EC inspectors evaluated on-site the measures put in place by local producers and authorities.

Source: International Food Policy Research Institute: www.ifpri.org; US FDA's Food Safety Gateway: http://www.foodsafety.gov/~fsg/fsghaccp.html; and World Health Organization: http://www.who.int/foodsafety/fs_management/haccp/, all websites accessed on 24 February 2005.

The systematic reporting of conformity assessment procedures as barriers to trade is extremely rare, especially for developing countries, where, at best, some anecdotal evidence is available. One example of a regular, systematic collation of foreign trade barriers that includes a section on conformity assessment for all reviewed trading partners, is the USTR's National Trade Estimate Report on Foreign Trade Barriers (NTE). From the 2004 NTE, it appears that mandatory certification in the importing country is relatively frequent, especially in the food sector. Similarly, a number of countries are listed that only accept test results from laboratories in their own country as supporting documentation for a mandatory certification (see Box 13 for selected examples). However, there are also cases where the report simply notes that, despite certain regulations, imports are, in practice, admitted into the country with little reference to actual conformity.[124]

Box 13: Selected examples of conformity assessment requirements faced by US exporters

The National Trade Estimate Report on Foreign Trade Barriers (NTE) is an annual survey that has been carried out for almost 20 years by the USTR to identify significant foreign barriers to US exports in main trading partner countries (USTR, 2004). In 2004, almost 60 export markets were covered. For each export market, the report contains a section on "standards, testing, labelling and certification (including unnecessarily restrictive application of sanitary and phytosanitary standards and environmental measures, and refusal to accept US manufacturers' self-certification of conformance to foreign product standards)". The examples given below are randomly selected to illustrate mandatory certification and testing requirements by the importing country, often, but not only relating to the food sector.

Certification

Many countries, both developed and developing, have restrictive certification requirements only in a few areas, notably in the biotechnology sector. Switzerland, for instance, grants marketing approval for bio-engineered foods and additives exclusively through certification by the Federal Food Safety Office.

The Thai government requires a compulsory certification by the Thailand Industrial Standards Institute (TISI) of 60 products in ten sectors, including: agriculture, construction materials, consumer goods, electrical appliances and accessories, PVC pipe, medical equipment, LPG gas containers, surface coatings and vehicles.

India has identified 159 specific commodities (including food preservatives, milk powder, condensed milk, infant milk foods, colour dyes, steel, cement, electrical appliances and dry cell batteries) that the Bureau of Indian Standards (BIS) must certify before the products are allowed to enter the country. To be certified, exporters/manufacturers must either establish a presence in India or name a local Indian representative to accept responsibility, pay an annual fee as well as a percentage of the invoice value of shipments to India, and subject all certified exports to inspection.

Testing

In Indonesia, all imported food products must be tested by the Agency for Drug and Food Control (BPOM). Fees for such testing range from Rp 50,000 ($6.00) to Rp 2.5 million ($300) per item, and between Rp 1 million ($120) to Rp 10 million ($1200) per product.

El Salvador requires importers to deliver samples of all foods for laboratory testing to the Ministry of Public Health, which upon approval issues the product registration numbers that allow the imported goods to be sold at retail outlets. In the past, some processed foods that were approved in the United

[124] This is the case, for instance, for Cameroon. See USTR (2004): 35.

States were reported to have been rejected after analysis in El Salvador, thereby barring their sale. The United States and the Salvadorian Ministry of Public Health initiated discussions on this issue in 2002. Apparently, an agreement has not been reached yet to allow entry of US-approved products, and this issue forms part of the CAFTA negotiations on acceptance of testing results.

In the manufacturing sector, it is often pharmaceuticals and chemicals that are subject to double testing in the importing country. The Korean government, for instance, requires that each shipment of a drug imported into the Republic of Korea for commercial purposes be tested once registered.

For Argentina, the report notes conformity assessment procedures, including re-testing, for US exports of low voltage electrical products (household appliances, electronics products and electrical materials), toys, covers for dangerous products, gas products, construction steel, personal protective equipment and elevators.

In order to address problems faced by exporters in an importing country with rigid prescriptions on the conformity assessment institutions, and activities or procedures that may be used, governments often engage in the negotiation of MRAs. Divergent ideas about which conformity assessment procedures to conduct, which bodies to consider competent, and the multitude of systems at the national level often make the conclusion of MRAs more time-consuming and costly than originally foreseen. For instance, in the US-EC MRA, differences in accreditation concepts needed to be addressed. The EC had difficulty in accepting US accreditation programmes that were largely private, decentralized and of a complex nature, as they had arisen in a rather uncoordinated fashion through case-by-case responses to specific industry demands. Conversely, the EC required some form of government involvement in accreditation, which prompted the United States to introduce the concept of governmental recognition of private accreditors. It developed the National Voluntary Conformity Assessment Systems Evaluation (NVCASE), administered by NIST, to provide for government recognition of its multiple private accreditation institutions and create accreditation programmes in sectors where there were none.

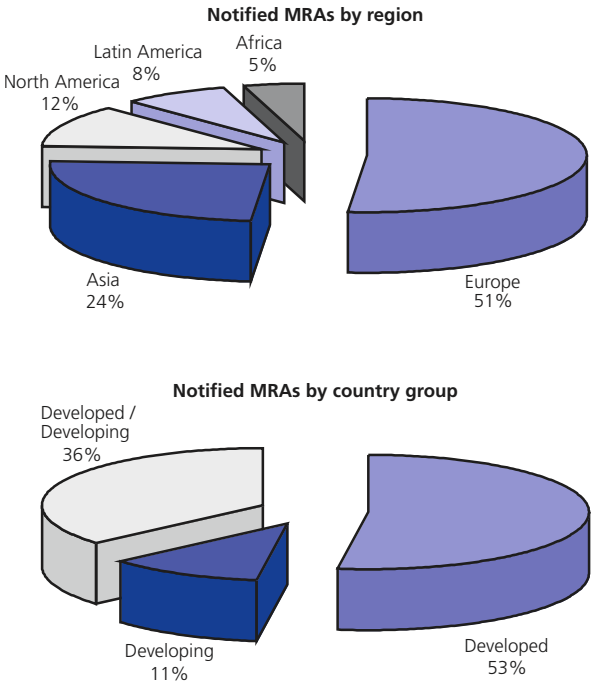
In contrast, the United States objected to the fact that there was no mechanism by which a non-European organization could become a "notified" body exclusively entitled to perform certain testing and certification operations under the EC's "Global Approach to Testing and Certification". The MRA ultimately comprised six sectoral annexes containing detailed provisions on the degree of acceptance of conformity assessment results. For instance, for electrical safety equipment, the test reports of US bodies are to be accepted by EC authorities "in the same way that reports from European Community notified bodies are accepted", or for electromagnetic compatibility devices, the test reports as well as certificates "shall be recognized by the Regulatory Authorities of the other Party without any further conformity assessment of the products" (US Mission to the European Union, 1998: pp. 21 and 36). The difficulties involved in the US-EC MRA negotiations are also underlined by the fact that six sectoral annexes with differing levels of commitments had to be devised (telecommunication equipment, electromagnetic compatibility (EMC), electrical safety, recreational craft, pharmaceutical good manufacturing practices (GMPs) and medical devices). A general acceptance of test results, inspections and product/systems certifications for all 11 sectors that had originally been under negotiation – an objective that, at least, the European side had stated repeatedly – turned out not to be possible (Wilson, 2000). Wilson also observed that differences in assurance needs in certain sectors were simply too wide, in particular since the "European system does not rely on firms' self-declaration of conformity as widely as the US system does" (Wilson, 2000: p. 3).

In sum, the greater the difference between existing systems for conformity assessment in two countries, the greater the difficulties in negotiating and maintaining MRAs. Differences of view in regard to the classes of products subject to third-party assessment or government control, as well as on the technical aspects of what constitute appropriate procedures, mistrust in the competence of conformity assessment bodies, and different accreditation requirements and procedures all increase the time and resources needed to achieve

mutual recognition. This is why, in general, MRAs seem more likely between countries at higher and similar levels of development. By and large, this reality seems to be confirmed by the number of MRAs notified to the WTO under TBT Article 10.7 (see Chart 11). The low number of MRAs with African participation is particularly noteworthy, as well as the fact that more than half of all notified agreements involve developed countries only.

Of course, the levels of ambition also vary amongst different government-to-government MRAs. Any MRA will clearly specify the product sectors to which it applies, which may be only a few. There is also a difference as to whether merely raw test/inspection data by accredited foreign bodies are admitted as inputs into domestic compliance decisions or whether recognized foreign bodies are entitled to give de facto final marketing approval in the importing country. The former appears to be the case, for instance, for medical devices in the context of the US-EC MRA, where US conformity assessment bodies listed in the annex only qualify to provide reports on quality systems to an EC notified body for its endorsement. While endorsement is meant to be the norm, the notified body may request a re-inspection or, ultimately, perform the quality systems evaluation itself (US Mission to the European Union, 1998: pp. 90-91).

Chart 11
Notified MRAs by region and country group



Source: Based on WTO Secretariat (2005c).

It is difficult to draw any general conclusions on the level of ambition from the information contained in the database on MRA notifications under TBT Article 10.7. Sometimes the notifications do not specify the products covered, and if they do, the product range is usually quite narrow. The Japan-US MRA, for instance, is confined to the mutual acceptance of each party's grading system of organic agricultural products and processed organic foods. A number of agreements refer to the acceptance of test reports only, such as the MRA between Chinese Taipei and Canada to accept test reports for specified information technology equipment. Some MRAs specifically include the acceptance of each other's certificates, for example the MRA between Australia and Thailand on road vehicles, equipment and parts. Wilson (1995) and Stephenson (1997) caution that the acceptance of certifications granted by other countries is in practice quite rare. For the members of the Asia Pacific Economic Co-operation (APEC), they find that MRAs on certification issues are often not only limited to specific sectors, but also subject to special conditions.

3. CONCLUSIONS

While information on standardization at the international level is fairly comprehensive and easily accessible, for most countries it is very difficult to obtain a complete picture of standardization infrastructure at the national level on the basis of available information. The emerging parts of the iceberg are ISO plus a few other international standardization bodies and the member bodies of ISO. Information on whatever takes place outside of this system is scattered, incomplete and heterogeneous.

The overview suggests that the standards development process organized by national, regional and international standards institutions is progressively evolving. The role of international bodies has gained prominence. The national standardization infrastructures of most industrialized countries are now integrated into the network of international standardization. In Europe, for instance, adoption of European standards

is mandatory for national member bodies and European standards organizations transpose the international standards into European standards. Many developing countries are also participating in the system. Close to 40 per cent of Malaysian standards are "aligned" with international standards and this proportion is rapidly growing as more standards are revised and new standards developed are increasingly based on international standards.

A considerable number of low-income and transition countries have not, however, followed the trend. Their national institutions are not part of the international network. ISO, for instance, has only three member bodies from LDCs and more than half of LDCs have no formal contact with ISO. Contrary to expectations, countries with scarce resources and limited capacity do not necessarily have many adopted international standards. In fact, resource constraints seem to restrict poor countries' integration into the international standardization system as much if not more than their own standardization activities.

The development process for voluntary, consensus based standards, and in particular the procedures used by ISO and many of its member bodies, are strictly regulated by the WTO and ISO codes of good practice. The process consists of several distinct but closely related activities. It is fairly open and transparent but producers who have clear priorities and are usually better organized than consumers typically play the leading role. In some industrial countries, governments actively promote the participation of consumers by funding consumer organizations. Institutions which compete with less formal private standardization initiatives are concerned that the whole process may be too slow.

In principle, the trend is towards separating standardization activities from regulatory activities, with the former left to the private sector and the latter with the public sector. The separation between public and private standard setting, however, is not always clear cut. The organization of the process of standardization varies widely across countries. In general, regulations concerning safety, health and the environment are issued by governments. Often, however, the specific measures that satisfy the objectives of government regulations are spelled out in technical standards developed by private organizations. In European countries, for instance, the government refers to privately developed standards in regulations. Standards institutions in poorer countries are generally in the public sector, with little or no participation of the private sector. In a small number of countries, mainly in Africa, the CIS and the Middle-East, the share of national standards with a mandatory status exceeded 50 per cent of the total number of standards published at the end of 2002.

Improving participation of developing countries in international standardization is crucial. This has been recognized for several decades and, as discussed below, numerous initiatives have been undertaken to improve the situation. Recent evidence, however, suggests that these initiatives have not achieved much improvement yet. And progress may be slow as the main difficulty for developing countries seems to be the lack of expertise needed for participation in the work at the technical level on the formulation of standards and the limited support from the private sector.

Conformity assessment is an everyday reality in commercial transactions. Purchasers and regulators want to ensure that the requirements and standards they impose on suppliers are fulfilled. Assessment procedures carried out by suppliers themselves or third-parties add to transactions costs. Sometimes these costs can be larger for foreign suppliers than for domestic ones. This may be the case, for instance, if a certification of compliance with a product regulation can only be given by domestic bodies in the importing country. If the exporter is required to comply with the same regulation in its home country, a double examination puts it at a disadvantage. By the same token, it is understandable that regulators wish to rely on conformity assessment results from sources in whose competence and integrity they have full confidence.

A lot of international cooperation is taking place to establish confidence in the work of conformity assessment bodies in other countries. An efficient way forward seems to be the conclusion of mutual recognition agreements (MRAs) between accreditation bodies such that the results of any laboratory or other conformity assessment body accredited by one of the parties are accepted in any other country. In order for this happen, it is important that common standards on best practices are adhered to, giving other parties confidence in the work of their partners. However, while such MRAs may, in practice, help purchasers to gain trust in the results

of foreign bodies, it is not certain to what extent they are relied upon by governments in regulated sectors. A range of government-to-government MRAs, which are often bilateral or plurilateral with only a few parties at similar and higher levels of development, show that commitments to mutual acceptance of conformity assessment results in sectors involving health, safety and environmental concerns tend to be quite limited.

In developing countries, the provision of conformity assessment services is often inadequate or costly. Given that many activities, such as testing, inspection and certification can be profit-making enterprises, the question arises what factors impede their provision by the private sector and to what extent governments need to step in. Regional provision, especially of accreditation services, has proven a viable way forward for smaller and poorer countries. Considerable technical assistance is provided from a variety of sources in the endeavour to build the necessary conformity assessment infrastructure. Priority is usually given to conformity assessment needs of sectors of particular export interest in developing countries facing stringent conformity assessment requirements in major export markets.

A major problem in drawing a conclusion on where efforts in the area of conformity assessment and trade should be concentrated is the absence of empirical studies. For instance, it would be important to know how the costs of negotiating an MRA compare to the savings made in terms of reduced testing needs. While there is an almost confusing multitude of publications describing institutional arrangements and conformity assessment concepts at length, often in very general terms and without concrete examples, there is a shortage of comparative analyses of conformity assessment practices across sectors or countries. There seems to be a clear need for all organizations involved in the field of conformity assessment to shift their research focus towards more applied, quantitative analysis of existing experiences and a systematic collection of cost data.

APPENDIX TABLES

Appendix Table 1
World Standard Services Network list of international standardizing bodies

- **BIPM** – Bureau international des poids et mesures
  Scope: Units, standards and methods of measurement of physical quantities.
- **BISFA** – International Bureau for the Standardization of Man-made Fibres
  Scope: Specification and testing of man-made fibres.
- **CCSDS** – Consultative Committee for Space Data Systems
  Scope: Space-related information technologies, data handling techniques.
- **CIB** – International Council for Research and Innovation in Building and Construction
  Scope: Pre-standardization work in the field of building and construction.
- **CIE** – International Commission on Illumination
  Scope: Metrology in the fields of light, lighting and colour; science, technology and art of light, lighting and colour.
- **CIMAC** – International Council on Combustion engines
  Scope: Acceptance tests for combustion engines; noise; pollution.
- **CODEX** – Codex Alimentarius Commission
  Scope: Specification, sampling and analysis of food products; food additives; food hygiene; pesticide residues; contaminants; labelling; essential composition; nutritional aspects; veterinary drug residues; food import/export inspection and certification systems.
- **CORESTA** – Cooperation Centre for Scientific Research Relative to Tobacco
  Scope: Analysis and testing of tobacco and tobacco products.
- **FDI** – World Dental Federation
  Scope: Dental materials; dental instruments and equipment; working environment of the dentist.
- **FIATA** – International Federation of Freight Forwarders Associations
  Scope: Freight forwarding services.
- **IAEA** – International Atomic Energy Agency
  Scope: Nuclear energy; nuclear and radiation safety; radioisotopes; documentation.
- **IATA** – International Air Transport Association
  Scope: Procedures for airport and passenger services. Procedures for cargo services, including shipping of live animals and dangerous goods. Minimum standards for IATA accreditation of cargo and passenger agents and their modus operandi.
- **ICAO** – International Civil Aviation Organization
  Scope: Air transport; air navigation; aviation safety; airports design; airworthiness; aircraft noise; international law, etc.
- **ICC** – International Association for Cereal Science and Technology
  Scope: Testing and analysis of cereals and cereal products.
- **ICDO** – International Civil Defence Organisation
  Scope: Disaster management and prevention.
- **ICID** – International Commission on Irrigation and Drainage
  Scope: Irrigation and drainage; terminology.
- **ICRP** – International Commission on Radiological Protection
  Scope: Radiation hazards and radiation protection.
- **ICRU** – International Commission on Radiation Units and Measurements
  Scope: Radiation units and measurements; radiation dosimetry.
- **ICUMSA** – International Commission for Uniform Methods of Sugars Analysis
  Scope: Methods of sugar analysis.
- **IDF** – International Dairy Federation
  Scope: Milk and milk products (composition, sampling and analyses); milk farm and factory equipment; disinfectants.
- **IEC** – International Electrotechnical Commission
  Scope: Electrical and electronic engineering.

- **IETF** – Internet Engineering Task Force
  Scope: Internet architecture and operation.
- **IFLA** – International Federation of Library Associations and Institutions
  Scope: Bibliographic control and other aspects of library matters.
- **IFOAM** – International Federation of Organic Agriculture Movements
  Scope: Organic agriculture and processing.
- **IGU** – International Gas Union
  Scope: Gas transmission distribution and utilization safety; use of SI units in gas industry.
- **IIR** – International Institute of Refrigeration
  Scope: Tests of thermal performance of insulated vehicles; tests of insulating materials; refrigerated storage and transport of perishable foodstuffs; food freezing; refrigerating equipment; terminology.
- **IIW** – International Institute of Welding
  Scope: Welding and allied processes.
- **ILO** – International Labour Office
  Scope: Working conditions and environment; occupational safety and health; equality of treatment between men and women; non-discrimination; rights of tribal and indigenous peoples; employment.
- **IMO** – International Maritime Organization
  Scope: Maritime safety; prevention of pollution from ships; facilitation of international maritime traffic.
- **IOOC** – International Olive Oil Council
  Scope: Table olives; olive oil; olive-pomace oils.
- **ISO** – International Organization for Standardization
  Scope: All fields except electrical and electronic engineering.
- **ISTA** – International Seed Testing Association
  Scope: Seed testing.
- **ITU** – International Telecommunication Union
  Scope: ITU-T: All aspects of telecommunication equipment, systems, networks and voice and non-voice services. All related technical, operating and administrative areas. ITU-R: Radiocommunications.
- **IULTCS** – International Union of Leather Technologists and Chemists Societies
  Scope: Analysis and testing of leather.
- **IUPAC** – International Union of Pure and Applied Chemistry
  Scope: Nomenclature, terminology, symbols, quantities and units in chemistry.
- **IWTO** – International Wool Textile Organization
  Scope: Testing of wool textiles.
- **OIE** – International Office of Epizootics
  Scope: Standards for the international trade in animals and animal products, diagnostic techniques, reference reagents, vaccines and procedures for international reporting of transmissible animal diseases.
- **OIML** – International Organization of Legal Metrology
  Scope: Measuring methods and units; measuring devices and instruments; verification and control of measuring devices (from a legal point of view).
- **OIV** – International Vine and Wine Office
  Scope: Methods of wine analysis; oenology; labelling.
- **OTIF** – Intergovernmental Organisation for International Carriage by Rail
  Scope: International carriage of dangerous goods by rail.
- **RILEM** – International Union of Laboratories and Experts in Construction Materials, Systems and Structures
  Scope: Nomenclature and testing of building materials and structures.
- **UIC** – International Union of Railways
  Scope: International railway traffic.
- **UN/CEFACT** – Centre for the Facilitation of Procedures and Practices for Administration, Commerce and Transport
  Scope: Trade facilitation and electronic business.
- **UNESCO** – United Nations Educational, Scientific and Cultural Organization
  Scope: Scientific and technological information and documentation, libraries and archives.

- **UPU** – Universal Postal Union
  Scope: Compatible postal operations.
- **WCO** – World Customs Organization
  Scope: Classification; customs valuation; customs procedures; customs applications of computers; harmonization of Rules of Origin.
- **WHO** – World Health Organisation
  Scope: All matters directly or indirectly related to health, including biological and pharmaceutical and similar products and substances, food additives, pesticides, pesticide residues in food, food safety, air and water quality, diagnostic procedures, terminology, nomenclature and classification.
- **WIPO** – World Intellectual Property Organisation
  Scope: Patents; trademarks; industrial designs; appellations of origin; copyright; neighbouring rights; classification systems.
- **WMO** – World Meteorological Organization
  Scope: Meteorological and hydrological observations; agricultural, aeronautical and marine meteorology; data processing and telecommunications.

Source: http://www.wssn.net/WSSN/print/listings/links_international.html

Appendix Table 2
ISO Member Bodies: resources and standardization activities, 2002

Country	ISO status	Staff directly employed by ISO member	Annual budget 2002 (Thousands of Swiss francs)	Number of organizations to which standards development work is delegated	Government subsidy in % of total revenue	Total number of standards published at 31/12/2002	Voluntary standards in % of total number of standards	Number of international standards adopted as national standards at 31/12/2002
Africa								
Algeria	Member	75	602	130	71	6177	98	5360
Angola	Correspondent	...	341	...	100	...	...	...
Benin	Subscriber	10	300	120	60	4	50	...
Botswana	Member	66	4503	...	77	181	93	64
Burundi	Subscriber		44	...	100	...	...	...
Cameroon	Correspondent	7	90	...	80	204	95	170
Congo, Democratic Rep. of	Correspondent	141	7375	...		2	100	...
Côte d'Ivoire	Member	23	483	...	12	560	60	186
Egypt	Member	825	7269	...	100	4183	91	959
Eritrea	Subscriber	34	495	17	...	334	0	...
Ethiopia	Member	328		...		389	0	...
Ghana	Member	367	2744	...	73	226	0	370
Kenya	Member	657		...	56	3021	35	1243
Lesotho	Subscriber	11	100	...	100	...	...	...
Libya	Member	40		...	90	479	0	...
Madagascar	Correspondent	...	175	...	53	67	90	...
Malawi (1999)	Correspondent	145	2100	...	52	450	70	155
Mali	Subscriber	45	250	...	100		75	
Mauritius	Member	71	1600	...	63	149	92	38
Morocco	Member	25	600	8	100	3707	98	1221
Mozambique	Correspondent	15	97	...	82	16	94	5
Namibia	Correspondent	6		...	100	...	...	...
Niger	Subscriber	7	48953	...	100	...	...	...
Nigeria	Member	164	331	10	77	578	96	9
Rwanda	Correspondent	...	639	...	100	6	50	6
Senegal	...	...	...	...	...	...	...	...
Seychelles	Correspondent	...	1500	...	73	67	88	8
South Africa	Member	1032	45000	...	26	4966	99	1430
Sudan	Correspondent	720	3500	4		628	0	1100
Swaziland	Correspondent	3	...	...	100	...	...	...

Appendix Table 2
ISO Member Bodies: resources and standardization activities, 2002 (cont'd)

Country	ISO status	Staff directly employed by ISO member	Annual budget 2002 (Thousands of Swiss francs)	Number of organizations to which standards development work is delegated	Government subsidy in % of total revenue	Total number of standards published at 31/12/2002	Voluntary standards in % of total number of standards	Number of international standards adopted as national standards at 31/12/2002
Tanzania	Member	123	1884	...	39	738	68	328
Tunisia	Member	104	2154	...		5401	85	4320
Uganda	Correspondent	85	1696	...	75	467	70	121
Zambia	Correspondent	...	216	1	85	400	97	12
Zimbabwe	Member	72	2565	...	50	1195	96	195
Asia								
Australia	Member	478	68573	2	2	6664	75	1877
Bangladesh	Member	478	2347	...	11	1729	92	115
Brunei Darussalam	Correspondent	...	...	...	100	25	100	14
Cambodia	Subscriber	...	...	25	100	10	80	3
China	Member	60	16580	...	100	20206	86	8931
Chinese Taipei	...	...	...	...	...	...	...	...
Fiji	Subscriber	5	54	...	100	17	65	4
Hong Kong, China	Correspondent	214	26700	...	100	...	...	...
India	Member	1996	23844	...	...	17764	99	1070
Indonesia	Member	123	2077	14	100	5868	97	1100
Japan	Member	108	26500	588	100	9009	100	...
Korea, Dem. People's Rep. of	Member	187	100	204	100	11100	0	752
Korea, Rep. of	Member	244	32732	...	100	15176	100	7054
Macao, China	Correspondent	60	5000	...	92	10	0	...
Malaysia	Member	40	2500	1	100	3702	98	1064
Mongolia	Member		587	102		3776	21	1057
Nepal	Correspondent	104	387	...	100	654	99	30
New Zealand	Member	48	5800	2	...	2371	95	911
Pakistan (1999)	Member	152	630	2000	...	4602	99	1902
Papua New Guinea	Correspondent	13	286	...	23	1400	86	1400
Philippines	Member	87	679	25	100	1941	95	1167
Singapore	Member	544	28910	...	82	824	76	273
Sri Lanka	Member	304	1774	...	21	1627	98	448
Thailand	Member	485	11997	...	100	2347	97	272
Viet Nam	Member	964		...	60	5370	94	1400

Country	ISO status	Staff directly employed by ISO member	Annual budget 2002 (Thousands of Swiss francs)	Number of organizations to which standards development work is delegated	Government subsidy in % of total revenue	Total number of standards published at 31/12/2002	Voluntary standards in % of total number of standards	Number of international standards adopted as national standards at 31/12/2002
Central and Eastern Europe, Baltic States, CIS								
Albania	Correspondent	25	250	70	95	7038	100	3479
Armenia (1999)	Member	420	1055	20	4	272	70	8
Azerbaijan	Member		1440	8	70	567	10	6
Belarus	Member	46	1000	39	100	20593	50	2319
Bulgaria	Member	1174	300	75	43	17194	100	929
Czech Rep.	Member	176	6790	...	36	26082	100	5379
Estonia	Correspondent	20	621	22	51	10266	100	1978
Georgia	...	...	...	...	...	...	...	...
Hungary	Member	120	6715	...	26	22283	100	1488
Kazakhstan	Member	28	3867	48	100	400	0	22
Kyrgyzstan	Correspondent	136	296	3	100	515	50	6000
Latvia	Correspondent	29	466	40	70	10739	100	4207
Lithuania	Correspondent	58	1415	745	80	11743	100	708
Moldova, Rep. of	Correspondent	185	299	...	100	574		110
Poland	Member	294	8738	8	75	25613	98	6843
Romania	Member	86	885	...		22710	100	5718
Russia	Member	190	9440	28	82	22219	60	560
Slovakia	Member	108	2948	420	57	26295	100	2031
Turkmenistan (1999)	Correspondent	22	4010	8	2	600	0	12
Ukraine	Member	132	1242	1	100	23585	75	3010
Uzbekistan (1999)	Member	925	...	...	15	2679	0	...
Latin America								
Antigua and Barbuda	Subscriber	...	139	...	90	1	0	...
Argentina	Member	170	6261	...		7710	91	101
Barbados	Member	29	1200	...	90	200	78	70
Bolivia	Correspondent	43	1200	11		1300	65	200
Brazil	Member	73	5771	...	17	9271	100	340
Chile	Member	50	1738	...	11	2583	60	651
Colombia	Member	170	7200	5	2	5000	100	1370
Costa Rica	Member	16	885	...	2	344	100	80
Cuba	Member	1068	6	...	60	4278	94	2353
Dominica	Subscriber	6	250	...	100	...	...	...

Appendix Table 2
ISO Member Bodies: resources and standardization activities, 2002 (cont'd)

Country	ISO status	Staff directly employed by ISO member	Annual budget 2002 (Thousands of Swiss francs)	Number of organizations to which standards development work is delegated	Government subsidy in % of total revenue	Total number of standards published at 31/12/2002	Voluntary standards in % of total number of standards	Number of international standards adopted as national standards at 31/12/2002
Dominican Rep. (1999)	Subscriber	60	503	...	62	523	77	24
Ecuador	Member	87	1399	...	4	2318	75	27
El Salvador	Correspondent		375	2		904	92	835
Grenada	Subscriber	9	267	...	65	117	89	21
Guatemala	Correspondent	7	88	5	100	706	9	16
Guyana (1999)	Subscriber	42	28	...	98	172	...	94
Honduras	Subscriber	...	...	...	...	12	80	12
Jamaica	Member	149	8412	...	20	343	56	45
Mexico	Member	104		7	100	5570	85	...
Nicaragua	Correspondent	...	204	...	100	...	10	...
Panama	Member	8	167	...	100	522	85	10
Paraguay	Correspondent	173	2532	...	70	529	99	17
Peru	Correspondent	273	15270	...	11	3800	99	202
Saint Lucia	Correspondent	11	333	25	100	57	63	10
Saint Vincent and the Grenadines		...	...	...	...	...	...	...
Trinidad and Tobago	Member	200	4225	...	39	505	70	255
Uruguay	Member	35	1500	...	...	1561	91	254
Venezuela	Member	67	2435	17	...	3804	90	454
Middle East								
Bahrain	Member	21	977	2	95	1685	75	245
Iran	Member	1322	33551	1	29	6400	93	4800
Iraq	Member			...	...	...	...	...
Israel	Member	730	59700	...	3	2475	76	906
Jordan	Member	165	6502	...	100	1607	65	326
Kuwait	Member		2250	5	88	1247	72	62
Lebanon	Correspondent	6	1000	2	100	655	85	86
Oman	Member	70	...	4	100	1780	94	137
Palestine	Subscriber	91	730	...	100	621	43	55
Qatar	Correspondent	123	6112	2	100	1071	79	222
Saudi Arabia	Member	522	27000	...	89	2136	11	268
Syrian Arab Rep.	Member	110	300	...	100	2250	18	
United Arab Emirates	Member	18	3750	10	100	1062	75	...
Yemen	Correspondent	134	965	...	85	...	...	...

Country	ISO status	Staff directly employed by ISO member	Annual budget 2002 (Thousands of Swiss francs)	Number of organizations to which standards development work is delegated	Government subsidy in % of total revenue	Total number of standards published at 31/12/2002	Voluntary standards in % of total number of standards	Number of international standards adopted as national standards at 31/12/2002
North America								
Canada	Member	88	11000	4	56	2143	100	1053
USA	Member	77	24426	194	3	...	100	836
Western Europe								
Austria	Member	120	18000	1	11	14106	74	2219
Belgium	Member	42	6570	2	29	17170	99	11000
Bosnia and Herzegovina	Member	23	423	194	60	13626	40	2158
Croatia	Member	149	4925		49	6057	100	2699
Cyprus	Member	13	1087	3	85	10000	97	10000
Denmark	Member	176	27235		29	17496	95	
Finland	Member	60	9000	15	28	16532	99	2698
France	Member	630	119500	28	...	26544	99	9911
Germany	Member	727	140000	15	11	27179	100	8860
Greece	Member	89	7140	...	36	12384	...	1897
Iceland	Member	9	1296	1	63	13106	100	4754
Ireland	Member	167	...	...	24	272	100	12619
Italy	Member	120	21905	14	24	15561	95	1197
Luxembourg	Member	7	1106	52	100	14197	100	5560
Macedonia, the former Yugoslav Rep. of	Member		70		100	11657	100	2
Malta	Member	25	1000	8	90	12000	100	113
Netherlands	Member	220	32200	...	1	22053	100	10092
Norway	Member	14	2760	4	33	11775	89	2650
Portugal	Member	11	12710	48	19	5241	100	732
Serbia and Montenegro	Member	105	1133	...	100	13933	39	1533
Slovenia	Member	31	2828	...	75	15055	100	1776
Spain	Member	430	66797	...	5	19735	80	3611
Sweden	Member	160	31400	...	10	21800	100	4675
Switzerland	Member	30	8000	5		13950	100	3500
Turkey	Member	1408	76252	...		26572	100	6550
United Kingdom	Member	5175	500626	38	1	22589	100	10145

Source: ISO Members Directory 2003.

D STANDARDS IN THE MULTILATERAL TRADING SYSTEM

This Section focuses on standards-related WTO legal texts and relevant jurisprudence. The Section begins with a discussion of the texts themselves. This is followed by a detailed discussion of some of the key concepts relevant to standards in the TBT and the SPS Agreements as well as GATT 1994. The Agreements are then placed in the context of the economic discussion presented in the previous Sections and reference is also made to accumulated standards-related jurisprudence.[125] Since the focus of the Report is on product standards, only WTO legal texts and jurisprudence bearing on "goods" will be discussed. It is important to note though that the General Agreement on Trade in Services (GATS) also contains standards-related provisions on services, specifically, in Article VI paras. 4 and 5.

The two standards-related Agreements in the WTO – the TBT and SPS Agreements – have to be considered within the larger set of Agreements of the multilateral trading system, specifically GATT 1994 and the Dispute Settlement Understanding (DSU), to which they are linked in an integral fashion. These links are sometimes very clear – as for example in Article 14 of the TBT Agreement and Article 11 of the SPS Agreement, which refer to how disputes related to these Agreements have to be settled in accordance with the provisions of the DSU. Other links are less obvious but no less important, such as those relating to the basic obligation of Article I (Most-Favoured-Nation – MFN – treatment), Article III (National Treatment), Article XI (General Elimination of Quantitative Restrictions) and Article XX (General Exceptions) in GATT 1994.

The TBT and SPS Agreements seek to ensure that governments which pursue non-trade-related policy objectives through the use of standards do so with the least disruptive effects on trade. The MFN and national treatment obligations – the non-discrimination obligations – provide an important check against standards whose application results in less favourable treatment of foreign suppliers compared to domestic producers or compared to other foreign suppliers. The dispute settlement mechanism allows countries to settle disagreements regarding the consistency of specific standards with the requirements of the TBT and SPS Agreements and the obligations of GATT 1994.

There have been some recent studies attempting to explain why there are international agreements on standards.[126] But a simpler explanation is the one that economists give to justify international cooperation in tariffs. If countries pursue unilateral trade policies, trade wars are a likely outcome. Each country attempts to shift the terms of trade in its favour by applying the optimal tariff, but this inevitably invites retaliation from trade partners. Thus, the world ends up poorer with higher average protection and lower volumes of international trade. A similar situation can arise with product standards, as each country tries to achieve its policy objectives with the use of product standards without considering the costs imposed on its trading partners.

The above argument illustrated the similarities between tariffs and standards, in the sense that tariffs and standards that are optimal from the national point of view may well be suboptimal from a global point of view. There is also an important difference between the two policy instruments. While a tariff clearly has the purpose and effect of discriminating between imported and domestic products, it can in practice be quite difficult to establish the purpose and effect of a standard. It may therefore occur that governments claim to introduce a standard to correct for market imperfections like the ones discussed in Section IIB, but that the standard in reality has been designed such as to create an artificial comparative advantage for domestic producers. In other words, standards may be employed as a "disguised" form of protectionism. Note that this

125 As pointed out in Section IIB.1 the economic terminology with respect to standards does not exactly correspond to the legal terminology. This Section will continue to use mainly economic terminology. But whenever direct reference is made to the TBT or the SPS Agreements or related jurisprudence, the legal terminology is used (see Table 1).

126 In a recent paper, Battigalli and Maggi (2003) used the notion of incomplete contracts to explain the nature of international agreements on product standards. An incomplete contract is an agreement which is unable to specify each party's contractual obligation for every possible state of the world. This incompleteness arises in the case of product standards because it is impossible to predict what kinds of standards may arise in the future. Changes in technology, in consumer demand and in the degree of international integration will lead to the development of new product standards. Government regulations on standards are also likely to change depending on emerging public concerns. So it is impossible to write ex ante agreements that can anticipate all possible contingencies relating to standards and trade. They argue that in these circumstances, the optimal set of international agreements on product standards would have a three-part structure: (i) provisions that specify standards for existing products; (ii) a non-discrimination (national treatment) rule; and (iii) a dispute settlement procedure.

is in principle not in the interest of the country introducing the standard, as consumers tend to suffer from protectionist policies. Given the reliance of governments on information from producers when it comes to designing standards (see Section IIC) the risk of government capture by the private sector seems real.

1. STANDARDS IN WTO AGREEMENTS

Well-designed standards can play an important role in guaranteeing the smooth functioning of markets. Standards that are set at the national level will typically aim at facilitating transactions in the national market. They may, however, also affect the outcome of international transactions and may enhance or reduce trade. Standards can also be designed with the purpose of reducing imports and afford protection to domestic producers. The Preambles of both the TBT and the SPS Agreements state that Members should not apply standards in a manner which would constitute a "disguised restriction to international trade".

(a) TBT Agreement

The TBT Agreement covers technical regulations, standards and conformity assessment (see Box 14 for the exact definition of these terms). A major distinction between a technical regulation and a standard is that compliance with the regulation is mandatory. The TBT Agreement applies to a wide range of bodies and systems, local, national, regional and international, governmental and non-governmental. Rights and obligations under the TBT Agreement vary depending on the type of body concerned. For instance, technical regulations prepared by central government bodies are subject to the highest level of obligations under the Agreement.

Box 14: Some definitions used in the TBT Agreement

Technical regulation is a document which lays down product characteristics or their related processes and production methods, including the applicable administrative provisions, with which compliance is mandatory. It may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method.

Standard is a document approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for products or related processes and production methods, with which compliance is not mandatory. It may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method.

Conformity assessment is any procedure used, directly or indirectly, to determine that relevant requirements in technical regulations or standards are fulfilled.

Source: Annex 1 of the TBT Agreement.

The TBT Agreement recognizes that governments employ technical regulations to attain legitimate objectives such as national security requirements, the prevention of deceptive practices, protection of human health or safety, animal or plant life or health, or the environment. But technical regulations must not be prepared, adopted or applied with a view to, or have the effect of, creating unnecessary obstacles to international trade. So technical regulations should not to be more trade-restrictive than necessary to fulfil a government's legitimate objective(s).

Article 2 of the TBT Agreement provides a set of principles that are to be adopted in the preparation, adoption and application of technical regulations by central government bodies. These include:

- MFN and national treatment in respect of technical regulations;

- using relevant international standards as a basis for technical regulations. Whenever a technical regulation is in accordance with relevant international standards, and is prepared for one of the legitimate objectives explicitly mentioned, it shall be rebuttably presumed not to create an unnecessary obstacle to international trade;
- playing a full part in the preparation by international standardization bodies of international standards;
- accepting as equivalent technical regulations of other Members, if these regulations adequately fulfil the objectives of their own domestic regulations;
- specifying technical regulations based on product requirements in terms of performance rather than design or descriptive characteristics;
- informing other WTO Members in advance and discussing with them their comments whenever a proposed technical regulation is not in accordance with the technical content of relevant international standards, and if the technical regulation may have a significant effect on their trade; and
- publishing promptly or making available all technical regulations which have been adopted.

Most of the principles applied by the TBT Agreement to technical regulations also apply to voluntary standards which are covered by the *Code of Good Practice for the Preparation, Adoption and Application of Standards* (Annex 3 of the Agreement). Pursuant to Article 4.1 of the TBT Agreement, Members must take "such reasonable measures" as may be available to them to ensure that standardizing bodies, which are on their territory or to which they are related, accept and comply with this Code of Good Practice. Members are further instructed not to take measures which have the effect of requiring or encouraging such standardizing bodies to act in a manner inconsistent with the Code of Good Practice. In addition to the obligations by Members, standardizing bodies that have accepted the Code of Good Practice assume the general disciplines of the TBT Agreement.

The Committee on Technical Barriers to Trade has agreed on a set of principles concerning transparency, openness, impartiality and consensus, effectiveness and relevance, coherence, and developing country interests that would clarify and strengthen the concept of international standards under the Agreement and contribute to the advancement of its objectives.[127] These principles were also seen as equally relevant to the preparation of international standards, guides and recommendations for conformity assessment procedures. Bodies operating with open, impartial and transparent procedures, that afforded an opportunity for consensus among all interested parties in the territories of at least all Members, were seen as more likely to develop standards which were effective and relevant on a global basis and would thereby contribute to the goal of the Agreement to prevent unnecessary obstacles to trade.

A major part of the TBT Agreement deals with conformity assessment procedures, which are technical procedures – such as testing, verification, inspection and certification – to confirm that products fulfil the requirements laid down in technical regulations and standards. Conformity assessment procedures are not to be prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade. So conformity assessment procedures shall not be stricter or be applied more strictly than is necessary to give confidence that products conform with the applicable technical regulations or standards.

Article 5 of the TBT Agreement prescribes the procedures to be followed for conformity assessment by central government bodies. These include:

- MFN and national treatment with respect to various aspects of conformity assessment procedures, such as expeditiousness, information requirements, confidentiality of information about products, fees, the siting of facilities used in conformity assessment procedures and the selection of samples, procedures to review complaints, etc.;
- using relevant guides or recommendations issued by international standardizing bodies as a basis for their conformity assessment procedures;

[127] See Annex 4 of WTO document G/TBT/9 dated 13 November 2000.

- playing a part in the preparation by international standardizing bodies of guides and recommendations for conformity assessment procedures;
- whenever a relevant guide or recommendation issued by an international standardizing body does not exist and if the conformity assessment procedure may have a significant effect on trade of other Members, publishing a notice at an early stage, notifying other Members, providing to other Members copies of the proposed procedure and allowing reasonable time for other Members to make comments in writing, discussing these comments upon request, and taking these written comments and the results of these discussions into account;
- publishing promptly or otherwise making available all conformity assessment procedures which have been adopted.

As was pointed out in Sections IIB and IIC, multiple testing of products will increase the costs of international trade. Thus, Article 6 of the TBT Agreement requires Members to ensure that the results of conformity assessment procedures in other Members are accepted provided of course that they are satisfied that the procedures offer an assurance of conformity equivalent to their own procedures. To this end, Members are encouraged to enter into mutual recognition agreements in respect of the results of each others' conformity assessment procedures. But a high degree of confidence in the testing and certification bodies of one's trade partner is a basic pre-condition for the effective functioning of an MRA. Thus the TBT Agreement recognizes that prior consultations may be necessary to arrive at a mutually satisfactory understanding regarding the competence of the conformity assessment bodies.

Given that developing countries may encounter difficulty in the preparation and application of standards, the TBT Agreement provides for technical assistance and special and differential treatment for these countries.

Article 11 refers to technical assistance that is to be provided by WTO Members to other Members. The TBT Agreement envisions that this will be given on a range of activities such as the preparation of technical regulations, the establishment of national standardizing bodies, participation in international standardizing bodies, the establishment of regulatory bodies, or bodies for the assessment of conformity with technical regulations and standards, and the establishment of the institutions and legal framework which would enable them to fulfil the obligations of membership or participation in international or regional systems for conformity assessment, etc.

The special and differential (S&D) treatment provisions in Article 12 require WTO Members to ensure that their technical regulations, standards and conformity assessment procedures do not create unnecessary obstacles to exports from developing country Members, to recognize that developing country Members are not expected to use international standards which are not appropriate to their development needs as a basis for their technical regulations, standards or test methods, to take reasonable measures to ensure that international standardizing bodies and international systems for conformity assessment facilitates participation of relevant bodies in all Members, taking into account the special problems of developing country Members.

(b) SPS Agreement

The SPS Agreement applies to sanitary and phytosanitary measures which may, directly or indirectly, affect international trade (see Box 15 for the definition of SPS measures).

There are several basic obligations of Members under the SPS Agreement (Article 2). The first is to ensure that their SPS measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination among Members where the same conditions prevail or a disguised restriction on international trade. Second, measures are to be applied only to the extent necessary to protect human, animal or plant life or health, are to be based on scientific principles and are not to be maintained without sufficient scientific evidence.

Box 15: What are SPS measures?

An SPS measure is any measure applied:

(i) to protect animal or plant life or health within the territory of the Member from risks arising from the entry, establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms;

(ii) to protect human or animal life or health within the territory of the Member from risks arising from additives, contaminants, toxins or disease-causing organisms in foods, beverages or feedstuffs;

(iii) to protect human life or health within the territory of the Member from risks arising from diseases carried by animals, plants or products thereof, or from the entry, establishment or spread of pests; and

(iv) to prevent or limit other damage within the territory of the Member from the entry, establishment or spread of pests.

Source: Annex A of the SPS Agreement.

The SPS Agreement encourages harmonization of sanitary and phytosanitary measures among Members on as wide a basis as possible based on international standards (Article 3). This is because harmonization of SPS measures will prevent their use for arbitrary or unjustifiable discrimination among Members or as a disguised restriction on international trade.[128] Furthermore, the recognized international standards (Codex, IPPC and OIE) are based on sufficient scientific evidence. In this harmonization, Members are to base their sanitary or phytosanitary measures on international standards, guidelines or recommendations, where they exist (see Box 16 for examples of the international standards, guidelines and recommendations specified in the SPS Agreement). In fact, measures which conform to international standards are deemed to be necessary to protect human, animal or plant life or health and to be consistent with the provisions of the SPS Agreement.

But since international standards will not exist in all cases, WTO Members may still adopt different SPS measures. They must, however, ensure that their measures are based on an assessment of the risks to health. Furthermore so that these do not hamper trade, the SPS Agreement mandates Members to accept the sanitary and phytosanitary measures of others as equivalent to their own if the exporting country demonstrates to the importing country that its measures achieve the importing country's appropriate level of SPS protection (Article 4).

The requirements of risk assessment and sufficient scientific evidence are essential for maintaining the balance in the SPS Agreement between the shared, but sometimes competing, interests of promoting international trade and of protecting the life and health of human beings, animals or plants.[129] So a WTO Member may maintain or introduce measures which result in higher standards than the prevailing international norms if there is scientific justification or as a consequence of the level of sanitary and phytosanitary protection a Member determines to be appropriate.

Article 5 of the SPS Agreement spells out the procedures and criteria for the assessment of risk and the determination of appropriate levels of sanitary or phytosanitary protection. In assessing the risk and determining the measure to be applied for achieving the appropriate level of sanitary or phytosanitary protection, both technical and economic factors are to be taken into account. Technical factors include available scientific evidence, relevant processes and production methods, relevant inspection, sampling and testing methods, prevalence of specific diseases or pests. Economic factors include the potential damage in terms of loss of production or sales in the event of the entry of diseases or pests, the costs of control or eradication in the

128 Appellate Body Report on *EC–Hormones*, para. 177.

129 Ibid.

territory of the importing Member and the relative cost-effectiveness of alternative approaches to limiting risks. When determining the appropriate level of sanitary or phytosanitary protection, WTO Members are to take into account the objective of minimizing negative trade effects.

However, the SPS Agreement also recognizes in Article 5.7 that there will be cases where scientific evidence is insufficient. In such cases, WTO Members may still adopt emergency or precautionary SPS measures on a provisional basis but are required to obtain additional information for a more objective assessment of the risk and to review the measures within a reasonable period of time.

Given that developing countries may encounter difficulty in the preparation and application of SPS measures, the Agreement provides for technical assistance and special and differential treatment for these countries. Where the risk allows the phasing in of SPS measures, the S&D treatment involves longer time-frames for compliance on products of export interest to them and, upon their request, time-limited exceptions from some obligations under the SPS Agreement.

Box 16: International standards, guidelines and recommendations

For food safety, the standards, guidelines and recommendations established by the Codex Alimentarius Commission relating to food additives, veterinary drug and pesticide residues, contaminants, methods of analysis and sampling, and codes and guidelines of hygienic practice;

for animal health and zoonoses, the standards, guidelines and recommendations developed under the auspices of the International Office of Epizootics;

for plant health, the international standards, guidelines and recommendations developed under the auspices of the Secretariat of the International Plant Protection Convention in cooperation with regional organizations operating within the framework of the International Plant Protection Convention; and

for matters not covered by the above organizations, appropriate standards, guidelines and recommendations promulgated by other relevant international organizations open for membership to all Members, as identified by the WTO Committee on SPS Measures.

Source: Annex A of the SPS Agreement.

(c) Relation to GATT 1994

GATT 1994 contains 38 articles and has a long history of jurisprudence behind it. So there is some degree of simplification involved when only three articles – Article III (National Treatment on Internal Taxation and Regulation), Article XI (General Elimination of Quantitative Restrictions) and Article XX (General Exceptions) are specifically discussed here. However, disputes involving the SPS and TBT Agreements are almost always accompanied by claims that the contested measures are inconsistent with some of these articles.

Article III is one of the most important provisions of GATT 1994 and obliges WTO Members not to apply internal taxes or regulations to imported products so as to afford protection to domestic production. Thus, a WTO Member must accord treatment that is no less favourable to imported products than to like domestically produced products. An important link with the obligations in the TBT and SPS Agreements come from the requirements that technical regulations and SPS measures should not be used as means of protection to domestic industry.

GATT Article XI requires a WTO Member not to impose prohibitions or restrictions other than duties, taxes or other charges on the imports of any other Member. The link with the TBT and SPS Agreements arises

when the application of the technical regulation or SPS measure results in prohibiting or restricting imports of products which do not meet the regulation or the SPS measure.

Finally, GATT Article XX allows a WTO Member to adopt or enforce measures intended to secure a range of policy objectives – including those necessary to protect human, animal or plant life or health or relating to the conservation of exhaustible natural resources – provided that the measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade. Some of the policy objectives cited in Article XX are identical to those cited in both the TBT and SPS Agreements, and Members could use Article XX to provide cover for their TBT actions. However, the SPS Agreement explicitly states that it provides a further elaboration of rules for the application of Article XX(b), and that SPS measures which comply with the SPS Agreement will be presumed to be in accordance with the obligations of governments under GATT provisions relating to sanitary or phytosanitary measures. It is therefore considered to be more specific than GATT Article XX(b) and is to take precedence with respect to SPS measures.

2. KEY CONCEPTS FROM AN ECONOMIC AND A LEGAL ANGLE

WTO Members have committed themselves to ensure that technical regulations and standards do not create unnecessary obstacles to international trade, while also recognizing that governments should not be prevented from using standards to pursue other legitimate policy objectives. This implies that, in the case of a dispute, a panel may be required to distinguish between a "legitimate" standard and an "illegitimate" standard, i.e. one that is inconsistent with WTO law. The legal texts on which any decision on such a matter will be based, have briefly been introduced above. This Subsection contains a more detailed look at some of the key concepts that may play a role in any legal analysis of a dispute involving standards. An attempt is made to compare these concepts with related concepts from the economic analysis presented in Section IIB.

(a) Striking a balance versus welfare maximization

The discussion in Section IIB has shown that a standard that aims at correcting a market failure – be it an information asymmetry in the case of product safety or a production externality related to environmental protection – may have negative effects on trade. Correcting for the market failure has a beneficial effect on the economy while a negative trade effect tends to lead to losses for the relevant economy. The implementation of the standard typically also involves costs and thus a loss for the economy. From an economist's point of view, the "optimal policy" instrument would strike the best possible balance between the positive effects owing to an enhanced functioning of the market on the one hand and the costs involved with the implementation of the standard and any possible negative trade effects on the other hand.[130]

The notion of "striking a balance" is also present in WTO jurisprudence. Although the GATT has no specific language authorizing a balancing test, "balancing" of a range of factors has, for example, explicitly been mentioned in cases, where recourse was taken to GATT Article XX(d) in interpreting the term "necessary". In *Korea-Various Measures on Beef* the Appellate Body states:

> "In sum, determination of whether a measure, which is not "indispensable", may nevertheless be "necessary" within the contemplation of Article XX(d), involves in every case a process of weighing and balancing a series of factors which prominently include the contribution made by the compliance measure to the enforcement of the law or regulation at issue, the importance of the common interests or values protected by that law or regulation, and the accompanying impact of the law or regulation on imports or exports."

[130] To be more precise the optimal policy instrument ensures that marginal welfare gains and marginal welfare losses caused by the measure are equalized.

The "balancing exercise" involves in both cases similar elements: the standard's positive effect on the policy aim and the possibly negative effect on trade. In the first case the aim of the exercise is to determine the policy that maximizes the welfare of the national economy (which is supposed to take into account the well-being of all individual agents in the economy). In the second case the aim is to determine whether a policy is consistent with WTO law.

It has been argued in the literature that the two exercises should produce similar outcomes, in the sense that policy instruments that are not optimal from a national welfare point of view, should be suspected to be inconsistent with WTO law.[131] This argument makes sense when the aim of multilateral trade law is assumed to be to prevent the adoption of policy measures that are used to artificially give domestic producers a competitive edge. Such protectionist measures would in general also be bad from a national welfare point of view, as domestic consumers end up being the ones who pay the price for not being able to buy from the cheaper foreign producers. Their losses tend to outweigh the possible gains for domestic producers.[132] As a consequence, policies designed in such a way would not be optimal policies from a national welfare point of view. Implicitly the multilateral trade system would in this case help to protect governments and ultimately consumers against possibly economically damaging effects of lobbying efforts by producers.

This argument, however, abstracts from the possibility that what is good for one country is not necessarily good for its trading partner nor for the multilateral trading system as a whole. In the presence of market failures such as the ones discussed in Section IIB, it is possible that policies which are optimal from a national point of view cause losses to trading partners. It is also possible that these losses outweigh the benefits going to the country introducing the policy. In other words, policies that are optimal from a national point of view may not be optimal from a global point of view.[133] The question therefore arises whether such policies should be considered to be consistent with the multilateral trading system or not.

The following Subsection contains a more detailed discussion of the economic approach to "balancing" in the context of national welfare maximization. This is followed by a discussion of "balancing" in WTO jurisprudence.

(i) "Welfare maximizing" policy instruments

If it was accepted that the balancing exercise involved in determining a nationally optimal policy instrument can serve as a reference point for the legal analysis of WTO disputes involving standards, the question arises how to apply such an approach. In other words, the question arises whether and to what extent economic reasoning related to optimal policy instruments can be used for legal analysis when it comes to disputes involving standards. Unfortunately, it is not always possible to measure the effects of all the different factors which play a role in determining the optimal policy instrument. It will, therefore, in general be difficult for economists to define the exact design of the best possible policy choice. Yet economists do have certain ideas as to when one instrument strikes a better balance than another.

Consider the case of product safety. A whole range of instruments exist to guarantee a certain level of product safety. Different instruments imply different levels of government intervention, different mechanisms of solving the underlying information problem and different effects on the functioning of markets.

In many cases suppliers are able to signal product quality, for instance, through the use of product guarantees. By offering a higher level of product guarantee suppliers signal a higher confidence in the quality, in this case safety, of their product and thus correct to some extent for the underlying information asymmetry. Government involvement with this type of instrument is very limited and restricted to setting the legal system

131 See Mattoo and Subramanian (1998). Strictly speaking the authors apply this argument to GATT Article III, but it would be straightforward to apply it also to Article XX. See Jansen and Keck (2005) for a discussion of differences and similarities in the interpretations given to GATT Articles III and XX in the relevant jurisprudence and literature.

132 Exceptions to this rule exist, as discussed in the strategic trade literature (e.g. Brander and Spencer, 1985) or in the case of big countries (optimal tariff argument).

133 See the approach taken in Battigalli and Maggi (2003) discussed previously.

in which supplier guarantees function. The correction of the marker failure is, thus, left to a very large extent in private hands and this instrument is unlikely to have large distortionary effects on the market in general and trade flows in particular. This instrument is unlikely to lead to desirable policy outcomes in the case of credence goods.

Private labelling schemes would allow consumers to differentiate among products of a higher or lower level of safety. Like in the case of guarantees, suppliers signal the quality of the product to consumers. In most cases the label will be linked to characteristics of the good, guaranteed by the suppliers. Whereas guarantee policies are typically given by individual suppliers, it is usually a group of suppliers that adheres to a private labelling scheme. Government intervention is needed in order to set the legal environment in which private labelling schemes function. Compared with guarantees, private labelling schemes may have a stronger effect on trade flows as they oblige foreign producers to choose in which scheme to belong, or not to belong to any scheme at all, whereas in the case of guarantees they are entirely free to choose an individual policy. But private labelling schemes may also have limited applicability to credence good cases.

Voluntary public labelling schemes function in a very similar way as private labelling schemes. The main difference is that the government decides which product characteristics deserve which type of label and that the government controls the use of the labelling policy. Public labelling may be less flexible than private labelling and therefore public labelling policies may adapt more slowly to changes in the market. But government intervention of this type makes sense in markets of goods with credence good characteristics. It has been shown in the previous Sections that in these markets private labelling schemes may not be able to function because producers have incentives to cheat.

The difference between mandatory public labelling schemes and voluntary ones is that in the first case the lower quality (in this case lower safety) goods are labelled, while in the second case goods in the higher range are labelled. Using one policy or the other should not have significant effects on market outcomes. In both cases the "safer" goods can be expected to obtain a price mark-up in the market. But the two policies may have different implications when it comes to which producers have to pay for the labelling costs.

A minimum standard has stronger effects on market outcomes as it basically bans certain types of products from the market. In order to be sold in the market, products must guarantee a certain minimum level of safety. Products not able to meet these criteria cannot be sold. Such a policy is likely to have stronger impacts on trade flows than the policies mentioned so far, but may be justified if the risks incurred by consumers using the lower quality products are significant. In such a situation the government may want to eliminate any possibility of the risky products being consumed by simply taking them off the market.

The above paragraphs show that different policy instruments can be more or less trade restrictive. Economists would accept the use of more trade restrictive instruments the more severe the market failure (e.g. credence goods versus experience goods) and the more likely and larger a possible negative impact of the use of low-safety products on consumers.[134] The welfare maximizing instrument would be the one that equalizes (brings into perfect "balance") the marginal cost of introducing the instrument, including any negative trade effects, to its marginal benefits, in terms of risk reduction.

(ii) Striking a balance in WTO jurisprudence

As mentioned before the GATT has no specific language authorizing a balancing test, but the "balancing" of a range of factors has, for example, been explicitly mentioned in cases where recourse was taken to GATT Article XX(d) in interpreting the term "necessary". The term "necessary" also appears in Article XX(b). Article XX(b) and (d) state that:

[134] This implies that risk assessments have to be carried out to determine the possible size of such a negative impact and the probability that negative impacts will occur. See Subsection (c) for a further discussion of risk assessment.

"Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:

(b) necessary to protect human, animal or plant life or health;

(d) necessary to secure compliance with laws or regulations which are not inconsistent with the provisions of this Agreement, including those relating to customs enforcement, the enforcement of monopolies operated under paragraph 4 of Article II and Article XVII, the protection of patents, trade marks and copyrights, and the prevention of deceptive practices;"

In *Korea–Various Measures on Beef* (see Box 17), the Appellate Body stated that "a treaty interpreter assessing a measure claimed to be necessary to secure compliance of a WTO-consistent law or regulation may, in appropriate cases, take into account the relative importance of the common interests or values that the law or regulation to be enforced is intended to protect". Indeed, the Appellate Body sets up, rather explicitly, a balancing test. It considers the degree to which the measure contributes to the realization of the end pursued: "the greater the contribution, the more easily a measure might be considered to be 'necessary'".[135]

Box 17: "Balancing" in *Korea–Various Measures on Beef* (WT/DS 161, 169)

Korea-Various Measures on Beef concerned several measures taken by Korea affecting beef imports and Korea's internal beef market. One of these measures led to the establishment of a dual retail system for the sale of beef. Under this system, most imported beef had to be sold either in specialized stores that sell only imported beef (although they may sell other meat products, both foreign and domestic), or in larger, department-style stores, where imported beef must be kept in separate sales areas. Stores selling imported beef had to display a "Specialized Imported Beef Store" sign to distinguish them from domestic beef sellers.

With regard to this dual retail system, the Panel found that this measure resulted in less favourable treatment for imports in violation of GATT Article III:4, and was not justified under GATT Article XX(d). Korea appealed this finding, but the Appellate Body upheld the Panel's conclusion that Korea's dual retail system was not "necessary" to secure compliance with the Korean Unfair Competition Act, and therefore was not justified under GATT Article XX(d).

The Korean Unfair Competition Act aimed, among other things, at the prevention of deceptive practices. In the present case, the alleged deceptive practices the dual retail system was supposed to prevent, were the misrepresentation of the origin of beef, i.e. selling imported beef as domestic beef, a practice which is commercially profitable because of the price differential.

The Panel argued that in order to demonstrate that the dual retail system was "necessary" to secure compliance with the Unfair Competition Act, Korea had to show that no alternative measure consistent with the WTO Agreement was reasonably available at present in order to deal with the misrepresentation in the retail beef market as to the origin of beef. The Panel considered that Korea had not discharged this burden for two inter-related reasons. First, Korea had not found it "necessary" to establish "dual retail systems" in order to prevent similar cases of misrepresentation of origin from occurring in other sectors of its domestic economy, for instance in the case of domestic dairy cattle beef. Second, Korea had not shown to the satisfaction of the Panel that measures, other than a dual retail system, compatible with the WTO Agreement, were not sufficient to deal with cases of misrepresentation of origin involving

[135] See also the above Appellate Body quote from *Korea-Various Measures on Beef*.

imported beef. In this context a number of alternative measures were discussed including labelling, record-keeping, prosecution and fines that would be effective in detecting and preventing deceptive practices as to the origin of beef.

The Appellate Body upheld the Panel's finding and noted that the "weighing and balancing process" outlined in the main text of this Section is comprehended in the Panel's approach.

In *EC–Asbestos* the Appellate Body referred to its decision in *Korea–Various Measures on Beef* when stating that:

> "In this case, the objective pursued by the measure is the preservation of human life and health through the elimination, or reduction, of the well-known, and life-threatening, health risks posed by asbestos fibres. The value pursued is both vital and important in the highest degree. The remaining question, then, is whether there is an alternative measure that would achieve the same end and that is less restrictive of trade than a prohibition."

Box 18 below discusses the asbestos case in relation to the necessity requirement.

Box 18: *EC–Asbestos* (WT/DS135) and the necessity requirement

Background

In December 1996, France adopted a Decree imposing a ban on asbestos in order to protect workers' and consumers' health. Asbestos is the name of a group of highly fibrous minerals with separable, long, and thin fibres. In 1998, Canada, the world's largest exporter and second largest producer of asbestos (after Russia), claimed the French Decree violated several GATT and TBT Articles and therefore complained to the DSB.

Necessity

Among the issues considered in this case, the question of necessity in relation to GATT Article XX proved crucial. In this regard, the Panel found that the Decree was justified under GATT Article XX(b) as a measure necessary "to protect human [...] life or health". In its October 2000 appeal, Canada challenged this conclusion on two grounds.

First, Canada disputed the evidence that asbestos represents a risk to public health. In this case, according to Canada, there was no need for a measure that protects life or health. The Appellate Body (AB), however, upheld the Panels' decision on the ground that majority scientific opinion agreed that asbestos represents a serious risk to human health.

Second and contrary to the Panel's finding, Canada claimed that a "controlled use" of asbestos constituted a reasonably available alternative. On this point, the AB also rejected Canada's argument on two grounds. Firstly, consistent with the analysis of Article XX(b) in the *Korea–Beef* case (see Box 17), the AB considered the pursued objective, namely preservation of human life or health, as "both vital and important in the highest degree" and consequently claimed that it should be easier for the EC to prove the necessity of the measure at issue, namely a ban on asbestos. Secondly, it argued that the effectiveness of "controlled use" in fulfilling the pursued objective had yet to be demonstrated. Therefore, the AB concluded that no reasonably available alternative existed and confirmed the Panel's decision that the EC had demonstrated the Decree was indeed necessary under GATT Article XX(b). The appeal was adopted in April 2001.

The need for balance is also reflected in Article 2.2 of the TBT Agreement, which states that "technical regulations shall not be more trade-restrictive than necessary to fulfil a legitimate objective, taking account of the risks non-fulfilment would create". It has been argued that it is reasonable to expect that the interpretation of this article will in the future be parallel to that developed under the necessity test of Article XX.[136] Note that towards the end of the negotiations of the Uruguay Round, a footnote was included in draft Article 2.2 that read: "This provision is intended to ensure proportionality between regulations and the risks non-fulfilment of legitimate objectives would create." This footnote is not present anymore in the current text of the TBT Agreement.

In the SPS Agreement the idea of "balancing" seems to be reflected in Article 5.6: "[M]embers shall ensure that such measures are not more trade-restrictive than required to achieve their appropriate level of sanitary or phytosanitary protection, taking into account technical and economic feasibility."[137] Besides, footnote 3 to this Article adds: "[F]or the purpose of paragraph 6 of Article 5, a measure is not more trade-restrictive than required unless there is another measure, reasonably available taking into account technical and economic feasibility, that achieves the appropriate level of sanitary or phytosanitary protection and is significantly less restrictive to trade."

In *Australia–Salmon*, the Appellate Body declared that Article 5.6 and, in particular, the related footnote "clearly provides a three-pronged test to establish a violation of Article 5.6". The complaining party must prove that an alternative measure exists which: " (1) is reasonably available taking into account technical and economic feasibility; (2) achieves the Member's appropriate level of sanitary or phytosanitary protection; and (3) is significantly less restrictive to trade than the SPS measure contested." The Appellate Body added that:

> "These three elements are cumulative in the sense that, to establish inconsistency with Article 5.6, all of them have to be met. If any of these elements is not fulfilled, the measure in dispute would be consistent with Article 5.6. Thus, if there is no alternative measure available, taking into account technical and economic feasibility, or if the alternative measure does not achieve the Member's appropriate level of sanitary or phytosanitary protection, or if it is not significantly less trade-restrictive, the measure in dispute would be consistent with Article 5.6."

Box 19: *Australia–Salmon* (WT/DS18) and SPS Article 5

In 1975, Australia introduced a quarantine measure requiring fresh, chilled, and frozen salmon products be heat-treated for certain prescribed durations and at certain temperatures before being imported into Australia. This measure was aimed at preventing the spread of fish diseases among Australia's salmon population. As a consequence, imports of salmon were limited to smoked and canned salmon.

In 1994, Canada urged Australia to conduct an Import Risk Assessment (IRA) of wild Pacific salmon imports. In justifying its request, Canada claimed among other things that evisceration of salmon (as opposed to heat-treating) is a widely accepted practice to effectively prevent the spread of diseases and that therefore no other measure should be required. Although two preliminary drafts of the IRA Report conducted by Australia concluded that imports of salmon should be permitted, the final version of the Report, released in 1996, recommended the ban be maintained.

In 1997, Canada filed a complaint before the DSB. In 1998, the Panel found that Australia's ban on fresh, chilled and frozen salmon from Canada was inconsistent with GATT Articles XI and XIII and with SPS Articles 2, 3 and 5. However, according to the hierarchy in WTO Agreements, it was enough for the Panel to prove inconsistency with the most specific and relevant article of the most specific and relevant Agreement, SPS Article 5 in the present case. The Panel concluded that the measure at issue was inconsistent with Articles 5.1 (and 2.2 by implication) in that it was not based on a risk assessment. The Panel also found the measure

136 Marceau and Trachtman (2002).

137 The concept is also reflected in SPS Article 2.2: "Members shall ensure that any sanitary or phytosanitary measure is applied only to the extent necessary to protect human, animal or plant life or health, ...".

violated Article 5.5 (and Article 2.3 by implication), for it adopts arbitrary or unjustifiable distinctions in levels of protection in different but comparable situations that result in discrimination or a disguised restriction on international trade. Finally, the Panel claimed the measure violated Article 5.6, since it was more trade restrictive than necessary. Australia appealed the Panel's ruling.

With regard to Article 5.1, the Appellate Body (AB) reversed the Panel's decision, stating that the Panel had examined the wrong measure (the "heat-treatment requirement") instead of the "import prohibition". Nonetheless, when considering the "correct" measure, the AB concluded that it also violated Article 5.1, for it was not based on a risk assessment, which required: (1) identification of potential diseases to be prevented with an SPS measure; (2) evaluation of the likelihood of entry, establishment or spread of these diseases and associated potential consequences; (3) evaluation of likelihood of entry, establishment or spread of the diseases under various available SPS measures. The AB noted that Australia failed to meet the second and third requirements. Consequently, the AB reached the same conclusion as the Panel.

The AB also found that the measure at issue failed to meet all the (cumulative) elements of Article 5.5: (1) the Member adopts different appropriate levels of sanitary protection in several "different situations"; (2) those levels of protection exhibit differences which are "arbitrary or unjustifiable"; (3) the measure embodying those differences results in "discrimination or a disguised restriction on international trade". The AB considered other fish product imports (herring, cod, haddock, etc.) comparable to salmon imports as to the risks they present. The AB noted that Australia treated those different situations much more leniently as compared to salmon imports, and these distinctions were "arbitrary and unjustifiable" and constituted a "disguised restriction to international trade". The AB therefore found, as the Panel did, that Australia acted inconsistently with Article 5.5 (and with Article 2.3 by implication).

Finally, the AB noted that three elements lead to the violation of Article 5.6: (1) there is a measure which is reasonably available taking into account technical and economic feasibility; (2) this measure achieves the Member's appropriate level of SPS protection; (3) this measure is significantly less restrictive to trade than the measure contested. While the Panel found that such alternatives existed, the AB noted that factual information contained in the 1996 Final report, and regarding the level of protection achieved by these available alternatives, was insufficient to conclude that these alternatives would permit the achievement of the same level of protection, namely a "zero-risk" level, as the prohibition of salmon imports did. As a result, the AB did not uphold the Panel's finding that Australia acted inconsistently with Article 5.6.

(b) Consistency

Notwithstanding the stated preference for international standards, WTO Members are free to set their own appropriate level of sanitary protection against the risks to human, animal or plant health or life.[138] SPS measures cannot, however, be maintained "without sufficient scientific evidence" and they should be based on risk assessment.[139] Article 5.5 of the SPS Agreement states that:

> "With the objective of achieving consistency in the application of the concept of appropriate level of sanitary or phytosanitary protection against risks to human life or health, or to animal and plant life or health, each Member shall avoid arbitrary or unjustifiable distinctions in the levels it considers to be appropriate in different situations, if such distinctions result in discrimination or a disguised restriction on international trade."

This obligation relates to the objective of achieving consistency in the level of risk a Member can accept in respect of "different situations". It aims at avoiding situations where a Member – without making explicit

138 See para. 199 of the Appellate Body report in *Australia–Salmon* and also WTO (2000a).

139 SPS Articles 2.2. and 5.1-5.3, as discussed in more detail in the next Subsection p. 144.

origin-based distinctions – imposes a very high level of protection for one situation or product, while at the same time being very lenient with respect to another situation or product even though both pose the same danger (or the former poses an even more serious danger than the latter).[140] Such "inconsistent" behaviour should, at the very least, raise the suspicion that the objective of the relevant SPS measure may be to discriminate against foreign suppliers rather than to protect domestic health or life.

In case law the following three elements have been identified in order for there to be a violation of SPS Article 5.5:

1. the Member concerned adopts different appropriate levels of sanitary protection in several "different situations";
2. those levels of protection exhibit differences which are "arbitrary or unjustifiable"; and
3. the measure embodying those differences results in "discrimination or a disguised restriction on international trade".[141]

The first two points are most directly related to the concept of "consistency". In particular the question arises as to how to interpret the concept of "different situations". In *EC-Hormones*, the Panel found that the situations to be compared are those "where the same substance or the same adverse health effect is involved".[142] In this case the regulation on the use of hormones administered to cattle for growth promotion was compared to the regulation of the same hormones occurring naturally in cattle and other products (such as milk and eggs) or administered for other purposes, as well as to the use of non-hormonal antimicrobial growth promoters in swine production. In *Australia-Salmon*, the Appellate Body found that situations which involve a risk of "the same or a similar disease" as well as situations with a risk of "the same or similar associated potential biological and economic consequences" have some common elements sufficient to render them comparable under SPS Article 5.5. As herring, live ornamental finfish and salmon all have at least one disease in common, the Panel compared the different "appropriate levels of protection" chosen by Australia across those products. That is, the import prohibition on salmon was compared to the few controls on the admission of herring in whole, frozen form used as bait and the allowed importation of live ornamental finfish.[143]

Box 20: *EC–Hormones* (WT/DS26, WT/DS48) and the consistency requirement

Background

The European Communities (EC) adopted a set of Council Directives that resulted in a prohibition of the importation and marketing of meat and meat products treated with any of six hormones used for growth purposes. Three of these hormones are naturally produced by animals (oestradiol-17ß, progesterone and testosterone), whereas the others are artificial (trenbolone, zeranol, and melengestrol acetate).

In 1996, in their complaint to the DSB, first the United States then Canada argued that this prohibition violated SPS Agreement Articles 2, 3 and 5 and TBT Agreement Article 2. The United States also claimed that the measures at issue violated GATT Articles I and III, while Canada argued that they violated GATT Articles III and XI. Since the matter challenged by the United States and Canada was the same, only one Panel was established. Two similar, but not identical, reports were released, both concluding that the EC measures were inconsistent with SPS Agreement Articles 3.1, 5.1 and 5.5. The EC appealed the decision in September 1997.

140 Pauwelijn (1999).

141 *Australia–Salmon*, Panel Report, para. 8.108; Appellate Body Report, para. 140.

142 Para. 8.176, US Panel Report and para. 8.179 Canada Panel Report. Note that this legal test was upheld by the Appellate Body but that its application by the Panel was reversed by the Appellate Body (see Box 20).

143 This rather broad interpretation of the notion "different situations" in *EC–Hormones* and *Australia–Salmon* stands in contrast to the more restrictive notions of "like" and "directly competitive and substitutable" products in the GATT (Pauwelijn, 1999 and Pienaar, 2003).

Consistency

The finding that the EC measures at issue violated Article 5.5 is relevant as an example of how compliance with the principle of consistency was assessed.

In its Report, the Appellate Body (AB) stated that three elements are necessary for a finding of violation of Article 5.5: (1) the Member adopts different appropriate levels of sanitary protection in several "different situations"; (2) those levels of protection exhibit differences which are "arbitrary or unjustifiable"; (3) the measure embodying those differences results in "discrimination or a disguised restriction on international trade".

In considering the first element, the AB noted that situations are comparable to each other if they involve the same substance or the same adverse health effect. The AB relied on the Panel which had identified five situations that were comparable but exhibit different levels of protection: (1) the level of protection in respect of natural hormones when used for growth promotion; (2) the level of protection in respect of natural hormones occurring endogenously in meat and other foods; (3) the level of protection in respect of natural hormones when used for therapeutic or zootechnical purposes; (4) the level of protection in respect of synthetic hormones (zeranol and trenbolone) when used for growth promotion; and (5) the level of protection in respect of anti-microbial agents (carbadox and olaquindox).

The AB then examined the second element, whether the levels of protection exhibited arbitrary and unjustifiable differences in the treatment of these different situations. There was, according to the AB, a fundamental distinction between added hormones used for growth promotion (situations (1) and (4)) and naturally-produced hormones (situation (2)), thus justifying different levels of protection in each situation for it is impossible in the latter case to limit residues. In this regard, the AB disagreed with the Panel who described as "arbitrary or unjustifiable" the differences of treatment between those three situations. However, the AB found that the levels of protection in situations (1) and (4) did exhibit arbitrary and unjustifiable differences with those in effect in situation (5). On this point, the AB upheld the Panel's finding.

Having found that the level of protection exhibited "arbitrary or unjustifiable" differences between at least two comparable situations, it remained for the AB to examine whether the third requirement was met, that is, the measures at issue resulted in discrimination or a disguised restriction on international trade. Here, the AB challenged the Panel's finding that "the import ban on treated meat and the Community-wide prohibition of the use of the hormones here in dispute for growth promotion purposes in the beef sector were not really designed to protect its population from the risk of cancer, but rather to keep out US and Canadian hormone-treated beef and thereby to protect the domestic beef producers in the European Communities" (AB Report, para. XII.245). Therefore, the AB concluded that the measures failed to meet the third requirement.

Overall, given this last point, the AB reversed the Panel's conclusion that the measures at issue were inconsistent under Article 5.5.

With a view to clarifying the practical implications of the requirements of Article 5.5, WTO Members adopted on 18 July 2000 "Guidelines to Further the Practical Implementation of Article 5.5".[144] The Guidelines have to some extent built on SPS jurisprudence and the practice of Members and have added variables to be used for the operationalization of Article 5.5.[145]

144 WTO (2000a).

145 See Marceau and Trachtman (2002).

Neither the GATT nor the TBT Agreement contains explicit consistency requirements, but it has been argued that the GATT Article XX necessity test contains a "soft" consistency requirement.[146] In particular, the Appellate Body in *Korea-Various Measures on Beef* stated the following:

> "The application by a Member of WTO-compatible enforcement measures to the same kind of illegal behaviour – the passing off of one product for another – for like or a least similar products, provides a suggestive indication that an alternative measure which could "reasonably be expected" to be employed may well be available. The application of such measures for the control of the same illegal behaviour for like, or at least similar, products raises doubts with respect to the objective necessity of a different, much stricter, and WTO-inconsistent enforcement measure."[147]

The use of the term "similar" indeed indicates that in this argument "comparability" may be applicable to a broader category of goods than in the context of determining "likeness" or "directly competitive or substitutable" goods. The Appellate Body in *Korea–Beef* refers to the use of different enforcement measures in comparable situations, whereas in the case of SPS Article 5.5 the issue is one of justifying different "appropriate levels of protection" in "comparable" situations.

(c) Scientific evidence and consumer preferences

When it comes to disputes concerning standards there is, in general, no disagreement on the legitimacy of the policy objective the defendant claims to pursue. The protection of human or animal health, for instance, or the protection of the environment are broadly accepted policy objectives. Disagreement may arise, within or among societies, about the desirable degree of protection to be achieved. Disagreement may also arise about the existence of a link between a tradable good (e.g. hormone-treated beef) and the pursued policy objective (e.g. food safety) and about the level of that link. Last but not least, disagreement may arise about the effectiveness of a given policy instrument, like a standard, to achieve a certain policy objective.

The Preambles of the SPS Agreement and the TBT Agreement indicate that WTO Members are free to determine what they consider their "appropriate level of protection".[148] This has been confirmed in the relevant WTO jurisprudence, also with respect to the GATT Agreement.[149] Disputes concerning standards and their effect on trade flows may, however, ensue from disagreement on the other two issues: the link between a traded item and the claimed policy objective, and the appropriateness of using a certain type of standard in the relevant situation.[150]

Scientific evidence can play an important role in shedding some light on these two issues. For instance, in many countries a whole range of products, like medications or chemicals, have to go through established testing procedures before they are even allowed to circulate in the internal market. Scientific evidence also plays a role in WTO Agreements. This is to some extent the case in the TBT Agreement, but above all in the SPS Agreement.[151] This Section will therefore have a stronger focus on the SPS Agreement. Some major differences between the TBT Agreement and the SPS Agreement, in particular with respect to the relevance of scientific evidence, are discussed in Box 21.

146 Marceau and Trachtman (2002).

147 Appellate Body Report *Korea–Various Measures on Beef*, WT/DS161/AB/R and WT/DS169/AB/R para. 172.

148 This is reflected in imposing the burden of proof on the country challenging a standard to prove that it is WTO inconsistent even if it is admitted by both parties that the challenged national standard is set at a level higher than an existing international standard.

149 See Marceau and Trachtman (2002).

150 In theory, a fourth issue could arise even if there is agreement between Members on the three aspects mentioned so far. This is the issue of whether the measure chosen by one Member to achieve its appropriate level of protection should be the measure that maximizes national welfare, or the one that maximizes global welfare (see Subsection (a)).

151 This difference is mainly due to the fact that the SPS Agreement is narrower in its coverage than TBT, focusing on food safety and the prevention of the entry and spread of pests and diseases.

Box 21: Distinction between TBT and SPS standards

The TBT Agreement has a considerably wider coverage than the SPS Agreement. It also contains much broader, less closely-defined objectives for the introduction of technical regulations, standards or conformity assessment procedures than the SPS Agreement.

The SPS Agreement covers all measures whose purpose is to protect human or animal health from food-borne risks; to protect human health from animal- or plant-carried diseases; to protect animals and plants from pests or diseases or to prevent or limit other damage to a country from the entry, establishment or spread of pests. The TBT Agreement covers all technical regulations, voluntary standards and conformity assessment procedures to ensure that these are met, except when these are sanitary or phytosanitary measures as defined by the SPS Agreement. Thus it is the type of measure which determines coverage by the TBT Agreement, but the purpose of the measure which is relevant in determining whether a measure is subject to the SPS Agreement. Most labelling requirements, nutrition claims and concerns, and quality and packaging regulations are generally not considered to be sanitary or phytosanitary measures and hence are normally subject to the TBT Agreement.

The two Agreements have some common elements, such as the basic obligation of non-discrimination and similar requirements for the advance notification of proposed measures and the creation of information offices ("Enquiry Points"). Nevertheless, many of the substantive rules are different. For example, both Agreements encourage the use of international standards. However, under the SPS Agreement scientific arguments resulting from an assessment of potential health risks are required to justify the choice of standards which are more stringent than those advocated by international standard-setting bodies. In addition, governments may impose SPS measures only to the extent necessary to protect human, animal or plant health, on the basis of scientific information. Under the TBT Agreement, WTO Members may derogate from international standards when they deem them to be either inappropriate or ineffective in the fulfilment of a legitimate objective, for instance, due to fundamental climatic or geographic factors, or fundamental technological problems. Scientific evidence may be relevant, depending of the specific legitimate objective pursued, and the specific reason for which a Member has derogated from an international standard. The TBT Agreement also calls for measures to not be more trade restrictive than necessary.

(i) Consumer preferences, scientific evidence and optimal policy instruments

While several WTO Agreements provide countries with the explicit right to implement potentially trade-distorting policies to protect the health of their citizens and environment within particular contexts, consensus on what constitutes the optimal type, timing, and extent of government intervention remains elusive. The concept of market failure developed in Section IIB provides guidance on how to address these questions.

A number of market failures exist relating to the provision of health or environmental protection. As described in a previous Section, these market failures can be related to imperfect information (e.g. credence goods) or externalities (e.g. pollution). In these situations, government intervention may be justified in order to compensate for the sub-optimal national provision of public or environmental health. In the case of medications, for instance, patients cannot know the expected positive health effects and the potential negative health effects without the advice of doctors and/or the information provided on the package insert. The market for medications suffers from information asymmetries and mechanisms of the type discussed in Section IIB are necessary to allow such a market to function efficiently. The provision of safe food also may not occur efficiently without government intervention. For instance, the improper handling of food can cause microbial contamination, such as salmonella. Those handling the food may not be aware and not take into account the full extent of the damage which problems like contamination can cause to other individuals. At the same time, consumers do not have full information about the health characteristics of these products.

In order to determine the appropriate type and level of intervention, governments have a series of decisions to make. As a first step, to determine the policy goals, governments must weigh the preferences of diverse groups with different opinions as to the optimal policy outcome. Typically in relation to health and environmental policies, this outcome relates to a desired level of risk either to human or environmental health. In the theoretical economic models, these types of value judgements should reflect consumer attitudes towards risk and towards the link between cause and effect. In other words, in economic analysis consumer preferences determine to a large extent whether and with which policy tool a government should intervene.[152] Producer interests will also play a role in such a decision. Compared to consumers, producers may, for instance, prefer more flexible policies which would allow them to adopt flexible compliance strategies. In the context of an economic analysis of these policies, one would also care about the associated costs of implementing a certain policy and about the policy's effects on the policy objective. In developing (public/private) labelling schemes to provide consumer information, for example related to credence goods, it might not be optimal, or feasible, to provide all information which consumers may be interested in.

Scientific evidence is likely to be one of the determinants of consumer opinions. This raises important questions about the availability of scientific evidence to consumers, the quality of that evidence and its timeliness.[153] Much more is known today, for instance, about the health effects of smoking than at the time cigarettes were launched to the broad public. The recent removal of certain arthritis drugs from the market also illustrates the issue of the appropriate timing and design of scientific research.

Other actors and phenomena, including media coverage, influence consumer opinion. As a result, preferences related to risks may not always reflect the true risk of a situation, but rather a consumer's pre-existing bias or a misinterpretation of facts. Consumers may, for instance, have disproportionate aversion to risks and prefer to avoid all risk, even when the cost of avoiding these risks is high. In some situations, consumers may believe that a direct causal link exists between a consumption activity and a particular outcome, regardless of whether they have scientific evidence establishing a link. In this situation, the government must weigh the current benefits of introducing a certain policy measure against its costs and its potential future benefits in terms of risk reduction. These future benefits will be lower than consumers expect today if they have misinterpreted the actual risk involved. In other words, policies based on erroneous consumer opinions concerning risk may end up being very costly for a society.

Evaluating the trade-off between costs and benefits of a policy is often also made difficult by the timing of a policy's impact. In the case of environmental goods, for example, the impacts of particular policies may only be evident in the long-term. In addition, predicting ecological responses to policy interventions is complicated by a lack of certainty. Science therefore also plays an important role in evaluating the possible impacts of government interventions on pursued policy objectives.

(ii) The role of science in WTO agreements and jurisprudence

The SPS Agreement acknowledges countries' right to implement measures to protect the health of the population, plants, animals and the environment. According to the TBT Agreement, governments have the right to implement policies which are not "more trade-restrictive than necessary to fulfil a legitimate objective". Legitimate objectives include "national security, prevention of deceptive practices, protection of human health or safety, animal or plant life or health, or the environment". Scientific evidence plays an important role in the judgement of whether an SPS measure is justified or not, while in the TBT Agreement the requirement for scientific justification is less rigorously defined. At the same time, in both Agreements, this right is balanced by obligations in order to prevent the protectionist use of these measures. The texts of agreements, various dispute panel reports, ministerial conference decisions and committee guidelines have provided guidance to countries about the role of science in justifying measures which may be potentially trade-distorting.

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152 In more technical terms, consumer attitudes towards risk and the link between "cause and effect" are typically implicit in the utility function. The utility function is in turn one of the main determinants of the welfare maximizing policy (see IIB.2(a)).

153 See for instance the discussion in Martin (2004).

WTO Members, according to the SPS Agreement, have the right to determine their appropriate level of protection (ALOP) and are obliged to ensure that they avoid arbitrary and unjustifiable distinctions in the levels considered to be appropriate in different situations, if these differences result in disguised restrictions to trade. Dispute jurisprudence has affirmed that "the level of protection deemed appropriate by the Member establishing a sanitary ... measure, is a prerogative of the Member concerned".[154] Thus the determination of ALOP is considered separately from the choice and application of measures to achieve this ALOP.

As mentioned above, the TBT Agreement preamble recognizes the right of each WTO Member to determine the level of protection which it considers appropriate subject to the requirement that measures are not applied "in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail or a disguised restriction on international trade". The TBT Agreement accords to governments a high degree of flexibility in the preparation, adoption and application of their national technical regulations, but tempers this flexibility by the requirement in Article 2.2 that technical regulations "are not prepared, adopted or applied with a view to, or with the effect of, creating unnecessary obstacles to trade". This Article also specifies that "...technical regulations shall not be more trade-restrictive than necessary to fulfil a legitimate objective, taking account of the risks non-fulfilment would create". And further "In assessing such risks, relevant elements of consideration are, *inter alia*: available scientific and technical information, related processing technology or intended end-uses of products."

Regarding sanitary and phytosanitary measures, countries have a range of options in terms of achieving their ALOP. On the permissive end of the spectrum, countries may choose limited interventions and therefore allow all food and agricultural products to be traded without restrictions based on food safety or environmental risks. Alternatively, WTO Members have the right to restrict trade in these products under certain conditions. The SPS Agreement (Article 2.2) provides that sanitary and phytosanitary measures must be based on scientific principles and may not be maintained without sufficient scientific evidence, except in the case of insufficient scientific evidence (as permitted under Article 5.7 discussed below). However Members are encouraged to choose measures that conform to international standards or guidelines. In these circumstances, a rebuttable presumption arises that the SPS measure selected meets all SPS disciplines, including the requirements of "sufficient scientific evidence" and "risk assessment".[155]

While consumers may prefer very strict food safety standards, under the SPS Agreement governments are obliged to justify the standards they set either by basing them on international standards as discussed above, or by conducting their own risk assessment. In relation to the SPS Agreement, the potential for consumer preferences to drive national food safety standards to a zero risk tolerance is tempered by the obligations of the government only to maintain measures that are based on scientific principles. Therefore, while governments have the right to set very strict risk thresholds for particular products, these thresholds must relate to a demonstrable risk.

SPS Article 2.2 states that SPS measures must not be maintained "without sufficient scientific evidence." In the *Japan–Varietals* case the Appellate Body stated:

> "The ordinary meaning of 'sufficient' is 'of a quantity, extent, or scope adequate to a certain purpose or object'. From this, we can conclude that 'sufficiency' is a relational concept. 'Sufficiency' requires the existence of a sufficient or adequate relationship between two elements, in casu, between the SPS measure and the scientific evidence ... the obligation that an SPS measure not be maintained without sufficient scientific evidence requires that there be a rational or objective relationship between the SPS measure and the scientific evidence."[156]

154 *Australia–Salmon* Appellate Body, para. 199.

155 See Pauwelijn (1999). In a sense international standards represent the "globally" preferred level of risk. However, developing countries may find it difficult to participate effectively in international standard-setting bodies due to financial and human resource constraints. Thus, the negotiated standards may not represent the global consensus on risk preferences, but rather the preference of the wealthier countries. Since wealth is linked to higher demand for such attributes as environmental quality, lack of representation of developing countries in international standard setting bodies could lead to the adoption of higher standards with negative trade impacts for developing countries (Drahos 2004). See also the discussion in Section IIC.

156 *Japan–Varietals*, Appellate Body Report, paras. 73 and 84.

In the case of this dispute, the Panel and Appellate Body concluded that Japan's requirement that import approval must be sought separately for each variety of fruit was not maintained with sufficient scientific evidence. Dispute jurisprudence has confirmed that the determination of whether a measure is justified scientifically should be conducted on a case-by-case basis.

The SPS Agreement (Article 5) discusses the types of evidence which Members should take into account when conducting a risk assessment. These factors include scientific evidence, particularly related to prevalence of specific diseases or pests, existence of pest or disease-free areas, and relevant ecological and environmental conditions. This information provides the basis for determining the risks associated with a particular product if it were introduced without policy interventions to mitigate the risks. In addition, this Article indicates that Members should consider policy and production-related evidence including the existence of quarantine policies or other treatment, relevant processes and production methods, relevant inspection, sampling and testing.

The text of the SPS Agreement (Annex A paragraph 4) distinguishes between risk assessments required for food-borne risks and those for disease or pest risks. In *Australia–Salmon* the Appellate Body stated:

> "While [risk assessment for food-borne risks] requires only the evaluation of the potential for adverse effects on human or animal health, the [risk assessment for disease or pest risks] demands an evaluation of the likelihood of entry, establishment or spread of disease, and of the associated potential biological and economic consequences."[157]

The Salmon dispute clarified the criteria for the risk assessment related to pest or disease risks. In this dispute the Appellate Body ruled that a risk assessment within the context of the SPS Agreement must do the following:

1. identify the diseases whose entry, establishment or spread a Member wants to prevent within its territory, as well as the potential biological and economic consequences associated with the entry, establishment or spread of these diseases;
2. evaluate the likelihood of entry, establishment or spread of these diseases, as well as the associated potential biological and economic consequences; and
3. evaluate the likelihood of entry, establishment or spread of these diseases according to the SPS measures which might be applied.[158]

In addition, governments must demonstrate a rational relationship between scientific evidence and the measure in question, and risk assessment must "connect the possibility of adverse effects with an antecedent or cause".

EC–Hormones was the first dispute to consider arguments related to the SPS Agreement. In this dispute the Panel and the Appellate Body both ruled on Article 5.1 as it related to the arguments of the case. Both bodies found that a rational relationship did not exist between the EC's measures and the scientific evidence submitted on five of the hormones. No risk assessment was submitted for the sixth hormone. Six invited experts were consulted, including experts in animal health and foods safety (see Box 20).

In *Japan–Apples*, the United States argued that Japan had maintained measures against US apple exports "without sufficient scientific justification". The Panel in this case heard testimony from a variety of plant health experts and concluded that the scientific evidence "suggests a negligible risk of possible transmission of fire blight through apple fruit". The Panel also discussed the view apples could act as a pathway for the entry, establishment or spread of fire blight within Japan and concluded that scientific evidence did not support this view. The Panel then drew conclusions based upon this scientific evidence and the elements of the Japanese import inhibiting measure that were considered "disproportionate" to the risk (see Box 22).[159]

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157 *Australia–Salmon,* Appellate Body Report, footnote 69.

158 *Australia–Salmon*, Appellate Body Report, para. 121.

159 The SPS Agreement does not call for a comparison of "like products" or distinguishing "product versus process" characteristics. Rather, the focus of the analysis for determining whether a product has been discriminated against is the justification for the discrimination (Marceau and Trachtman, 2002).

Box 22: "Scientific evidence" in *Japan–Apples* (WT/DS245)

Background

In an attempt to prevent the spread of a plant disease caused by the fire blight bacterium to its domestic production of apple fruits, Japan imposed restrictions on imports of apples from the United States. This bacterium affects a number of host plants, including apple trees but not humans. Under Japanese restrictions, imports of apples from the United States remained possible provided that certain requirements regarding production, handling and exporting were met.

According to the United States, there had never been any scientific evidence that harvested apple fruits transmit fire blight. In its submission to the DSB in 2002, the United States claimed that Japan's import-restrictive measure was inconsistent with a number of Articles of the GATT, the SPS Agreement and the Agriculture Agreement. For reasons of judicial economy, the Panel decided to examine only the measure in question with respect to SPS Agreement Articles 2.2 (necessity of the measure and need for scientific evidence), 5.1 (risk assessment), 5.2 (risk assessment based on scientific evidence), 5.7 (provisions for insufficient scientific evidence), as well as Article 7 and Annex B (transparency of SPS regulations).

Scientific evidence

Before the Panel, the United States contended that the measure was contrary to Article 2.2, which states that any SPS measure is not to be maintained without sufficient scientific evidence, except as provided in Article 5.7. The Panel concluded that, in the present case, the scientific evidence "suggests a negligible risk of possible transmission of fire blight through apple fruit," and that "scientific evidence does not support the view that apples are likely to serve as a pathway for the entry, the establishment or spread of fire blight within Japan." A measure is considered maintained without sufficient scientific if there is no rational or objective relationship between the measure and the relevant scientific evidence. Here, the Panel concluded that the measure was "clearly disproportionate to the ['negligible'] risk identified on the basis of scientific evidence" (Panel Report, para. VIII.198). Following an appeal by Japan, the Appellate Body upheld the Panel's finding that the measure was contrary to Article 2.2.

With respect to Article 5.7, Japan argued before the panel: "should the Panel find the scientific evidence insufficient to support Japan's measure under Article 2.2, the measure could be considered to be a provisional measure in the context of Article 5.7 […]". Article 5.7 provides that "[i]n cases where relevant scientific evidence is insufficient, a Member may provisionally adopt sanitary or phytosanitary measures on the basis of available pertinent information […]". The Panel objected that an important amount of relevant, high quality scientific evidence existed on the risk of transmission of fire blight through apple fruit. Therefore, the Panel concluded that this was not a situation in which the scientific evidence was insufficient hence Article 5.7 did not apply.

In all the disputes under the SPS Agreement, experts have been invited to provide scientific advice to the panel. These scientific experts do not have to represent mainstream science. The selection process for experts entails discussion among the panel and the parties to the dispute. Typically the panel seeks recommendations from the international standard-setting bodies as well as from the parties. Parties can object to particular scientific experts on legitimate grounds, but the final choice of experts rests with the panel, which can override objections of the parties. Of course, science does not always provide a single interpretation of a particular set of facts, and scientific experts, in this case, may provide conflicting information to the panel.

Article 5.7 allows for the use of provisional measures where scientific evidence is insufficient. Members should in such cases act on the basis of available information and seek to obtain the additional information needed for a more objective assessment of risk. The dispute Panel on *Japan–Apples* provided further interpretation of

this Article, clarifying that insufficient scientific evidence should not be interpreted as scientific uncertainty. In this case, Japan's contention that its measure was provisional was found to be unsubstantiated, because many studies related to fire blight existed.

One concern often raised in the context of measures relating to health of citizens or the environment which may restrict trade is that given scientific uncertainty relating to particular events or risks, and given the potential for extremely negative consequences, countries would like to maintain the right to implement measures in order to avoid these consequences.[160] While the precautionary principle was not included explicitly in the SPS Agreement, the Panel and Appellate Body in *EC–Hormones* found that the precautionary principle "found reflection in" the SPS Agreement, particularly in Article 5.7 and that invoking the "precautionary principle" did not override a country's obligations under Article 5.1.

Both the dispute reports from *Japan–Varietals*[161] and *Japan–Apples* provide further clarification regarding the appropriate implementation of provisional measures in the context of the SPS Agreement. First, Members must seek to obtain information even after implementing a measure based upon Article 5.7. Hence, the adoption of a provisional measure does not alleviate the obligation to seek the scientific justification of a measure. In addition, the Appellate Body in the *Japan–Apples* dispute ruled that uncertainty is not the same thing as insufficient scientific evidence. In the case of *Japan–Apples*, many well-conducted scientific studies existed. It was still possible that in cases where a large number of poorly conducted scientific studies existed, Article 5.7 would apply.

(d) Product and process standards

In Section IIB it was noted that the distinction between product and process standards has become important in the context of the multilateral trading system, particularly those process standards involving unincorporated processes and production methods (PPMs). Several environmental disputes bearing on the use of PPM-type standards have been taken up in the GATT and WTO. In what follows, an economic analysis of product versus process standards is undertaken. Then there is a discussion of how PPM related cases were resolved in the GATT and WTO and how different WTO Agreements apply to PPMs.

(i) Economic analysis

Apart from the trade literature, there is little controversy about standards that are applied to a product and standards applied to the process by which a product is made. For example, in dealing with an environmental externality the usual question posed is whether a tax or a non-price instrument, such as a standard, best restores economic efficiency, and not whether a process or a product standard is better. As discussed in Section IIB, environmental standards are widely used. And it turns out that many of them are process standards. For environmental reasons, regulators frequently prescribe standards on firms' waste water discharge, smoke emissions or energy use. In the mining industry, for example, a host of standards exists to regulate the types of chemicals used to separate precious minerals from ore and the treatment of mining discharge. The reason for these process standards is that environmental costs occur during the process of production and not during the consumption of the final product. In cases where the externality is generated by the consumption of the final product, a product standard can be used. For example, the use of petrol in motor vehicles leads to the release of large amounts of lead in the air. Because this poses major health risks, most countries have required the use of unleaded gasoline. So both product and process standards can be economically justified, depending on the source of the externality. The reasons why the distinction between product and process standards has given rise to international trade disputes are unrelated to the economic justification for standards. They are instead related to the difficulties to control and enforce standards of processes and production methods that are applied on production sites abroad.

[160] See Harremoës et al. (2002) and Martin (2004), on the one hand, and Marchant and Mossman (2004) on the other for differing views on the role of the "precautionary principle" in this context.

[161] WT/DS76.

Take the case, discussed in Section IIB.2, of an environmental resource (timber) that is used as an input to make a final product (furniture), which is traded internationally. Initially, two countries trade with one another, with the exporter selling furniture made from timber cut from its forests. But a subset of the citizens in the importing country care about the way timber is harvested in the exporting country. Unsustainable logging in the exporting country constitutes a negative externality for them, although they would be willing to support harvesting of timber in concessions where forestry management was "environmentally friendly". However, because of differences in resource endowments and the level of development, there is nowhere near the same level of concern on the part of the citizens in the exporting country about how its forests are harvested. For them, the use of their trees to make furniture does not embody a negative externality – on the contrary, the industry simply represents a source of income.

Assume that each national authority is intent only on maximizing national welfare. Then the national authority in the exporting country would adopt a *laisser-faire* policy towards its timber industry. However, because of the welfare impact that the cutting of trees causes a subset of its citizens, the authority of the importing country would want to take measures to curtail the activity. One possible measure would be a process-related standard which required all furniture, including imported furniture, to be produced from sustainably-logged forests. This is an example of an unincorporated PPM, since the fact that the timber used in making the furniture has been logged in a sustainable manner is not embodied or discernable through any kind of test on the furniture. The imposition of the mandatory standard in the importing country would be the source of a potential trade dispute. The importing country has addressed what it regards as a negative externality in its jurisdiction. The exporting country considers the measure unacceptable, reflecting a protectionist intent and/or an extra-territorial imposition.

Although this issue has been cast as an environmental externality, there is no prima facie reason why markets might not work sufficiently well to manage such problems. The Coase theorem states that in the absence of transactions costs, bargaining among the parties would lead to an economically efficient outcome, i.e. the costs associated with the externality will be minimized. If consumer preference for furniture made from sustainably-logged forests is sufficiently strong in the importing country, there is no reason why furniture makers in the exporting country will not respond to that demand. If they do so, the switch from the previous process of unsustainable forestry management to the new process constitutes a voluntary reaction in pursuit of higher profits. So the adoption of a different process of furniture manufacturing in the exporting country would have been effected by market forces and not by a standard imposed by a foreign government. It is very likely that if this sequence of events had occurred in our example, much less difficulty would have been created by the imposition of a process standard by the importing country.

A significant reason why the market may not react in the circumstances described above arises from the existence of information asymmetry. Consumers are not able to tell whether a piece of furniture is made from timber grown in sustainably-logged forests or not. And this information asymmetry is sufficiently acute to prevent an international market for furniture made from sustainably-logged forests to arise. But again, there are ways that the market mechanism itself can provide an answer in the form of private labelling schemes.[162]

A private labelling scheme is less trade restrictive than a mandatory standard, because the former allows for the co-existence of different types of timber in the market. The same can be said for a public labelling scheme. An important difference between both types of public policies and a private scheme consists in enforcement. Enforcement can in most cases not be left to producers as they have incentives to cheat and to declare that a PPM-type standard is met even if this is not the case. In the case of a public scheme enforcement will therefore to some extent be in the hands of the importing country's government, which may raise concerns with respect to the sovereignty of the exporting country. But also in the case of private labelling schemes, enforcement by independent bodies is required. Those bodies need to have access to the production site in the exporting country and need to be trustworthy from the point of view of the importing country's authorities.

[162] See footnote 27 on the shortcomings of labelling schemes related to PPMs.

(ii) WTO jurisprudence

How has WTO jurisprudence dealt with the issue of PPMs? In the case of *US-Shrimp* (see Box 23), the dispute centred on a US measure (Section 609 of Public Law 101-162) which prohibited the importation of shrimp or shrimp products when harvested with commercial fishing technology that adversely affected endangered species of sea turtles. To avoid the import ban, it was necessary to certify that a country's shrimp fishing fleet used technology that minimized the risk of catching sea turtles. The measure is an example of a PPM because it is a standard that is applied to the way the shrimp is caught rather than to the shrimp itself. It is also an example of an unincorporated PPM since it is not discernible from inspecting or testing the shrimp whether it has been caught with an environmentally-friendly fishing technology or not.

The US measure was examined under Article XX (General Exceptions) of GATT 1994. Applied to environmental issues, Article XX says that so long as a measure is not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail or a disguised restriction on trade, GATT 1994 does not prevent Members from adopting or enforcing "measures relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption".

In the first dispute, which was brought by India, Malaysia, Pakistan and Thailand, the Appellate Body decided that although the US measure served an environmental objective that was recognized as legitimate under Article XX of GATT 1994, it had been applied in a manner which constituted arbitrary and unjustifiable discrimination between Members of the WTO. The United States had failed to engage these Members in serious, across-the-board negotiations with the objective of concluding bilateral or multilateral agreements for the protection and conservation of sea turtles. The United States negotiated seriously on certification with some Members, but not with others that exported shrimp to the United States. Thus, the US measure was found inconsistent with the chapeau of Article XX, which requires that measures not be applied in a manner constituting arbitrary and unjustifiable discrimination between Members. The Panel and Appellate Body reports were adopted by the WTO's Dispute Settlement Body (DSB).

As a result of this, the US revised the guidelines implementing the relevant provisions of Section 609 of Public Law 101-162. This set forth new criteria for certification of countries to export shrimp to the US. But negotiations with one of the countries in the dispute (Malaysia) on an agreement on certification did not succeed. So Malaysia brought a new case to the WTO claiming that the US had failed to comply with the recommendations of the DSB. However, the Panel which looked into this second case decided that the revised guidelines were applied in a manner that did not constitute a means of "arbitrary or unjustifiable discrimination between countries where the same conditions prevail" and was within the scope of measures permitted under Article XX. It found that while the United States had an obligation to negotiate an international agreement regarding the protection of sea turtles, there was no obligation to conclude such an agreement. The Appellate Body subsequently upheld the Panel's ruling that the revised guidelines were justified under Article XX.

The treatment of PPMS by WTO jurisprudence seems clear. In the first Panel report on *US-Shrimp*, the Panel had found that Article XX could not justify a country imposing "measures conditioning access to its market for a given product upon the adoption by the exporting Members of certain policies". But on appeal, the Appellate Body gave a different view regarding this feature of the measure:

> Conditioning access to a Member's domestic market on whether exporting Members comply with, or adopt, a policy or policies unilaterally prescribed by the importing Member may, to some degree, be a common aspect of measures falling within the scope of one or another of the exceptions (a) to (j) of Article XX.[163]

Thus, one possible interpretation of this view is that PPM-type standards are allowed (see Marceau and Trachtman, 2002) so long, of course, as they satisfy Article XX (a) to (j) and they are not applied in a manner that results in arbitrary or unjustifiable discrimination between countries where the same conditions prevail.

[163] Appellate Body Report on *US–Shrimp*, para. 121.

Box 23: *US–Import Prohibition of Certain Shrimp and Shrimp Products* (WT/DS58)

Under the Endangered Species Act of 1973, the United States issued regulations requiring all US shrimp trawl vessels to use approved Turtle Excluder Devices (TEDs) or tow-time restrictions in specified areas where there was a significant mortality of sea turtles in shrimp harvesting.

With respect to trawlers from other nations, Section 609 of Public Law 101-162 called for negotiations to develop agreements with them to protect and conserve sea turtles. Section 609 imposed an import ban on shrimp harvested with commercial fishing technology which may adversely affect sea turtles. But the ban did not apply to harvesting nations that obtained certification from the US State Department that they had (a) a fishing environment which did not pose a threat of the incidental taking of sea turtles in the course of shrimp harvesting or (b) a regulatory programme governing the incidental taking of sea turtles in the course of shrimp trawling that was comparable to the US programme, and where the average rate of incidental taking of sea turtles by their vessels was comparable to that of US vessels.

The first dispute arose from a complaint filed by India, Malaysia, Pakistan and Thailand against the import ban imposed by the United States under Section 609 on the importation of certain shrimp and shrimp products from these countries.

The panel decided that the import ban on shrimp and shrimp products was not consistent with Article XI:1 of GATT 1994, and could not be justified under Article XX of GATT 1994. The United States appealed the decision that the measure could not be justified under Article XX. The relevant provisions of Article XX are: Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:

> (g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption;

The Appellate Body concluded that the measure qualified for provisional justification under Article XX(g). Sea turtles were an exhaustible natural resource, the US measure was related to the conservation of the exhaustible natural resource, and the measure was made effective in conjunction with restrictions on domestic production or consumption.

But the Appellate Body decided that the measure failed to meet the requirements of the *chapeau* of Article XX and, therefore, was not justified under Article XX of GATT 1994. Section 609 had been applied in a manner constituting "unjustifiable discrimination between countries where the same conditions prevail." Section 609 required all other exporting members to adopt the same policy as that applied to domestic US shrimp trawlers. The United States did not permit imports of shrimp even if they were harvested by commercial shrimp trawl vessels using TEDs if those shrimp originated in waters of countries not certified under Section 609. The United States failed to engage the appellees in serious, across-the-board negotiations with the objective of concluding bilateral or multilateral agreements for the protection and conservation of sea turtles. And the United States negotiated seriously on certification with some Members, but not with others that exported shrimp to the United States. In adopting a regulatory programme that was essentially the same as the US programme without inquiring into the appropriateness of that programme for the conditions prevailing in the exporting countries, the application of the measure was judged to constitute "arbitrary discrimination".

As a consequence, the US Department of State issued a set of revised guidelines for the Implementation of Section 609 of Public Law 101-162 relating to the protection of sea turtles in shrimp trawl fishing operations. However, a second dispute was filed by Malaysia. The US and Malaysia had failed to conclude an agreement on certification to enable Malaysia to export shrimp to the US. The Panel in this second dispute found that while the United States had an obligation to negotiate an international agreement regarding the protection of sea turtles, it had no obligation to conclude such an agreement. The revised guidelines were applied in a manner that did not constitute a means of "arbitrary or unjustifiable discrimination between countries where the same conditions prevail" and was within the scope of measures permitted under Article XX. When the Panel's ruling was appealed by Malaysia, the Appellate Body upheld the Panel's finding that the revised US measure was justified under Article XX as long as serious, good faith efforts to reach a multilateral agreement, remain satisfied.

(e) Harmonization

As discussed in previous Sections, harmonization is one approach to resolve potential problems in international trade when standards in the exporting and importing countries differ. Harmonization is nothing more than the agreement to use just one common (existing or new) standard in a situation where standards across jurisdictions differed before. Such a standard may be referred to as an "international standard".

As noted previously, both the TBT and SPS Agreements make reference to international standards. The TBT Agreement contains the obligation to use relevant international standards as a basis for technical regulations and standards set at the national level, except when such international standards would be ineffective or inappropriate in achieving their goal, for instance because of climatic or geographical factors or technological problems. An often-cited example is international standards for building construction, which may not be appropriate in areas prone to earthquakes. Similarly, the SPS Agreement mandates Members to base their sanitary or phytosanitary (SPS) measures on international standards, subject to certain exceptions. Most importantly, a country may have SPS measures in place that result in a higher level of SPS protection than that implicit in the international standard, if there is a scientific justification[164] or if the level of SPS protection deemed appropriate by the Member requires such measures in light of the risk assessment performed.[165]

The (legal) importance of international standards is highlighted by the fact that SPS measures conforming to (and TBT requirements being "in accordance with") international standards are presumed not to constitute trade barriers.[166] Apart from this important advantage of using international standards, both Agreements allow Members to define the "legitimate objectives" (TBT) – an open-ended, illustrative list is provided in TBT Article 2.2 – or an "appropriate level of protection" (SPS) such that stricter TBT requirements or more SPS-stringent measures than those sanctioned by a given international standard may be needed in order to achieve these objectives. The TBT Agreement (Article 2.2 and 2.4) provides that a technical regulation not based on an international standard must be evaluated in terms of two dimensions: first, in regard to its trade effects, a TBT measure may not be more trade-restrictive than necessary to fulfil its (supposedly legitimate) objective; second, in regard to its effectiveness, the risks of not achieving that objective must be assessed, taking into consideration, among other factors, the available scientific and technical information, related processing technology or intended end-uses of products.

164 According to footnote 2 of Article 3 of the SPS Agreement, a scientific justification exists if, on the basis of available scientific information, a Member determines that the relevant international standards are not sufficient to achieve the appropriate level of SPS protection.

165 This paragraph loosely paraphrases some key obligations contained in TBT Article 2.4 and Paragraph F of the Code of Good Practice, as well as SPS Articles 3.1, 3.3 and 5. It omits others as well as some potentially important legal nuances.

166 Again, this is only a rough representation of TBT Article 2.5 and SPS Article 3.2. It should be noted that only standards conforming to international standards, i.e. not merely being based on them, benefit from this rebuttable presumption of conformity. In *EC-Hormones*, the Appellate Body clarified the difference between "based on" in SPS Article 3.1 and "conform to" in SPS Article 3.2. "A measure that 'conforms to' and incorporates a Codex standard is, of course, 'based on' that standard. A measure, however, based on the same standard might not conform to that standard, as where only some, not all, of the elements of the standard are incorporated into the measure" (WTO, 1998: para. 163; see also paras. 164-166).

Pursuant to SPS Article 2.2, SPS measures may only be applied to the extent necessary to achieve protection of human, animal or plant life or health, must always be based on scientific principles and may not be maintained without sufficient scientific evidence (except for "precautionary" measures in accordance with SPS Article 5.7). They must also include an assessment of the risks against which a country wishes to protect itself (SPS Articles 5.1. to 5.4).[167]

All in all, the requirements imposed on SPS measures not conforming to international standards seem to be greater than on TBT measures, especially about the need to furnish scientific evidence and, for each measure, routinely to carry out an assessment of risks. In this context, it is worth noting that under the SPS Agreement, there are clear indications of what constitutes an international standard. In Article 3.4 and Annex A, paragraph 3, of the SPS Agreement, the standards of only three organizations are concretely identified as such (see Box 16). But no international standardizing bodies are listed in the TBT Agreement. Annex 1.4 of the TBT Agreement only contains a rather broad reference to an "international body or system" as one whose membership is open to the relevant bodies of at least all Members. Additional guidance on the identification of these bodies is provided in a decision by the TBT Committee (WTO, 2000b: 24-26, Annex 4), which established principles concerning transparency, openness, impartiality and consensus, relevance and effectiveness, coherence, and developing country interests to help clarify the concept of international standards for the purposes of the TBT Agreement.

It has been discussed in previous Sections that a common standard has the potential to facilitate trade across borders by making products more substitutable, improving consumer confidence in specific product characteristics, ensuring compatibility between products, and so on. To the extent that different standards have artificially segmented the domestic from foreign markets, harmonization is expected to lead to increased trade and competition and, ultimately, to lower prices and/or enhanced quality. All of these reasons may explain the strong support that harmonization and the adherence to international standards receive in both the TBT and SPS Agreements. Yet, the discussion in Section IIB also showed that harmonization and the possibly resulting reduction in product variety is not always desirable. This underlines the importance of the flexibility granted to Members in both the TBT and the SPS Agreement to deviate from international standards if sufficient justification for such a deviation is provided.

In WTO jurisprudence reference to international standards was made in *EC–Sardines* (see Box 24). In this case Peru disputed an EC Regulation that prohibited the use on cans/tins of the term "sardines" for species other than *Sardina pilchardus* (caught mainly off European coasts). A marketing standard for preserved sardines by the FAO/WHO Codex Alimentarius Commission (Codex Stan 94) allows for the use of the term "sardines" (albeit in a qualified manner, e.g. jointly with the country or species name) for a number of species other than *Sardina pilchardus*, including *Sardinops sagax* from the Eastern Pacific harvested by Peru. The central questions under Article 2.4 of the TBT Agreement were whether Codex Stan 94 constituted a relevant international standard, whether it had served as a basis for the disputed measure and, if not, why it had not been used – that is, why it was considered ineffective or inappropriate to fulfil the policy objective pursued.

On the first question, the EC's arguments were rejected. It had claimed that Codex Stan 94 was not a relevant international standard, as it had not been adopted by consensus and had a different product coverage than the EC regulation. The Appellate Body upheld the decision by the panel that, for the purposes of the TBT Agreement, the definition of a "standard" in Annex 1.2 to the TBT Agreement did not require approval by consensus for standards adopted by a "recognized body" of the international standardization community. It also confirmed that the Codex standard "bears upon, relates to, or is pertinent to" the EC technical regulation.

[167] In *EC–Hormones*, the Appellate Body succinctly observed: "In generalized terms, the object and purpose of Article 3 is to promote the harmonization of the SPS measures of Members on as wide a basis as possible, while recognizing and safeguarding, at the same time, the right and duty of Members to protect the life and health of their people. The ultimate goal of the harmonization of SPS measures is to prevent the use of such measures for arbitrary or unjustifiable discrimination between Members or as a disguised restriction on international trade, without preventing Members from adopting or enforcing measures which are both "necessary to protect" human life or health and "based on scientific principles", and without requiring them to change their appropriate level of protection. The requirements of a risk assessment under Article 5.1, as well as of "sufficient scientific evidence" under Article 2.2, are essential for the maintenance of the delicate and carefully negotiated balance in the SPS Agreement between the shared, but sometimes competing, interests of promoting international trade and of protecting the life and health of human beings" (WTO, 1998: para. 177).

It was, therefore, to be considered a relevant international standard, as it had implications for fish species that could be sold as preserved sardines, including *Sardinops sagax* (WTO, 2002: paras. 227 and 232-233). Next, the Appellate Body examined whether the Codex standard had been used "as a basis for" the EC technical regulation, i.e. acted as a "principal constituent" of that regulation.[168] It concluded that this was not the case, as, at a minimum, the technical regulation in question should not be contradictory to the relevant international standard. Indeed, under the EC regulation, species such as *Sardinops sagax* could not be called "sardines" even when combined with the name of a country, species, etc., as foreseen by Codex Stan 94. Finally, the Appellate Body held that the capacity of a measure to accomplish the stated objectives – its effectiveness – and its suitability to do so – its appropriateness – were "both decisively influenced by the perceptions and expectations of consumers in the European Communities relating to preserved sardine products" (WTO, 2002: para. 289). It did not see evidence that consumers in the European Communities had always associated the name "sardines" exclusively with *Sardina pilchardus*. The Appellate Body also noted that, under Codex Stan 94, *Sardinops sagax* could bear a denomination distinct from that of *Sardina pilchardus* and that the very purpose of these labelling regulations for sardines of species other than *Sardina pilchardus* was to ensure market transparency (WTO, 2002: para. 290). It, therefore, concluded that Codex Stan 94 was not ineffective nor inappropriate to fulfil legitimate objectives pursued by the EC regulation: market transparency, consumer protection, and fair competition.

As noted previously, the value of harmonization hinges critically on the availability of financial means and expertise in interested countries to participate in international standard-setting. The *EC–Sardines* case has underlined the importance of taking part in such processes. Both the SPS and TBT Agreements oblige Members and their standardizing bodies to take part in the preparation of international standards within the limits of their resources (TBT Article 2.6 and Paragraph G of the Code of Good Practice, and SPS Article 3.4). A lot of effort has gone into monitoring the use of international standards (pursuant to SPS Articles 3.5 and 12.4[169]) and facilitating the participation by developing countries in the work of relevant bodies, in particular since the Doha Decision on implementation. In November 2000, Members requested that the Director-General explore with relevant international standard-setting organizations and relevant intergovernmental organizations financial and technical mechanisms to assist the participation of developing countries in standard-setting activities ("Minutes of Meeting of 18 October 2000", WT/GC/M/59, 13 November 2000, paras. 11 and 14). In 2001/2002, the Director-General contacted a number of international standardizing bodies and intergovernmental organizations for this purpose and prepared a report compiling the information received from these bodies and organizations. In the Doha Ministerial Decision on Implementation-Related Issues and Concerns adopted on 14 November 2001, Ministers took note of the actions taken to date by the Director-General to facilitate the increased participation of Members at different levels of development in the work of the relevant international standard setting organizations as well as his efforts to coordinate with these organizations and financial institutions in identifying TBT and SPS-related technical assistance needs and how best to address them. The Director-General was further instructed to continue his cooperative efforts with these organizations and institutions, including with a view to according priority to the effective participation of least-developed countries and facilitating the provision of technical and financial assistance for this purpose.[170] On the SPS side, this decision has led, for instance, to the establishment of a fund (the Standards and Trade Development Facility, STDF) by the World Bank, administered by the WTO in partnership with the FAO, OIE, WHO and World Bank. Other international organizations, in both the TBT and SPS areas, have created their own mechanisms, such as the "FAO/WHO Trust Fund for the Participation of Developing Countries and Countries in Transition in the Work of the Codex Alimentarius Commission". These capacity-building activities have been discussed in more detail in Section IIC.

168 The Appellate Body, using the usual dictionaries, found more synonyms and was also guided by its related decision in *EC–Hormones*. See WTO (2002): paras. 244-245, and WTO (1998): para. 163.

169 See also related documentation, in particular WTO (2004).

170 See WTO (2001): para. 3.5 (SPS) and para. 5.3 (TBT), and WTO (2003): 12-13, on follow-up activities.

Box 24: WTO dispute: *European Communities–Trade Description of Sardines*

This dispute arose when the European Communities prohibited the use of the term "Peruvian sardines" on tins containing sardine-like fish species (*Sardinops sagax*) caught off the Peruvian coast. The relevant EC Regulation provided that only products prepared form *Sardina pilchardus* (the "European sardine") may be marketed as preserved sardines. In other words, only products of this species were allowed to feature the word "sardines" as part of the name on the container.

The Panel, confirmed in September 2002 by the Appellate Body, ruled in favour of Peru. It found that a standard set by the Codex Alimentarius Commission for sardine products constituted a "relevant international standard" under the TBT Agreement. The Codex standard set forth specific labelling provisions for canned sardines prepared from fish from a list of 21 species, including both *Sardina pilchardus* and *Sardinops sagax*. The Panel and Appellate Body ruled that this standard had not been used as a basis for the EC Regulation and that the standard was not "ineffective or inappropriate" to fulfil the legitimate objectives" pursued by the EC Regulation. Therefore, that regulation was declared inconsistent with TBT Article 2.4.

In July 2003, Peru and the EC informed the WTO Dispute Settlement Body that they had reached a mutually agreed solution to the dispute. According to the amended EC Regulation, Peruvian sardines could be marketed in the EC under a trade description consisting of the word "sardines" together with the scientific name of the species, i.e. "Sardines – Sardinops sagax".

3. CONCLUSIONS

In this Section, the legal texts related to standards were presented and an analysis of some of the key concepts relevant to standards in the TBT and SPS Agreement as well as GATT 1994 was provided. These concepts have been compared to similar or analogous concepts in the economic analysis presented in Section IIB and reference was also made to the relevant WTO jurisprudence. The discussion has shown that economic and legal reasoning evolve along similar lines. Yet it also draws attention to the following unresolved issues.

National versus global welfare maximization

Standards that aim at resolving any one of the market inefficiencies discussed in Section IIB may have a negative effect on trade. If this is the case, the standard may reduce the welfare of the imposing country's trading partners. It is also possible that these losses outweigh the benefits going to the country introducing the policy. In other words, the standard is not one that maximizes global welfare. The exact role of the WTO in such a context seems not to have been explicitly defined.

The WTO is a multilateral organization and its role has often been defined in terms of global welfare maximization. Yet, when it comes to the use of standards, WTO legal texts and jurisprudence indicate clearly that Members have the right to define their own "appropriate level of protection". This is a concept related to national welfare maximization. It has also been argued that optimal policies from the point of view of national welfare should be considered consistent with WTO Agreements. However, it must be acknowledged that targetting global welfare maximization would be difficult in practice in this context because it would require the weighing of different "appropriate levels of protection" across Members.

The role of consumer interests and scientific evidence

Consumer preferences play a crucial role in economic analysis when it comes to determining appropriate government policy. Scientific evidence is likely to be one of the determinants of consumer opinions, which raises important questions concerning the availability of scientific evidence to consumers, the quality of that evidence and its timeliness. But consumers may not base their opinion on scientific evidence alone. Other sources of information, including media, influence consumer opinion. Consumers may also simply not have appropriate access to the relevant scientific evidence. Their opinions with respect to certain government policies, e.g. food safety or environmental standards, may therefore be "mistaken" from the point of view of scientific evidence. They may, for instance, overestimate the health risk posed by a certain food.

In this situation, a well-informed government must weigh the costs of the measure against current and future benefits of risk reduction. The future benefits are likely to be lower than consumers expect today because they misjudge the actual risk involved. In other words, policies based on erroneous consumer opinions concerning risk may end up being very costly for a society. Even so, the current benefits to consumers may be important enough to introduce a policy measure that deviates from the one that may appear most appropriate from a purely scientific point of view. Governments have a role here to improve the quality of the information available to consumers. Yet the example raises an intriguing question with respect to WTO disputes that has also been raised in the relevant literature. What if a defendant argues that health protection is only one objective and that consumer concerns or moral standards are the real basis for the relevant measure? Should the measure in this case be considered an SPS measure or not? This question is important as the SPS Agreement makes it very clear that the need for measures must be justified on the basis of scientific evidence, while in the TBT Agreement the requirement for scientific justification is less rigorously defined.

The role of international standards

The economic discussion in Section IIB concluded that the international harmonization of standards is not in all cases a desirable objective, either from the national or global point of view. The discussion in this Section has shown that WTO Agreements encourage the creation and use of international standards. In particular, countries applying an international standard are presumed to be applying WTO-consistent policies under both the SPS Agreement and the TBT Agreement. Should it be concluded that WTO Agreements are in conflict with economic thinking?

Not necessarily. Neither Agreement excludes deviations from international standards. These can be WTO-consistent if they pursue legitimate policy objectives. Besides, the SPS Agreement requires proof of a rational link between the relevant policy measure and the policy objective, or more specifically the Member's "appropriate level of protection". All these requirements make sense from an economic point of view. In particular, the emphasis on scientific evidence in the SPS Agreement appears justified considering that this Agreement only deals with mandatory measures. The discussion in Section IIB has shown that mandatory measures tend to have strong impacts on market transactions in general, and trade flows in particular. Welfare maximization considerations would therefore probably lead economists to conclude that such measures should be based on very strong evidence.

How to enforce process standards in the multilateral trade system?

The multilateral trading system has long been hesitant to deal with non-incorporated PPMs, but with the *US-Shrimps* decision, such measures may be argued to have become part of the system. The concerns about their enforcement, however, remain. Non-incorporated PPMs cannot be controlled at the border and involve control on the production site of the exporting country. In the case of *US-Shrimps*, these were vessels, but in other cases, this may involve control of other types of production sites. It is not sure whether exporting countries will, as a general rule, accept inspectors from importing countries to inspect production sites in their territory.

E CONCLUSION

This Report has shown that it is important to distinguish standards according to their function. The conceptual framework adopted in the Report distinguished standards related to network externalities, imperfect information and negative production or consumption externalities.

Given this range of functions, the effect of standards on international trade flows is likely to vary. Standards targeting network externalities will probably increase trade flows. Voluntary standards targeting imperfect information (e.g. safety standards) or negative production externalities may also have a positive impact on trade, as they are likely to increase the variety of products supplied in the market. Mandatory safety standards and environmental product standards have ambiguous effects on the size of trade flows, but are likely to decrease trade if they create a cost disadvantage (in relative terms) for producers exporting to the countries imposing the standard. The impact of mandatory process standards relating to the environment depends on whether they are applied to foreign producers. If they are, trade flows may decrease.

Increases and decreases in trade flows do not always bear a matching relationship to increases or decreases in welfare, or income. In the final analysis, the welfare consequences of policies are more important than their effects on trade flows. In the field of standards, it will often be the case that increased trade is welfare-enhancing. But there will also be those cases where the welfare calculus takes account of other factors such that increased trade does not contribute to increased welfare. It is important to bear this relationship between trade and welfare in mind.

The case in favour of international standards is likely to be much stronger in the context of compatibility standards (network externalities). In this case, markets will tend to oversupply varieties. Compatibility standards therefore reduce the number of varieties in markets. Yet, in this case, market forces are likely to generate the desirable outcome without the need for government intervention. However, oversight of some sort may still be needed because of possible anti-competitive effects if a *de facto* standard is proprietary.

When standards addressing global production or consumption externalities are set at the national level they are likely to be inefficient. This is, for instance, the case for global environmental externalities. International collaboration is necessary in order to correct for such externalities but the optimal solution will not necessarily involve harmonized standards, as production technologies and consumer preference differ across countries.

The case in favour of harmonization of standards is relatively weak when it comes to standards addressing imperfect information (e.g. safety standards) and local environmental externalities. To the extent that countries differ it may be preferable to have different policies rather than one single policy.

Producers will set standards in a profit maximizing way. As a consequence they automatically take consumer interests into account, but only to the extent that consumer preferences are reflected in prices. This is unlikely to be the case in the presence of production externalities and/or imperfect information. Consumer and producer interests would therefore deviate in these cases. Government intervention is necessary to ensure that consumer interests are taken into account. This is also the case when the interests of employers and employees do not coincide. Consumer and producer interests are likely to coincide when it comes to network externalities and it therefore makes sense for compatibility standards to be set by the private sector.

Producer and consumer interests may also differ in international trade. While producers may have an incentive to set standards so as to provide them with an artificial advantage, this is not in the interest of consumers. It should be the aim of governments to take both producer and consumer interests into account and to ensure that standards are not used as protectionist devices.

With the exception of environmental standards and SPS-related measures, a large part of the empirical literature on standards and trade has tended not to distinguish the nature or motivation of the standards being studied. This has made it difficult to confirm the theoretical insights using the available empirical literature.

The number of empirical studies have also been limited and the available databases subject to important limitations. Nevertheless, some preliminary conclusions can be drawn. Standard-setting activity seems to be pronounced in industries characterized by network externalities. The bulk of technical regulations focus on various problems associated with imperfect information. In some major markets, these regulations cover a large number of tariff lines and a significant share of imports, so there is potential for these regulations to have an adverse effect on trade.

The cost or price-raising effects of standards do not emerge as an important concern in OECD countries. However, the same conclusions do not seem to apply to either smaller firms. With respect to the cost of compliance by firms in developing countries, the evidence is mixed with the survey work suggesting that firms in developing countries face very high costs, while the case studies tell a more complex story where the costs of and benefits from compliance vary enormously among firms and countries and depend on a range of factors.

Illustrating the theoretical finding that the effects of standards on international trade flows is likely to vary, there is evidence that intra-industry trade can be spurred by greater standard-setting activity in industrial sectors. This points to the important role that standards play in increasing compatibility. The adoption of standards, even purely national ones, can increase trade.

It has not been possible to draw strong conclusions on the relative merits of harmonization or mutual recognition of standards to facilitate trade. But early evidence suggests that more robust and significant trade-enhancing effects are found in the case of mutual recognition, especially where conformity assessment is concerned.

The welfare-based literature finds that SPS measures are generally restrictive and involve a welfare loss in the importing country. The presumed health risks or losses from the introduction of pests through imports need to be extraordinarily high in order to justify some regulatory regimes in place. But questions have been raised about the appropriateness of the analytical framework employed, since there may be circumstances when regulatory authorities are not able to assign credible probabilities to the outcomes, and therefore are more risk averse than assumed in the papers. Standards are not necessarily barriers for developing countries. There are conflicting conclusions too about the trade impact of SPS measures on developing countries. There have been cases where access to export markets was denied due to sanitary or phytosanitary issues, resulting in substantial costs in terms of lost sales and market share. But rising standards also serve to accentuate underlying supply chain strengths and weaknesses and thus impact differently on the competitive position of individual countries. Some countries are able to use high quality and safety standards to reposition themselves in global markets.

Finally, recent empirical studies do not change the presumption that in most sectors, environmental standards do not have significant effects on trade and on investment flows. Less work has been done to examine empirically the issues of race to the bottom and regulatory chill, but available studies point to little or no effect on the behaviour of regulators.

The standards development process organized by national, regional and international standards institutions is markedly different from the past. Standards institutions now focus more on the specific concerns of industry and commerce. Hence, there is greater participation by the private sector. A lot of standards are now voluntary rather than mandatory. Standards must comply or be compatible with international norms and the testing and certification elements need to be recognized internationally. Standards institutions must be flexible and responsive to changes in market demand for standards.

The national standardization infrastructure of most industrialized countries is now integrated into the network of international standardization. The trend is towards separating standardization activities from regulatory activities, with the former left to the private sector and the latter with the public sector. In general, regulations concerning safety, health and the environment are issued by governments, although often the

specific measures that satisfy the objectives of government regulations are spelled out in technical standards developed by private organizations.

Many developing countries are increasingly being integrated into this standardization system. But a considerable number of low-income and transition countries have not followed the trend. Standards institutions in poorer countries are generally located in the public sector, with little or no participation of the private sector. Improving participation of developing countries in international standardization is crucial. While numerous initiatives have been undertaken to improve the situation, recent evidence suggests that these initiatives have yet to achieve a significant improvement.

The crucial role that conformity assessment plays in commercial transactions was highlighted in this Report. Purchasers and regulators want to ensure that the requirements and standards they impose on suppliers are fulfilled. These assessment procedures add to the transaction costs of international trade and can be larger for foreign suppliers than for domestic ones if a certification of compliance with a product regulation can only be given by bodies in the importing country.

A significant amount of international cooperation is taking place to establish confidence in the work of conformity assessment bodies in other countries and, in particular, on the conclusion of mutual recognition agreements (MRAs) between accreditation bodies. However, while MRAs may help purchasers to gain trust in the results of foreign bodies, it is not certain to what extent they are relied upon by governments in regulated sectors. A range of government-to-government MRAs, which are often bilateral or plurilateral, show that commitments of mutual acceptance of conformity assessment results in sectors involving health, safety and environmental concerns tend to be quite limited.

In developing countries, the provision of conformity assessment services is often inadequate or costly. But here also, international cooperation is playing an important role in addressing their problems. Regional provision, especially of accreditation services, has proven a viable way forward for smaller and poorer countries. Considerable technical assistance is being provided from a variety of sources to build the necessary conformity assessment infrastructure. Much remains to be done, however, and many developing countries will tend to be excluded from mutual recognition agreements until the appropriate infrastructure is developed.

Finally, WTO Agreements and jurisprudence relating to standards were examined. The relevant multilateral agreements have been developed over the years, in part and fundamentally from original GATT provisions. The current Agreements on Technical Barriers to Trade and Sanitary and Phytosanitary Measures came into force in 1995. They contain comprehensive disciplines intended to guide the design and application of technical regulations and SPS measures. While no attempt has been made to review systematically the effects that the two Agreements have had on standard-setting activity or trade, it turns out that important legal principles in the Agreements have strong links with economic thinking about standards. Economic and legal reasoning have evolved along very similar lines, although a number of issues which are likely to prove challenging to WTO jurisprudence have also been identified in this Report. These included the questions of national versus global welfare maximization, consumer preferences and scientific evidence, the role of international standards, and how to enforce process standards in the multilateral trading system.

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III THEMATIC ESSAYS

A QUANTITATIVE ECONOMICS IN WTO DISPUTE SETTLEMENT

1. INTRODUCTION

WTO dispute settlement continues to be the subject of extensive scrutiny by both trade practitioners and academics. Not surprisingly, most of this analysis is legal in nature, touching upon the various arguments that have been put forward by parties to disputes and the legal foundations upon which these disputes are adjudicated. While legal and procedural issues remain the domain of trade lawyers, economists are being called upon with increased frequency on matters that call for economic interpretation or quantification. This should hardly be surprising given that multilateral trade rules reflect key economic principles such as comparative advantage, and that many of the terms in WTO Agreements, which are important in the resolution of disputes, have an economic basis. It may also have to do with the fact that increasing numbers of disputes are reaching the implementation phase, in which arbitrators need to quantify the allowable level of retaliation, as will be further explained below.

The literature on economics and dispute settlement is rather limited. A range of studies try to measure the performance to date of the WTO dispute settlement mechanism in one way or another. These include studies on the incentives/disincentives faced by WTO Members to avail themselves of the WTO dispute settlement mechanism and to conform to rulings, as well as more descriptive analyses of the frequency and pattern of recourse to dispute settlement.[1] Other contributions have sought to elucidate, from a purely theoretical point of view, various functions of the WTO dispute settlement mechanism, such as deterrence of opportunistic behaviour by governments (Maggi, 1999; Butler and Hauser, 2000). Such institutional aspects of WTO dispute settlement are not the focus of this essay. Nor will economic analyses of the outcome of WTO disputes be discussed, such as the welfare implications of retaliatory measures (Breuss, 2004).

Instead, this essay analyses to what extent quantitative economics has played a role: (i) in the interpretation and application of WTO rules, as to both the consistency and the effects of contested measures; and (ii) in respect of authorized countermeasures, in particular the identification of the maximum allowable level of suspension of concessions, where a party losing a dispute has failed to implement the rulings and recommendations of the Dispute Settlement Body. Although the economic questions to be dealt with may be similar, these two situations are legally quite distinct. In arbitrations over countermeasures, the arbitrators themselves have employed economic models and techniques, whereas in panel/Appellate Body proceedings, it has been the parties, and not the adjudicators, who have undertaken such analysis. In the latter context, if parties include quantitative economic analysis in their arguments, the panels/Appellate Body may or may not find it useful or necessary to their own analysis. In order to distinguish these two types of situations, arbitrations will be addressed in a separate sub-section. This field of research has hitherto been neglected. Closest to describing this type of analysis are probably Sumner et al. (2003), Malashevich (2004), Keck (2004) and aspects of Horn and Mavroidis (2003). This essay does not question the economic rationale of WTO rules, although a good deal could be said about economic sense and nonsense in this context. It does not deal either with the much broader question of how economic concepts and terminology have been used by WTO adjudicating bodies, sometimes implicitly, to structure their reasoning. Instead, this essay simply seeks to identify when, why and in what form quantitative economic analysis has been used at various stages of the WTO dispute settlement process.

Trade disputes at the WTO are about differences in views between Members as to whether or not a specific policy measure of the defending Member contravenes WTO rules. In many cases, the precise effect of a breach of obligations need not be known by the panel.[2] An interpretation may be developed based on the ordinary meaning and context of a WTO provision in the light of the object and purpose. And yet, as Neven observes: "To the extent that a legal norm is not solely based on forms and relies on an assessment of the effects of any particular measure, economic analysis will be instrumental in its implementation" (Neven, 2000, p.3).

[1] For work in these areas see, for example, Horn et al. (1999), Bown (2002), Leitner and Lester (2003), and Busch and Reinhardt (2003).

[2] For instance, no demonstration of trade effects is required in respect of a *de jure* national treatment violation discernible from the text of the challenged law.

Indeed, certain WTO disciplines, for example in the Agreement on Subsidies and Countervailing Measures (SCM), provide for action based on the effects of subsidies. This essay concentrates on instances where a quantification of trade effects, as well as other economic conditions such as the competitive relationship within a given market, has come into play during panel/Appellate Body proceedings. In addition, as mentioned above, once a dispute has reached the implementation stage, the issue of countermeasures has been found in some cases to require an estimate of the effects that the offending measures have on trade.

The main objective of this Section is to examine the way in which quantitative economic analysis has been used during WTO dispute settlement proceedings. To that end, WTO cases that have proceeded at least to the Appellate Body stage have been reviewed and principal illustrative examples of the use of quantitative economic analysis at any stage of the adjudication process identified.[3] For the purposes of this essay, "quantitative economics" shall simply refer to attempts to measure the relationship between economic variables, including trade flows. Quantifying the effects that one variable has on another, and isolating these effects from other influences, is usually based implicitly on some form of theoretical economic model and requires a minimum of relevant data and reliable parameter estimates. In that sense, "quantitative economics" shall be understood to go beyond simple accounting operations or the use of descriptive statistics in order to characterize economic phenomena.

The essay contains four more Sections. The next Section (Section 2) identifies some questions common to disputes where quantitative economic analysis has occurred. The third Section explains briefly basic economic techniques to address such questions. The fourth Section illustrates the actual use of quantitative economics in selected WTO cases. The concluding Section summarizes observations on the possibilities and limitations of using quantitative economics in WTO dispute settlement.

2. THE CONTRIBUTION OF QUANTITATIVE ECONOMIC ANALYSIS TO LEGAL QUESTIONS IN WTO DISPUTE SETTLEMENT

A good starting point to examine the contribution that quantitative economics can make to WTO dispute settlement is to see when it has actually been used and why. So far, quantitative economic analysis seems to have been applied to find answers to two major questions implicit in a number of WTO provisions. The first concerns the effect of a policy measure (or its removal) on trade flows. Precise trade values may be required, or the trade impact of a more indirect measure may be assessed to see how, for example, the measure had affected world prices. This type of issue can arise either in the context of a determination by a panel and/or the Appellate Body whether a violation has occurred, or in the context of determining the level of authorized countermeasures, where a losing party has not implemented the dispute settlement findings. The second question concerns the effect of imports on competing domestic products or their producers. This type of issue may typically arise in the process of determining a violation. For example, in a discrimination case, the degree of competition between two products may be at issue and if it is not significant, the two products may be seen as not belonging to the same relevant market (and could, for instance, be regulated differently).[4] Alternatively, as in a WTO challenge of a trade remedy measure, it may be necessary to review how the relevant national authorities separated the effect of imports on prices, profitability, sales and other indicators of the health of a domestic industry from the effects that other factors, such as developments in technology/

[3] Evidently, every case in which a violation is found, whether appealed or not, eventually is adopted by the Dispute Settlement Body (DSB) – by the reverse consensus rule – and thus creates a requirement that the losing party implement the DSB's rulings and recommendations. The review of cases for the purposes of this essay was "artificially" limited to those in which appeals took place in order to keep the task within manageable dimensions. This undertaking is modest in nature confining itself to a simple stock-take and ex post analysis of some of the existing case law. The actual examples will be used to further explain some of the analytical tools commonly employed by economists. Some issues relating to data and underlying assumptions will also be highlighted. Clearly, the intention of this essay is not to rewrite WTO case law nor to adopt a prescriptive stance on the use of quantitative economics.

[4] It is important to note that, here, quantitative economics may be used to determine the degree of direct competition or substitutability. Once that is established, no precise assessment of the trade effects may be necessary for a violation finding if, for instance, a *de jure* discriminatory treatment derives from the text of the challenged measure itself.

productivity or changes in demand, may have had on those variables. This last question is not unrelated to the preceding one, but the focus is less on the degree of competition from imports and more on the need to ensure that other influences have not been falsely attributed to imports.

(a) Effect of policy measures on trade

Qualitative explanations of the existence of an effect of a measure, where this is necessary to show a violation of trade rules, may often be sufficient to resolve a dispute. Why, then, has it sometimes been seen as advantageous by parties to inform economic insights through quantifiable information? And why have arbitrators in certain cases employed quantitative trade models to estimate the allowable level of suspension of concessions? In arbitration cases under Article 22.6 of the Dispute Settlement Understanding (DSU), a quantification of counterfactual trade effects has been a key device for some arbitrators to fulfil their mandate – namely, to determine the level of nullification or impairment of benefits suffered by a complaining Member, which the requested suspension of concessions or other obligations must not exceed. Some parties have provided quantitative economics or were solicited by arbitrators to do so, which the latter used to varying degrees in their own analysis. Examples also include the areas of prohibited and actionable subsidies, where arbitrators have faced the special mandate under the SCM Agreement to decide whether the countermeasures proposed are, respectively, "appropriate" or "commensurate" with the adverse effects found. Arbitrations may occur in relation to any WTO Agreement and, potentially pose challenging questions, for instance, in regard to the quantification of non-tariff measures and their effects.

Apart from the concrete mandate given to arbitrators, the issue of measuring the effect of policy measures on trade has also been brought up on occasion by parties during panel proceedings. Here, quantitative economic analysis formed part of parties' argumentation in order to give an indication of the extent to which a disputed measure diminished a Member's benefits in terms of lost trading opportunities. This is a key question in claims of "serious prejudice", which is one of the adverse effects to a Member's interests that may emanate from "actionable" subsidies. The concrete questions that may arise in such cases include whether such a subsidy displaces or impedes the exports of the complaining Member or leads to significant price undercutting, price suppression/depression or lost sales in the same market.

(b) Effect of imports on domestic products/producers

As far as the effect of imports on competing domestic products or their producers is concerned, parties have at times seen an advantage in using quantitative economics, for instance, to sustain or ward off claims of tax discrimination against foreign products to the benefit of domestic producers. As a prerequisite for such claims, imported and domestic products need to be in a competitive relationship. If products were unrelated and therefore were not in competition in the market, they could well be treated differently. While adjudicating bodies in these and similar cases have relied on qualitative criteria, such as physical properties of the products or the extent to which the products were capable of serving the same or similar end-uses as well as consumer perceptions, the competitive pressure two products exert upon one another is ultimately a matter of degree. In related fields, such as anti-trust investigations, an essential measurement tool is the cross-impact (elasticity) on price. There are a few WTO cases where parties have seen merit in providing empirical evidence of the intensity of competition, notably by estimating cross-price elasticities.

From a different angle, the competitive pressure exerted by imports is of key importance in investigations of injury of a domestic industry, the results of which may be challenged at the WTO. In particular, to apply a WTO-consistent trade remedy, the national authorities involved need to determine, on the basis of an investigation conducted in accordance with the applicable WTO rules, that dumped or subsidized imports or import surges, as opposed to other factors, cause injury to a domestic industry (so-called "causation" and "non-attribution" analysis). Both the procedural and substantive aspects of such a determination can be the subject of WTO dispute settlement.[5]

[5] As described in more detail below, WTO dispute settlement in respect of anti-dumping determinations is subject to a special standard of review.

In sum, quantitative economic analysis is bound to occur with most regularity in WTO arbitrations due to their specific mandate and the need to make a precise award that in most cases must be quantified, often with reference to the effects of the inconsistent measure. That said, during regular panel proceedings, where the question is the existence of an inconsistency with a WTO provision, parties may include quantitative economic analysis in their submissions whenever they deem it necessary or required under the respective agreements to show how seriously a domestic policy impacts on trade or how imports relate to developments in domestic factors. Panels need not ascribe the same evidentiary weight or draw the same legal or factual conclusions from quantitative economics as the party submitting it.[6] This is clearly expressed in the view of the panellists in *Korea–Alcoholic Beverages*,[7] who stated that "quantitative analyses, while helpful, should not be considered necessary" (*Korea–Alcoholic Beverages*, Panel Report: para. 10.42).[8] Before discussing a representative range of cases where quantitative analysis has been used, we shall briefly review some relevant economic techniques and terminology.

3. TRADE MODELS: SPECIFICATION AND PARAMETERS

Intuitive understanding of economic relationships – say, for example, consumers buy less of a product when it becomes more expensive – is often based implicitly on an economic model. In our simple example, the idea is of a general loss in purchasing power and substitution to other products.[9] Why formalize such relationships? Most importantly, because one may wish to identify the relationship with more precision. For a given price increase, for example, by how much will the quantity demanded fall? In addition, formalization forces the analyst to be explicit about assumptions, simplifications and presumed relationships. It helps to prevent omission of important linkages and misguided impressions about the relative importance of individual factors. Finally, the quality of a formal model can be measured in terms of the degree of confidence one can have in its result. This Section provides a basic introduction into technical aspects of trade model-building. These technical characteristics can be the subject of controversy if models form part of parties' submissions in a dispute. Although a wide range of trade models exist, and some of them can become quite complex, the focus of the discussion here will be on basic aspects of models that may be relevant in dispute settlement.

(a) Model specification

Trade models combine information on trade flows and trade policy measures for different product categories in a structured manner. They can then be used to show to what extent outcomes are sensitive to assumptions and policy changes and, therefore, are a useful tool to evaluate competing conjectures about potential trade impacts of a measure. While many trade models focus on import market conditions only, recent approaches have included global market clearing conditions, and, subject to data availability, domestic production (Francois and Hall, 2003).

Trade models are commonly used to evaluate how a change in trade policy may affect prices and consequently trade flows. By the same token, trade may also feature in a model as one determinant of other economic variables of interest, such as prices, output and employment. A quantitative model consists of one or several equations that relate different economic variables to one another. In the simplest case, a model is made of just one equation, which explains one variable as a function of one or several other variables. In models consisting of a set of equations a variable of interest may be a function of several other variables that are related to each other as well. This allows for a more realistic set-up, as, usually, variables are interdependent and causality goes in both directions. Besides such "behavioural equations", multi-equation models contain accounting identities that link the behavioural equations to one another. Usually,

6 It should be noted that there are no evidentiary rules under the DSU constraining the type of admissible evidence. Parties to disputes are free as to the type of evidence they submit, as they are presumed to act in good faith. Panels are free to admit evidence and assign weights to it as they see fit. There are, of course, requirements to submit specific evidence in, for instance, anti-dumping and countervailing duty investigations. For more see Anderson (2004).

7 Throughout the essay, the short titles for WTO dispute settlement cases are used. For full case titles and citations, see Appendix Table 1.

8 See also *Korea – Alcoholic Beverages*, Appellate Body Report: paras. 109 and 131. In this report, the Appellate Body discussed the terms "directly competitive or substitutable" quite extensively from an economic perspective.

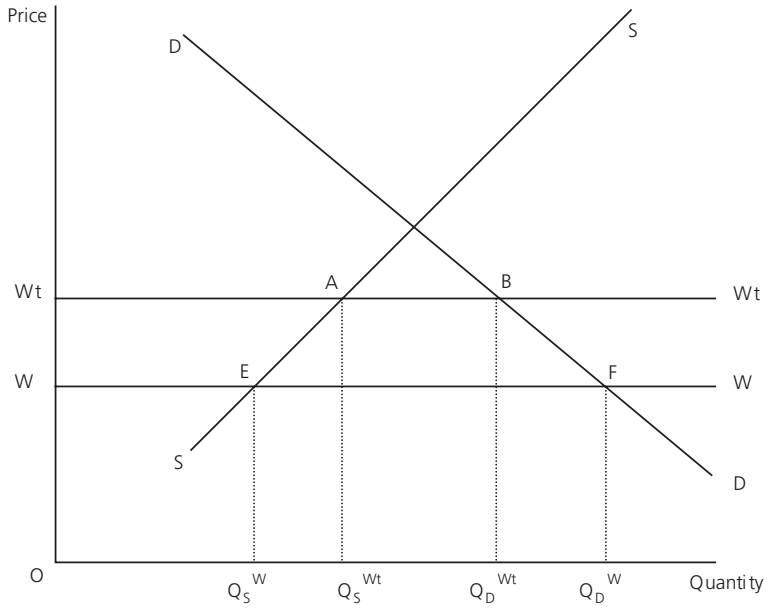
9 More precisely, in this case, there is a loosely conceived idea that the loss in purchasing power associated with a price increase reinforces substitution away from the more expensive good. However, if the product in question is inferior, the reduction in real income leads to an opposite income effect that may well outweigh substitution tendencies and lead to an overall increase in demand ("Giffen good").

there are a number of possibilities to construct a model, and the burden of additional data collection and estimation difficulties for added variables or multi-equation systems have to be compared to the expected gains in precision.[10]

A very simple model is shown in Chart 1 below. Domestic demand for a product falls with higher prices (curve DD), while the opposite is the case for domestic supply (curve SS). In mathematical form, this model would consist of two behavioural equations reflecting the factors determining market demand (e.g. price and income) and supply (e.g. price)[11] and one accounting identity stipulating that demand should equal supply in equilibrium (i.e. the intersection of both lines, reflecting a situation in which there are no further adjustments of variables). In this interrelated series of equations, price and quantity (the so-called endogenous variables) are simultaneously determined within the model, taking into account also the equilibrium condition. Income is not determined by the model; it is a so-called exogenous variable for which values must be postulated or predicted, for instance on the basis of past trends.

In this model, a trade measure can be modelled as an *ad valorem* increase in the import price of a product. Instead of the world market price of imports WW, the price to be paid by domestic consumers has risen to WtWt in Chart 1. What would happen if the trade measure was removed? In this model, the size of the trade effect is determined by three factors: the effect of the measure on the price of imports and the responsiveness of quantity demanded and quantity supplied. Once a measure is removed, the trade effect of the implicit decrease in price (if perfect competition is assumed, the price would fall back to WW)[12] is the combined impact of a reduction in domestic supply and an increase in demand (depicted as the difference between EF and AB in the chart). The trade effect is larger the more responsive both supply and demand are to price changes (i.e. the flatter the domestic supply curve SS and demand curve DD).

Chart 1
A simple trade model



Note: In this model, curves DD and SS represent domestic demand and supply respectively. Excess demand (Q_D^W-Q_S^W) at world price WW is satisfied through imports EF. A tariff raises the import price to Wt, thus reducing imports to AB.

[10] If not much is known about causal relationships between variables to build such models, so-called time-series analysis allows for a study of the past behaviour of a variable and an extrapolation of the detected behavioural pattern into the future. The submission by parties of this type of analysis in WTO dispute settlement is discussed below, in the context of the "Alcohol" disputes.

[11] Of course, in advanced models, additional factors could be included, such as resource endowments having an impact on supply. While the curves portray the relationship between quantities and price, changes in income would lead to a shift of the demand curve.

[12] In the simple partial equilibrium (PE) model, the effect of a change of tariff T on market price P_m (with $P_m=(1+T)*P_f$, and P_f being the price of imports at the border) is given by Dalton's formula: $p_m=t*\eta_S/(\eta_D-\eta_S)$ (with small letters of p_m and t reflecting per cent change and η_S being the elasticity of supply and η_D the elasticity of demand). For instance, if demand is completely inelastic ($\eta_D=0$) or supply is perfectly elastic ($\eta_S=\infty$), the market price increases by the full tariff increase. Conversely, if there is either perfectly elastic demand ($\eta_D=\infty$) or inelastic supply ($\eta_S=0$), the market price remains unchanged.

In the Chart, it is also assumed that the reduction in imports due to the trade measure is small at the global level and does not affect world price. But an additional complication arises if, for example, the importing country is large and the contraction in imports causes the world price to fall. In this case, once the measure is removed, the effect on imports would be smaller than before due to a simultaneous rise in the world price. Also, imports and domestically produced goods are not necessarily perfect substitutes, and specific import demand elasticities need to be considered. If these are low, i.e. consumers do not consider an imported product to be a close substitute for a domestically produced good, the effects of a removal of trade barriers will be scaled down accordingly.

In partial equilibrium (PE) models like the one described above, cross-price effects in other markets are ignored as well as overall resource limitations and budget constraints. Conversely, general equilibrium (GE) analysis seeks to portray all linkages in the economy. For instance, an additional tax on alcoholic beverages may lead to a higher consumption and, consequently, production of soft drinks, additional demand for sugar as a key ingredient and, ultimately a shift of labour out of the alcohol industry into the soft drink and sugar sectors. These shifts may affect the income of households and, subsequently, their consumption patterns, which may trigger another round of feed-back effects in the economy.

In PE models, linkages between the sector modelled and the rest of the economy are deliberately left out in order to be able to reduce the amount of data needed, conduct the study at a more disaggregated level, and concentrate on the direct impact of specific policies only. In many cases, multi-commodity PE frameworks are entirely adequate, especially if the sector studied is small in relation to overall economic activity (Hertel, 1990).[13]

An important distinction must be made between the estimation of a model and simulations carried out using the model. Estimation refers to the determination of the individual parameters (elasticities, for example; see below) that quantify the impact of each factor on the variable under study.[14] A range of techniques of varying complexity exist to establish these dependencies, or, in the jargon, to "regress" a "dependent" variable on a set of "explanatory" variables.[15] Key criteria to be considered in choosing an appropriate regression technique and in interpreting the results will be further illustrated below in the discussion of some WTO disputes, where this was an issue. The resulting parameters give an indication of the specific influence of a factor on the variable under study, other things being equal.[16]

With estimated values for the parameters of a model, the initial (i.e. baseline) values for the endogenous (dependent) variables and a given time path for the development of the exogenous (independent) variables, the model can then be used to produce a forecast of the endogenous variables over that time period. Or individual exogenous variables controlled, say, by the government (e.g. taxes leading to reductions in disposable income) can be modulated in order to assess their impact on the target variable. This also has the advantage that the effects of individual policies can be predicted in isolation and compared to alternative options. These types of analyses are called simulations. Besides the nature of the policy change (and other assumptions about exogenous variables), the results of simulations are driven by the structural specification of the model (i.e. the chosen functional form and range of variables included) and the estimated behavioural parameters. In trade models, which often follow fairly standard theoretical structures, the latter account for much of the variation amongst the results of different studies.

13 Both GE and PE models are often of a "comparative static" nature, i.e. comparing an initial situation ("equilibrium") to the one after the economic environment has changed. The time path and adjustment process, i.e. the dynamic features of change, are not modelled.

14 Ideally, an empirical model is based on economic theory. This is not always the case. But even if it is, it may be estimated in a so-called "reduced form" that may not allow for an identification of all of the parameter values of the underlying structural model.

15 If there are mutual dependencies, all parameters in a system of equations must be estimated simultaneously, adding considerable complexity to the estimation procedure.

16 More precisely, the parameters reflect an estimation of the *average* value of the dependent variable for known values of the explanatory variables.

(b) Elasticity parameters

Trade model parameters are commonly expressed in the form of elasticities. An elasticity represents the percentage change of one variable in response to a one per cent change in another variable, all other things being equal. Elasticities are rooted in micro-economic theory and reflect the sensitivity of consumers and firms to changes in relative prices and income.[17] The basic elasticity expressions (price, income and substitution elasticities) are explained in Box 1. Elasticity values are not normally known with precision. The elasticity of demand for a given product, for instance, i.e. the percentage change in quantity demanded induced by a one per cent price change, may differ according to the econometric method employed, the quality of the historical price and quantity data as well as the number of variables included or held constant in the basic economic framework used for the estimation. Elasticities are so-called "local" parameters, i.e. valid only in a given situation of prices and income. In a different initial situation values may be altered. The term "trade elasticities" in the literature usually refers to expressions that are price or income elasticities of imports or exports, or elasticities of substitution between home and foreign or different foreign goods. For example, the own price elasticity of car imports is often referred to as the "import demand elasticity for cars."

Box 1: Main types of elasticities

Own-price and cross-price elasticity

The own-price elasticity of a product specifies the responsiveness (in per cent) of the demand for that good to an increase in its price by one per cent. In this case, it may be called a demand elasticity, which, typically, is negative. In case of producers, who normally are willing to sell more when prices rise, the own-price elasticity, or supply elasticity, is positive. Economists speak of "elastic" (or "inelastic") behaviour. This refers to cases when the absolute value of an elasticity is above (elastic) or below (inelastic) unity. In the above example, demand is said to be more elastic if the quantity demanded falls by, for instance, 2 per cent (elasticity of -2) in response to a one per cent price increase than if it falls by 1.5 per cent only (elasticity of -1.5). In many instances, consumers not only buy less of a product the price of which has increased (the so-called "own-price elasticity" described above), but, as a consequence, buy more of a substitute. For instance, if the price of butter increases by one per cent, consumers may wish to eat more margarine instead, leading to a, say, one half of a per cent increase in its demand. The cross-price elasticity expresses by how much (in per cent) the demand for a product (margarine) changes in response to a one per cent price increase of another product (butter). It is positive if two products are substitutes, and negative if they are complements. The latter is the case, for instance, when a price increase (and hence reduced demand) in automobiles leads to a lower demand in car radios.

Income elasticity

This concept describes the percentage change in demand for one good in response to a one per cent increase in income. Normally, one would assume that someone who has consumed a certain "mix" of products continues to do so at a higher income, at increased quantities of each product (perhaps with a slightly different allocation of spending across commodities). Hence, the income elasticity of a normal product is positive. However, it may also be that, at higher income levels, a consumer can afford to buy so much more of, say, truffles pasta that she wishes to eat less of a product she consumed before, such as potatoes. For such inferior goods, the income elasticity may be negative. Price and income elasticities together are key parameters in describing demand for a good.

[17] However, in empirical work, the supply and demand equations sometimes may not be derived from explicit assumptions about producer and consumer behaviour (Hertel, 1990).

Elasticity of substitution

The elasticity of substitution is closely related to the concept of cross-price elasticity. It has its origins in the theory of the firm characterizing firms' demand for different combinations of production factors ("inputs") to obtain a given output, subject to the technology used and cost structure of the firm. The elasticity of substitution (often denoted as σ ("sigma")) has a slightly different mathematical form than the above elasticity types, measuring how the ratio of two inputs responds to a change in the relative price of those two inputs (Varian, 1984). If the response is positive, substitution becomes more important the larger it is. If it is negative, the two goods are said to be complements. When there are more than two factors of production, one also needs to ask how those vary if relative prices change. For simplicity, total production is often considered to consist of production activities of several branches. Hence, elasticities of substitution often reflect the substitution effects within a branch, holding branch output constant (Keller, 1980). Elasticities of substitution are also used in the context of final consumer demand. They obviate some problems associated with direct price elasticity estimation, but are subject to a number of limiting assumptions concerning income and price elasticities of demand for the respective products. Essentially, this implies that the two commodities for which a substitution elasticity is estimated must be considered alike in all economic respects except that they are not perfect substitutes (Stern et al., 1976). In world trade models, this is a convenient assumption for products that are seen as imperfect substitutes owing solely to their difference in origin. The mathematical specification as a relationship between changes in volume and price ratios can reflect the change in market shares, which may be of more interest than changes in absolute levels of sales if the whole market expands/shrinks simultaneously.

Trade elasticities are key parameters in trade policy modelling. They are the nexus between trade policies on the import side and the domestic economy (Francois and Reinert, 1997). The most prominent types are the Armington elasticity of substitution and import demand elasticity.

(i) Armington elasticities

An Armington elasticity has to do with the notion that similar domestic and imported goods, as well as goods imported from different origins, should be regarded as imperfect substitutes. Trade models usually take this into account and differentiate goods by their country of origin, an idea originally proposed by Armington (1969).[18] The effect of a trade policy measure on the relative price of similar traded and domestically produced goods leads to a substitution of domestic for imported goods or vice versa, or to a substitution between imports from different sources. The Armington elasticity normally has the form of a substitution elasticity (i.e. percentage change in relative quantities of two products from different origin divided by the percentage change in relative prices – see Box 1). Many trade models working with Armington elasticities assume a two-tiered process, whereby a change in relative prices leads first to substitution between the domestic and foreign commodity. Once the overall level of imports of that commodity is determined, substitution among foreign suppliers is considered. Conventionally, the Armington elasticity of the second tier is set at twice the value of the first tier elasticity (Donnelly et al., 2004). Comprehensive studies at the industry level exist, mostly for the United States (McDaniel and Balistreri, 2002, provide an overview), but these have subsequently been applied to other countries (see, for instance, Donnelly et al., 2004).[19]

[18] In order to describe preferences among goods of different origin, Armington used a functional form implying a constant elasticity of substitution (CES), i.e. one that is independent of initial values. For this and other reasons, the Armington assumption has been subject to academic controversy, which, among other things, led to an alternative approach of firm-level product differentiation. The latter approach has the advantage of depicting the real world more accurately and minimizing terms-of-trade effects inherent in the Armington structure. However, owing to the scarcity of available firm-level data, sector- and region-specific product weights are often used resulting in an Armington-like approach (Francois and Reinert, 1997).

[19] It is, of course, preferable to determine elasticities based on historical data and to use econometric methods that are consistent with economic theory, like for instance Kee et al. (2004). The elasticities in Donnelly et al. (2004) have been derived from a range of existing studies. The authors have then employed the expertise of industry analysts to make appropriate adjustments to some of the elasticities found in the literature.

(ii) Import demand elasticities

The demand for imports is derived from the excess of domestic demand over domestic supply. The import demand elasticity usually takes the form of an own-price elasticity that indicates by how much import volumes adjust if import prices increase, e.g. due to a tariff hike. Imperfect substitutability between imports and domestic products is normally presumed to exist.[20] Apart from price, import demand functions used for estimation normally include other variables, such as income, prices of other domestic goods and domestic supply factors, such as resource endowments that may influence the result.[21] Some studies have estimated in similar ways export supply elasticities or income elasticities of both imports and exports to make predictions over the direction in which the trade balance of a country may move (e.g. Houthakker and Magee, 1969). Much effort has gone into such estimations, and increasingly the need was seen to focus on higher levels of disaggregation, where trade policies are usually determined. Kee et al. (2004) have conducted estimations of more than 300,000 import demand elasticities for 117 countries. Other authors have focused increasingly on bilateral trade relationships in order to reflect more accurately the sensitivity of the direction of trade to changes in import prices and income (Marquez, 1990).

All of these studies generally find a wide variability of trade elasticities across sectors and frequently arrive at a range of values for any particular sector. In view of different underlying assumptions, not all estimations can be meaningfully compared.[22] Marquez (1999) finds an explanation even for a dispersion of estimates that rely on the same constant elasticity model. A few observations common to all trade elasticity estimations can, however, be made (McDaniel and Balistreri, 2002; Kee et al., 2004), in particular, that the level of product aggregation is important, as trade elasticities are higher at lower levels of aggregation (i.e. switching from cotton shirts to wool shirts is easier than from shirts and pants). Therefore, the application of aggregate elasticities to individual sectors or of the average elasticity from disaggregate estimates to an aggregated commodity would lead to an under- or over-estimation of results respectively. Trade simulation models, especially when they are of a GE nature, often derive their elasticity values from a variety of specialized econometric studies, that may be limited to certain countries or sectors and may not involve the same functions in their estimation as those making up the simulation model. In addition, the sample period used in the estimation may not correspond to the date of the baseline scenario in the simulation model (Huff et al., 1997). These and other divergences may make it necessary to perform adjustments to render these elasticities model-consistent, probably at the cost of increased uncertainty about their true value. This is why a systematic sensitivity analysis with plausible elasticity values is advisable, and this will yield a range of possible model outcomes.

4. QUANTITATIVE ECONOMIC ANALYSIS IN SELECTED DISPUTE SETTLEMENT CASES

This Section will first, in Sub-section (a), discuss how the issue of measuring the effect of policy measures on trade has been dealt with in WTO arbitrations. In arbitrations, the consistency with WTO obligations is no longer at issue, and quantitative economic analysis has been applied by some arbitrators in order to determine the level of countermeasures. Sub-section (b) then gives examples from panel proceedings, where quantitative economics has been used to answer the questions mentioned in Section 2. The issue of the effect of a policy measure on trade will be discussed in relation to claims of serious prejudice caused by

[20] If domestic and imported goods are not considered close substitutes, as is commonly the case in trade models incorporating the Armington assumption, import demand elasticities can be estimated in their own right. Otherwise, domestic demand and supply elasticities should be estimated and combined with information on production and consumption in the exporting country. See Stern et al. (1976) and Stern (1973).

[21] Although both demand and supply factors influence prices and quantities and, hence, a system of equations should be estimated simultaneously, there is relatively little research incorporating the supply side. For an overview see Stern et al. (1976). Only recently have researchers, such as Kee et al. (2004) who treated imports as inputs into production rather than final goods to reflect increasing vertical specialization in today's global economy, taken into account supply side shifts associated with the reallocation of resources due to changes in prices and primary production factors.

[22] Elasticities in GE models have to be interpreted with particular care. While elasticities are, by definition, partial equilibrium phenomena, the model also produces so-called unconditional or GE elasticities, when all endogenous variables are permitted to adjust to their new equilibrium following a policy intervention. See Hertel et al. (1997) for a detailed explanation.

subsidies, i.e. adverse effects suffered in variously-defined markets, due to subsidies. Then examples from disputes will be highlighted, where the relationship between imports and domestic products/producers was analysed economically. One example deals with disputes in regard to alleged tax discrimination and one with disputes involving the application of trade remedies. Here, relevant legal concepts that have given rise to the presentation of quantitative economic analysis in the context of WTO dispute settlement are whether the domestic and imported products at issue are directly competitive and substitutable, and whether causation/non-attribution of injury in the context of trade remedy investigations has been properly performed.

(a) WTO-inconsistent measures and arbitration on proposed countermeasures under DSU Article 22.6: effect of policy measures on trade

Nine arbitrations pursuant to DSU Article 22.6 have taken place so far.[23] In certain of these cases, the arbitrators have opted to use quantitative economic analysis to carry out their mandated tasks. The arbitrations to date, which have involved requests for multi-million dollar awards, have been undertaken on the basis of one of two mandates.[24] The first is pursuant to DSU Article 22.7 (in connection with Articles 22.4 and 22.6), under which the arbitrators' principal duty is to ensure that the retaliation sought by a complaining Member is equivalent to the level of nullification or impairment that has arisen from the breach of WTO obligations.[25] The key challenge for arbitrators usually lies in determining what trade flows would have been *but for* the unlawful measure. So far, this so-called "trade effects approach" that equates nullification or impairment with the value of trade foregone has been the principal tool used to determine the final arbitration award. In so doing, arbitrators can either agree with the requested amount, or disagree and establish another level.[26]

The second mandate under which arbitration has been conducted to date is that covering prohibited export subsidies. Here, the relevant standard (Subsidies and Countervailing Measures (SCM) Agreement Articles 4.10 and 4.11) requires arbitrators to assess whether proposed countermeasures are "appropriate" as a response to the initial wrongful act and (according to footnotes 9 and 10) "not disproportionate" in light of the fact that the subsidies are prohibited.[27] In all three cases that have been adjudicated under Article 4.11 of the SCM Agreement, reference has always been made to the standard of "nullification or impairment" as stated in Article 22.4 of the DSU and its inapplicability to cases under SCM Article 4.10. It has also been stated that where trade concepts are explicitly contemplated they are defined in other parts of the Agreement.[28] The lack of precision arising from the term "appropriate" has implications for the consistency of the standard to be used by arbitrators across cases. This point is recognised by the Arbitrator in the Foreign Sales Corporations (FSCs) case who states that "countermeasures should be adapted to the particular case at hand".[29] The Arbitrator goes further by stating that "there is an element of flexibility, in the sense that there is thereby an

23 A number of articles on the WTO arbitration process have been published, most of which focus on the need for arbitration to ensure a viable dispute settlement process and the unique nature of the WTO's approach compared to other arbitration procedures (Lawrence, 2003; Bagwell and Staiger, 2002). Again, despite a growing literature, the role of economics in the arbitration process has received much less attention than the economics of arbitration. A few articles on the latter issue that have stressed the difference between welfare analysis and trade analysis may also be relevant in relation to the use of economics in arbitration (Anderson, 2002; Bernstein and Skully, 2003).

24 It should be noted that the key objective under both mandates is compliance with the original ruling. Arbitration is not supposed to result in "punitive" measures.

25 Pursuant to DSU Article 3.8, there is a presumption that a breach of the rules has an adverse impact on other Members, i.e. to constitute a case of nullification or impairment.

26 For either outcome, the basis for the decision needs to be explained, since the level of nullification and impairment a priori is unknown. Arbitrators face the precise task of establishing that level, especially if the requested suspension of concessions is in terms of a specific value. The Arbitrators in *EC–Bananas III (US) (Article 22.6 – EC)* stated: "It is impossible to ensure correspondence or identity between two levels if one of the two is not clearly defined. Therefore, as a prerequisite for ensuring equivalence between the two levels at issue we have to determine the level of nullification or impairment" *(EC–Bananas III (US) (Article 22.6 – EC)*: paragraph 4.3).

27 The words "appropriate" and "disproportionate" seem to give more leeway to arbitrators than the mandate of "equivalence" under DSU Article 22.6, which lays down a clear benchmark. For arbitration in respect of actionable subsidies (which to date has not been invoked), the pertinent standard, set forth in Article 7.9 and 7.10 of the SCM Agreement, is whether the countermeasures are "commensurate with the degree and nature of the adverse effects determined to exist".

28 An example is *Brazil–Aircraft (Article 22.6 – Brazil)*: para 3.49, referring to SCM Articles 7.9 and 10.

29 The Arbitrator in *US – FSC (Article 22.6 – US)* took this difference between the applicable standard of "appropriate" countermeasures in response to prohibited subsidies and the standard of "equivalence" to nullification or impairment caused that applies elsewhere under the DSU as a justification for authorizing countermeasures in an amount exceeding the level of subsidies paid on exports destined for the complaining Member.

eschewal of any rigid a priori quantitative formula". Despite this flexibility, the Arbitrator also recognised "an objective relationship which must be absolutely respected" (all three quotes *US–FSC (Article 22.6 – US)*: para. 5.12). While this concept does not specifically call for an examination of trade effects as a basis for determining "appropriateness", these effects were considered by the Arbitrator in the *US–FSC (Article 22.6 – US)* case. In particular, having reached a finding that the amount of countermeasures proposed by the EC based on the face value of the subsidy was not disproportionate, the Arbitration went on to find that even if the trade effects of the subsidy were addressed, there would be no reason to reach a different conclusion.

The possibility of nullification or impairment referring to something broader than direct trade effects has also arisen a number of times in the non-subsidy cases. This point was originally raised in *EC–Bananas III (US) (Article 22.6 – EC)*, when the US argued that loss of exports of goods or services between the US and third countries arising from the WTO-inconsistent measure should also be taken account. They further argued that the US content of lost exports from other complaining countries to the European Communities (EC), such as US fertilizer, pesticides and machinery shipped to Latin America and US capital or management services used in banana cultivation, should also be taken into account. These arguments were rejected on the grounds that the calculation of nullification or impairment of US trade flows should be losses in US exports of goods and services to the EC and not between the US and third countries (*EC–Bananas III (US) (Article 22.6 – EC)*: paras. 6.6-6.18).

Faced with arguments for a broader interpretation in *US–1916 Act (EC) (Article 22.6 – US)*, such as the inclusion of litigation costs and the "chilling effect" of the measure, i.e. the deterrence of imports due to the mere initiation of an anti-dumping investigation, the Arbitrators were of the view that the level of suspensions had to be quantified and equal to the level of nullification or impairment. Any overestimate of the level of suspensions, in their view, could be interpreted as punitive *(US–1916 Act (EC) (Article 22.6 – US)*: para. 5.34). The Arbitrators stated that they "were not aware of any basis in the WTO Agreements to support the view ... that legal fees can be claimed as a loss of a benefit accruing to a WTO Member" *(US–1916 Act (EC) (Article 22.6 – US)*: para. 5.76). They also noted that the requesting party had acknowledged that "it was not aware of any econometric model that would measure the 'chilling effect' produced by the mere existence of anti-dumping legislation" *(US–1916 Act (EC) (Article 22.6 – US)*: para 5.70, quotation marks omitted). Accordingly, Arbitrators declined to factor these issues into the final award. Their decision addressed the same question as in the bananas case, of whether or not broader economic costs, i.e. costs of actions taken by exporting firms in response to a WTO-inconsistent measure, should be included in the definition of nullification or impairment. In these cases, the arbitrators have made it abundantly clear that not only should the level of suspensions be quantified, but that the calculation of such measures should be limited to trade effects, unless otherwise specified in the relevant WTO Agreements.

In sum, the concept of counterfactual trade effects, i.e. the estimation of the level of trade that would occur if the contravening measure was brought into conformity, has become the standard under DSU Article 22.6 arbitrations. It also appears to play a supporting role in cases involving prohibited subsidies, where the special mandate under SCM Articles 4.10 and 4.11 applies. Most arbitrations to date, although considering trade effects as a benchmark, managed to dispense with the difficult task of estimating plausible elasticity values needed for a partial equilibrium analysis of the sort sketched out in the previous section. Before describing in more detail two recent cases (*US–FSC (Article 22.6 – US)* and *US–Offset Act (Byrd Amendment) (EC)*[30] *(Article 22.6 – US)*), where such analysis has been carried out, the methods used in the other cases will be briefly presented. As stated above, trade measures in respect of any WTO Agreement may come to arbitration. The nine arbitration cases to date had to do with different types of trade-restrictive measures or with government transfers. The trade-restrictive measure cases include quota administration issues (two *EC–Bananas (22.6)* cases), a total ban for sanitary purposes (two *EC–Hormones (22.6)* cases), and a non-tariff response to dumping (*US–1916 Act (EC) (Article 22.6 – US)*). The cases involving government transfers relate to prohibited export subsidies (*US–FSC (Article 22.6 – US)* and the *Brazil–Aircraft (Article 22.6 – Brazil) / Canada–Aircraft Credits and Guarantees (Article 22.6 – Canada)* cases) and the distribution of anti-dumping/countervailing duty proceeds to the injured industry (*US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*). An overview of all arbitrations to date is given in Table 1.

[30] The EC was just one of the original complainants among other Members. See Appendix Table 1.

Table 1
Arbitration cases in the WTO, 1995-2004

Full Case Title and Citation	Agreements/GATT provisions infringed	Requested level (by complainant)	Counter-level (by defendant)	Award by the arbitrators
Trade-restrictive measures				
European Communities – Regime for the Importation, Sale and Distribution of Bananas – Recourse to Arbitration by the European Communities under DSU Article 22.6, WT/DS27/ARB, 9 April 1999	GATT Art. XIII	$520 million (US)	-- (EC)	$191.4 million
European Communities – Regime for the Importation, Sale and Distribution of Bananas – Recourse to Arbitration by the European Communities under DSU Article 22.6, WT/DS27/ARB/ECU, 24 March 2000	GATT Art. XIII	450 million (Ecuador)	-- (EC)	$201.6 million
European Communities – Measures Concerning Meat and Meat Products (Hormones) – Original Complaint by Canada – Recourse to Arbitration by the European Communities under DSU Article 22.6, WT/DS48/ARB, 12 July 1999	SPS Agreement	C$75 million (Canada)	C$3.537 million (EC)	C$11.3 million
European Communities – Measures Concerning Meat and Meat Products (Hormones) – Original Complaint by the United States – Recourse to Arbitration by the European Communities under DSU Article 22.6, WT/DS26/ARB, 12 July 1999	SPS Agreement	$202 million (US)	$53.301 million (EC)	$116.8 million
United States - 1916 United States - Anti-Dumping Act of 1916 - Recourse to Arbitration by the United States under DSU Article 22.6, WT/DS136/ARB, 24 February 2004	GATT Art. VI, Anti-dumping Agreement	"Mirror" legislation (EC)	-- (US)	Monetary value of amounts payable
Government transfers				
United States – Continued Dumping Subsidy Offset Act, 2000 – Recourse to Arbitration by the United States under DSU Article 22.6, among others WT/DS217/ARB/EEC, 31 August 2004, see also Appendix Table 1.	GATT Art. VI, Anti-dumping Agreement, SCM Agreement	Full value of payments (EC, etc.)	$0.0 (US)	0.72 * value of payments
United States – Tax Treatment for "Foreign Sales Corporations" – Recourse to Arbitration by the United States under DSU Article 22.6 and SCM Article 4.11, WT/DS108/ARB, 30 August 2002	SCM Agreement	$4.043 billion (EC)	$1.11 billion (US)	$4.043 billion
Brazil – Export Financing Programme for Aircraft – Recourse to Arbitration by Brazil under DSU Article 22.6 and SCM Article 4.11, WT/DS46/ARB, 28 August 2000	SCM Agreement	$705.6 million (Canada)	-- (Brazil)	$344.2 million
Canada – Export Credits and Loan Guarantees for Regional Aircraft – Recourse to Arbitration by Canada under DSU Article 22.6 and SCM Article 4.11, WT/DS222/ARB, 17 February 2003	SCM Agreement	C$3.36 billion (Brazil)	-- (Canada)	C$247.796 million

(i) Trade-restrictive measures

As was shown in the simple model in the previous Section, an estimation of the trade effects of a border measure (or its removal) requires knowledge of the measure's effect both on price and the responsiveness of quantity demanded and quantity supplied. In *EC–Hormones (US) (Article 22.6 – EC)/EC–Hormones (Canada) (Article 22.6 – EC)* and *EC–Bananas III (US) (Article 22.6 – EC)/EC–Bananas III (Ecuador) (Article 22.6 – EC)*, historical price data were used and quantity responses were restricted by binding quota limits.

In the bananas cases, the core issues were the way in which the European Communities established a duty-free quota for imports of bananas originating from Africa, Caribbean and Pacific States (ACP), and the manner in which the most-favoured-nation (MFN) quotas under GATT Article XIII were allocated.[31] Arbitrators stated that the benchmark for the calculation of nullification or impairment should be losses in the complainant's (US) exports of goods and services supplied to the EC. Arbitrators then compared the value of those EC imports under the WTO-inconsistent banana import regime with an estimated value under a counterfactual regime that would be consistent with the terms of the waiver that the EC had obtained for the provision of ACP preferences. Arbitrators requested the US to provide estimates of the annual trade value of four different counterfactual regimes that would be WTO-consistent (see Table 2). It is not disclosed in the arbitration report how these values were calculated.

Table 2
Estimated impact on EC imports from the US under different counterfactual regimes

Counterfactual Regime	Estimated Value
A tariff-only regime, without tariff quotas, but including an ACP tariff preference (with effects calculated for a range of tariff rates from €75 per tonne to the out-of-quota bound rate);	$326.9 million
a tariff-quota system with licence allocations based on the first-come, first-served method;	$619.8 million
the complete allocation of a tariff-quota system (with traditional ACP quotas reduced to actual past trade performance) with country-specific allocations to all substantial and non-substantial ACP and non-ACP suppliers; and	$558.6 million
the base US counterfactual, which, as noted above, assumed a continuation of an 857,700 tonne quantity for ACP imports and an expansion of the MFN tariff quota to 3.7 million tonnes.	$362.4 million

Arbitrators ultimately decided to perform their own calculations (the reason for this is unknown). The existing tariff-rate quota appeared to be filled, and Arbitrators multiplied that trade volume with the current unit price to obtain the trade value of the actual (WTO-inconsistent) regime. Amongst the possible WTO-consistent counterfactual scenarios, they chose the existing global tariff quota equal to 2.553 million tons (subject to a €75 per ton tariff) and unlimited access for ACP bananas at a zero tariff (*EC–Bananas III (US) (Article 22.6 – EC)*: para. 7.7). Since only the distribution of licences was at issue, Arbitrators simply assumed that the aggregate volume of EC banana imports would remain unchanged from the current situation. From that they were able to conclude that EC banana production and consumption, and, consequently prices (the f.o.b., c.i.f., wholesale and retail prices of bananas),[32] also remained constant. The difference between this counterfactual scenario and the actual price and quantity data supplied for the WTO-inconsistent regime gives the aggregate value of import quota rents and relevant wholesale banana trade services. The only missing ingredient was then the US share of wholesale trade services in bananas sold in the EC and the US share of allocated banana import licences from which quota rents accrue. Using the data provided on US market shares and on current quota allocation, and estimating an allocation under the chosen WTO-consistent counterfactual (again, it is not known how this was done), Arbitrators determined the level of nullification or impairment at $191.4 million per year.[33]

31 The quotas themselves were not subject to dispute, since they were covered by a waiver from the general rules.

32 The term "f.o.b." stands for "free on board" and denotes the "export" price, i.e. price of a good at the border of the exporting country; "c.i.f." means "cost, insurance, freight" and refers to the price of a good at the border of the importing country. The difference between f.o.b. and c.i.f. prices is due to transport costs.

33 The same methodology was then used in *EC–Bananas III (Ecuador) (Article 22.6 – EC)*, and an award of $201.6 million per year was made. A number of additional legal issues were of interest in this case, in particular the possibility to «cross-retaliate», i.e. suspend concessions or other obligations across sectors and agreements.

A few issues are noteworthy in terms of the methodology applied: first, Arbitrators were faced with the unusual situation that at least four counterfactual situations could be conceived. Arbitrators did not report how it was decided which counterfactual would best serve their mandate, why they chose not to follow any of the four scenarios they had initially proposed, how the trade values in these scenarios were arrived at and why these values were so much higher than their final award. Second, the methodology of establishing the counterfactual on the basis of quota limits is convenient,[34] but clearly not universally applicable. Finally, overall quantities were not at issue and so prices between the actual and counterfactual scenario remained the same – a fairly exceptional situation. All in all, it seems that in terms of arbitration methodologies, there is not much to learn from this case that could be generalized.

Yet Arbitrators were able to apply a similar methodology (quota volume times quota share of the complainant times price) to estimate counterfactual trade effects in *EC–Hormones (US) (Article 22.6 – EC)/EC–Hormones (Canada) (Article 22.6 – EC)*. In these cases, the level of nullification or impairment was the value of hormone-treated beef imports into the EC from Canada and the United States if the import ban was lifted. For high quality beef (HQB), exporters from both Canada and the United States would face a binding quota (11,500 tons) in the absence of the import ban. Since that quota was shared between Canada and the United States, the Arbitrators estimated Canada's share of the quota to be 8 per cent, leaving the US with the remaining 92 per cent. Counterfactual imports were then the respective shares of the quota volume of lost trade (less exports of hormone-free beef, which formed part of the total quota amount).

However, the ban also applied in respect of edible beef offal (EBO), subject to tariffs only, not a tariff quota. Unlike for HQB, the calculation of the counterfactual trade volume was not trivial. Arbitrators considered average US exports of EBO to the EC before the ban (choosing the period from 1986-1988) to be a representative starting-point for their calculations of total exports under the counterfactual (i.e. assuming the ban would have been lifted on 13 May 1999). In order to take account of differences in current market conditions as opposed to the pre-ban situation, they made some adjustments. Most importantly, they acknowledged that imports into the EC not only declined due to the ban, but had also been affected by an overall reduction in EBO consumption in the EC. In order to isolate the effects related to the ban, Arbitrators extrapolated the trend in actual import volumes from 1981 to 1988 to the years 1989-91. They then calculated the absolute difference between projected import volumes for the years 1989-91 and the actual import volumes in those years under the ban. The annual average of this difference was then added to actual imports in each of the years 1995-97. These figures supposedly were lower than the average US exports of EBO in the 1986-88 period, which the Arbitrators attributed to a reduction in apparent consumption of EBO under the assumption that US exports would change in proportion to consumption. Consequently, they adjusted the pre-ban average of 65,568 tons downward by that factor (18.4 per cent) to obtain the volume of US exports to the EC but for the ban.

For both HBQ and EBO, no price calculations were performed by the Arbitrators themselves. In the case of HQB, Arbitrators accepted the price per tonne suggested by the US, although it was higher than current unit values of US beef entering the EC. However, they conceded that if the ban were lifted, prices would likely increase, as in order to maximize trade value the tariff quota would be filled with high quality hormone-treated cuts instead of whole carcasses not treated with hormones, which currently accounted for a substantial share of US exports. For EBO, the US had suggested a lower price than the average 1996-1998 unit price of current exports with the ban in place, as EBO prices would be expected to fall should the ban be lifted, as a result of an increased volume of imports. As, in addition, the price was similar to the 1986-88 average price assumed by the EC, Arbitrators went with the US suggestion.[35]

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34 The Arbitrators noted that this methodology avoided the need "to make assumptions about the volume responsiveness of producers, consumers and importers to EC domestic price differences" (*EC–Bananas III (US) (Article 22.6 – EC)*: para. 7.8), in other words to use estimates of trade elasticities.

35 For both HQB and EBO, counterfactual price determinations are not further explained in the report. The suggestions by the complainant seem to have appeared reasonable to the Arbitrators. For given quantities, prices may easily be determined if elasticities are available. On HQB, absent the ban, the quota was assumed to be filled with a different, higher value product. For EBO, the counterfactual quantity was calculated through an extrapolation of a past time trend. Price reductions could then follow from the demand elasticities, i.e. own-price elasticities, of high quality hormone-treated cuts and EBO respectively.

Finally, in *US–1916 Act (EC) (Article 22.6 – US)*, Arbitrators had to deal with the fact that the 1916 Act allowed for the imposition of treble damages, fines or imprisonment rather than tariffs in response to dumped imports. In that particular case, it was not possible to estimate the counterfactual trade effects of a removal of the measure, since it had never been implemented and, hence, no data on prices and import volumes in the presence of the measure were available.[36] Arbitrators had to make a qualitative award. The request by the EC had not involved a specific value, but was to implement legislation that would "mirror" the offending measure. Arbitrators declined the request for a mirror regulation, which potentially could apply to an unlimited amount of US exports to the EC. Such a situation would not ensure that the level of suspension was equivalent to the level of nullification or impairment. Instead, Arbitrators allowed the EC to determine the level of nullification or impairment it might suffer in the future itself and suspend concessions on the basis of verifiable information on the monetary value of court judgements and settlement awards under the 1916 Act against EC entities. If such cases were to occur, a calculation of trade effects would not be needed. The nullification or impairment would arise from the imposition of fines or of threefold damages, as foreseen in the 1916 Act. It is these amounts of money to be paid by the EC that would violate WTO rules on anti-dumping, where only measures in the form of duties are foreseen to counteract dumping.

(ii) Government transfers

Government transfers may have an impact on trade depending on how receiving firms use the additional funds (the so-called "pass-through" effect). To date, four such cases have gone to arbitration. Three of these dealt with prohibited subsidies as defined by SCM Article 3, i.e. subsidies contingent on export performance or on the use of domestic over imported goods. Two of those cases (*Brazil–Aircraft (Article 22.6 – Brazil)* and *Canada–Aircraft Credits and Guarantees (Article 22.6 – Canada)*) involved a single company producing aircraft. The third case (*US–FSC (Article 22.6 – US)*) involved an across-the-board subsidy. Finally, in *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*, the remittance to petitioning firms of anti-dumping and countervailing duties collected was at issue. The panel and Appellate Body found a violation by concluding that the Offset Act payments constituted a non-permissible specific action against dumping. In arbitration, it needed to be determined to what extent such payments could affect trade.

In the three SCM cases, the arbitrators decided that the value of the prohibited subsidy would be an appropriate and not disproportionate level of countermeasures. The key quantification aspect then was the value of the subsidy. In each of the cases, the precise amount of the transfer was not available and hence had to be estimated. In the two aircraft cases, part of the interest on the loan given to foreign buyers of aircraft was borne by the exporting country government. This implies that the government transfer to the exporting firm is spread out over the term of the loan. In order to know how much this future stream of payments is worth to the firm, the so-called net present value of the government transfer was calculated, a standard technique in industry analysis and financial accounting.

In the *US–FSC (Article 22.6 – US)* case, the measure was considered an export subsidy, since it exempted eligible firms from paying corporate tax on eligible export sales. Furthermore, a condition of eligibility was that at least 50 per cent of the products originated from the US. The panel found that this latter condition violated the national treatment provisions contained in Article III:4 of GATT 1994, and did not reach the SCM Article 3.1(b) claim. For arbitration purposes, the problem was the lack of information on disbursements under the FSCs programme for the reference period of the dispute, which was the year 2000. Data on expenditures under the FSCs programme was available only every four years, and only up to 1996. Although both parties to the dispute agreed that a growth factor was required to estimate the 2000 value, they held differing views about the value it should be assigned. The defending party (the US) argued that, based on historical evidence, the average annual growth rate over the four years should be one per cent. The complainant (the EC) argued that the growth should be compounded (i.e. allow for periodic reinvestment of the tax savings) resulting in a 10.69 per cent growth up to the year 2000 (*US–FSC (Article 22.6 – US)*: Table A.1). Final estimates were $3.739 billion using the US approach and $5.332 billion using the EC approach.[37]

[36] In the one case where the Act had been used and which effectively triggered the challenge of the measure under WTO rules, the dispute was settled by mutual agreement.

[37] These figures already reflect a number of additional adjustments, specific to the FSCs programme, such as accounting for agriculture and services. Estimated subsidy values before the adjustments were $3.869 billion (US) and $5.577 billion (EC).

While these differences are large, the general approach by the Arbitrator to his mandate was not to estimate the exact value of the subsidy, but only to ensure that the requested level of suspensions was appropriate and not disproportionate. Accordingly, since the requested amount of $4,034 million was between the two estimated disbursement amounts, the Arbitrator concluded that it was not disproportionate if the value of the subsidy was to be used as the basis of granting the countermeasures. With this understanding of the mandate, trade effects need not be known. Nevertheless, in *US–FSC (Article 22.6 – US)*, although not necessary, some analysis of trade effect was carried out. It played a supporting role, but only insofar as the analysis coincided with the decision of the Arbitrator to grant an award based on the value of the subsidy. In particular, an analysis of trade effects helped to ensure that the award was not seen as being "inappropriate", i.e., the Arbitrator reached a finding that the value of countermeasures proposed by the EC, based on the face value of the subsidy rather than directly on benefits conferred by it were not disproportionate to the initial wrongful act. They then went on to discuss trade effects and found that consideration of these effects would not lead to a different conclusion. Conversely, the Arbitrator in *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*, which had been adjudicated under the Anti-dumping and SCM Agreements, were subject to the mandate of equivalence of the award to the level of nullification or impairment, which they defined as the reduction in imports arising from the transfer of anti-dumping/countervail proceeds to petitioning firms. Unlike in the three prohibited subsidies cases, the Arbitrator deemed it necessary to undertake an estimation of the trade effects of the government transfers.

In both cases, arbitrators had to choose amongst competing models. In the *US–FSC (Article 22.6 – US)* case, the EC submitted a model based on the one used by the US Treasury to explain to the US Congress the impact of a programme similar to the FSCs scheme. The "Treasury model" is an aggregate model relying only on a small number of parameters, such as the value of the subsidy, the level of exports, elasticity of export demand and the extent to which government funds are used to lower the price of exports. It is practically identical to the model submitted by the EC in *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*, although the focus there was on imports (see Box 2 below). Despite arguing against the use of models in the *US–FSC (Article 22.6 – US)* case, the US submitted the so-called "Armington model" to estimate the trade effects. Parameter requirements for this model are similar to the Treasury approach[38] with the important difference that products of different origin are regarded as imperfect substitutes. Indeed, results obtained from that model were mainly driven by the estimates for the Armington elasticities of substitution, which the US had assumed to be fairly low due to the high level of product aggregation. The same model was also submitted to the Arbitrator in *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*.

In both cases, it was rejected for similar reasons, which included a lack of data to make the model fully operational. In *US–FSC (Article 22.6 – US)*, the Arbitrator concluded that "the United States has, in any event, failed to demonstrate that alternative assumptions leading to lower estimates would be more plausible than those used in the US Treasury study and relied on by the European Communities" (*US–FSC (Article 22.6 – US)*: para. 6.50). They also noted that their "task would not be to judge, with absolute precision which is the single correct model or which are the correct parameters, but to examine the results of these models to see if they provide an insight into the range of trade effects caused by the FSC/ETI scheme carrying sufficient weight to materially affect our judgement on whether the countermeasures proposed are disproportionate" (*US–FSC (Article 22.6 – US)*: para. 6.47). By taking this approach, the Arbitrator did not take on the responsibility of assessing each of the proposed models in detail. They were satisfied by the fact that the US argument for the Armington model was unconvincing and that the proposed countermeasures of the EC were in the range of both the trade effects produced by the US Treasury model and the two estimates of the value of the subsidy (*US–FSC (Article 22.6 – US)*: para. 6.46, footnote 94).

Since the task facing the Arbitrator in the *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)* case was more precise – the equivalence of the countermeasures with the level of nullification or impairment – their

[38] Data requirements for the Armington model were: (i) the current market value share for each of the products; (ii) an ad valorem measure of the subsidy; (iii) an estimate of the substitutability of the different products for each other (the elasticity of substitution); (iv) an estimate of the price sensitivity of supply for each product (the elasticity of US export supply, EC production, and rest-of-the-world production); and (v) an estimate of the demand elasticity, assumed to be -1. For a detailed explanation see USTR (2002a).

assessment of the proposed models was more rigorous.[39] As in the Bananas case, the *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)* Arbitrator noted that he had the option of rejecting the proposed models in favour of their own approach, which they did. They rejected the Armington model due to lack of data and expressed concerns about the aggregate model proposed by the EC due to the fact that the disbursements arising from the Offset Act scheme were concentrated in a few industries only. The inter-industry impact of across-the-board measures, such as the Continued Dumping and Subsidy Offset Act and the Foreign Sales Corporation Act, is an important issue for economic modelling. Since measures such as these are available economy-wide, it is tempting to use economy-wide variables. In reality, however, the incidence of the Offset Act was quite specific to certain industries such as food and primary metals, while, for instance, there were no payments in the textiles and fabrics industry in the years 2001 and 2002. Accordingly, when calculating the economy-wide impact, inclusion of the relevant variables for the latter industry would bias the overall result. In the end, the Arbitrator chose a model structure similar to the one proposed by the EC (see Box 2), but allowing for sectoral disaggregation and appropriate industry weights.[40]

Box 2: Modelling the trade effects of government transfers in *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*

The assumption by arbitrators was that for a given Offset Act expenditure only a percentage of the actual disbursement would affect trade. This percentage reduction was called the trade effect coefficient and is reflected by the term in square brackets underneath.

Trade effect = (value of disbursements)*[(pass-through)*(import penetration)*(elasticity of substitution)]

The rationale behind this formula is that, in order to know the effect on imports, government transfers S (expressed as a margin of the price reduction ΔP_q on domestic production Q financed by these payments) not only need to be scaled down with the pass-through coefficient α, but also by the ratio of the value of imports to the value of domestic shipments R and responsiveness of imports to price changes in the domestic market (that is, the elasticity of substitution η, which, in this case, has the form of a price elasticity, i.e. an import demand elasticity). Formally, the effect on import value $\alpha*\Delta M*P_m$ (pass-through times import volume change ΔM, with M being import volume, times import price P_m) can be expressed as

$$\alpha * \eta * S * R = \alpha * \left(\frac{\Delta M / M}{\Delta P_q / P_q} \right) * (\Delta P_q * Q) * \left(\frac{P_m M}{P_q Q} \right) = \alpha * \Delta M * P_m$$

In terms of a PE model, there is an implicit assumption that export supply is infinitely elastic, i.e. world prices are given and any amount will be supplied at whatever that price. Furthermore, it is assumed that there are no income effects and no substitution to other goods occurs when prices change.

39 The Arbitrator stated that "we are expected to produce, at a minimum, an outcome which is robust in a lowest common denominator sense, but which is nonetheless, in our opinion, a fair measure of the level of nullification or impairment" *(US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*: para. 3.126).

40 Since the overall trade effect was calculated as the product of the value of disbursements, pass-through effect, elasticity of substitution and import penetration, a simple average of these variables would not be representative of the aggregate impact. Instead, the Arbitrator requested data at the 3-digit level of the North American Industrial Classification System. They then implemented the above approach at that level of disaggregation for given elasticity and pass-through values and summed the results to obtain a weighted average of the trade effects of the Offset Act by industry. That procedure gave a greater weight to industries with higher payments, for a given set of other parameters. For example, an industry with zero or low payments would yield a correspondingly small trade effect, even if other model parameters were high, and, thus, could not bias the overall result. See *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*, Annex Table 3.

By looking into the trade effects of government transfers, the arbitrators, in both cases, also focused on the so-called "pass-through", i.e. the degree to which funds given to domestic firms affect the international market.[41] The Arbitrator in *US–FSC (Article 22.6 – US)* was of the view that since FSCs benefits were tied to exporting, at a minimum this ruled out a possible zero value for the pass-through effect. With this as a lower bound estimate, they were also guided by a study of a programme similar to that of the FSCs – the Domestic International Sales Corporation Act – for which a pass-through value of 75 per cent had been found by US authorities. In response to this finding, the US argued that the pass-through value had probably decreased since then for at least two reasons based on the evidence of the types of firms taking advantage of the FSCs programme. One key argument was that if firms in an industry had market power, they would not necessarily have an incentive to lower prices. Thus, the pass-through effect would be lower the less competitive the market. Upon examination of the evidence provided by parties on the nature of competition in international markets, the Arbitrator concluded that competition had increased in the past 30 years[42] and, therefore, remained inclined towards 75 per cent as a reasonable pass-through value.

In *US–FSC (Article 22.6 – US),* the US had originally argued that the Arbitrator could use the value of the subsidy as a "proxy" for the trade effects of the subsidy. By making this argument, the US implicitly had assumed that a $1 subsidy to an exporter would result in a $1 increase in exports, i.e. a 100 per cent pass-through. Interestingly, in *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*, it was the complaining parties who were of the view that the total value of disbursed revenues met the standard of DSU Article 22.4. The United States, as the defending party, unlike in *US–FSC (Article 22.6 – US),* opposed this view arguing that the amount disbursed did not bear any relation to the level of nullification or impairment, i.e. the trade effect of the measure. The US also contended that pass-through was zero and hence the trade effects of the disbursements would be zero. The Arbitrator accepted the US argument that the trade effects of the measure was the appropriate measure of nullification or impairment, but opined that pass-through would be neither zero nor 100 per cent because "as a basic rationale of economics, firms are expected to use their money efficiently, and at least some will use that money to lower their prices" (*US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*: para. 3.141).

Since in *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)* the measure in question was the annual disbursement of tariff revenue, which depended upon a number of factors, the requesting parties were of the view that the level of suspensions should not be static, but should vary according to the level of disbursements. This view was accepted by the Arbitrator, who did not see a conflict between a varying level of suspensions and the use of trade effects to proxy nullification or impairment. Therefore, their modelling approach was to estimate a coefficient which could be multiplied by the annual level of disbursements to obtain the annual level of the suspension of concessions.

In view of the lack of precision in the pass-through and the range of possible elasticity values at the sectoral levels submitted by parties, the Arbitrator took a general approach to estimate the trade coefficient. Elasticity values by the requesting parties were taken as the medium level and then varied upwards and downwards by 20 per cent to get the high and low levels. An annual value of the coefficient was then calculated using the average of the 50 per cent and 75 per cent pass-through scenarios combined with the mid-point elasticity estimate. This was done for each year between 2001-2003, and then the average of these three values was taken. Using this methodology the Arbitrator estimated the trade coefficient to be 0.72.[43] By awarding a

41 The Arbitrator gave the following definition: "[P]ass through relates to the degree to which a company uses a subsidy it receives to lower the price of the product that it exports. At one extreme the company may choose to apply the full amount of the subsidy to the price of its products, thereby lowering its price. At the other, it may choose not to lower the price of the product" *(US–FSC (Article 22.6 – US)*: para. 6.51, footnote 97). When a firm receives untied funds from the government, it faces a variety of expenditure options. Possible trade effects depend on the commercial possibilities that recipient firms can exploit with those funds. It is not clear that such funds will be put to immediate use to gain an advantage in international markets. In sum, an exporting firm receiving a $1 transfer from a government, even though the transfer is conditional on exporting, may not automatically increase its exports by $1.

42 Interestingly, in support of their argument, the arbitrators cited the fact that average import tariffs had declined since the 1970s due to the implementation of the results from the Tokyo Round and Uruguay Round of multilateral trade negotiations. It should also be noted that, generally, pass-through is not a monotonic function of the degree of competition.

43 The coefficient can also readily be interpreted in economic terms: in essence, the arbitrators have concluded that every dollar collected by the US government from anti-dumping revenues and returned to petitioning firms would reduce the value of US imports by 72 cents.

coefficient instead of an actual dollar amount, the Arbitrator linked the annual effect of the inconsistent measure to the retaliation. Therefore, the level of retaliation, in dollar amounts, would not necessarily be the same for each year, or for each complaining member to the dispute.

All in all, arbitrators have clearly been open to quantification on the basis of economic models, where they have found it necessary to fulfil their mandates, even where parties have argued against doing so. In *US–FSC (Article 22.6 – US)*, for example, the US put forth the argument that WTO arbitrations should not resort to economic modelling because it was too unreliable (*US–FSC (Article 22.6 – US)*: para. 6.36). While not suggesting that economic modelling could be done with any precision, the Arbitrator rejected the US argument by describing the alternative approach suggested by the US as "manifestly arbitrary" and added that, if the subsidy amount could be interpreted as a proxy for the scheme's impact on trade, the whole concept of "trade effect" became redundant (*US–FSC (Article 22.6 – US)*: para. 6.39). The Arbitrator in *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)* simply noted that while economic modelling was imprecise, it was not so inaccurate as to render the whole process meaningless. In particular, they expressed strong support for the position of Arbitrator in *US–FSC (Article 22.6 – US)* that "evaluating the trade effects of the scheme cannot be accomplished with mathematical precision", but that "economic science allows for the consideration of a range of possible trade effects with a certain degree of confidence" (*US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*: para. 3.125).

(b) Use of quantitative economics during panel and Appellate Body proceedings

As stated in the introduction, the use of quantitative economics during panel and Appellate Body proceedings is considerably different from that in the context of arbitrations. While in some instances, arbitrators themselves have elected to rely on quantitative economic analysis to carry out their mandates, in panel and AB proceedings to date, only parties have made such arguments and presented such analyses. The specific type of analysis and the way it is used varies depending on the nature of the claims and legal provisions involved. Most importantly, it must be kept in mind that there is no need to demonstrate any trade or other economic effects in order to justify a sufficient interest to initiate and trigger the dispute settlement mechanism. Each WTO Member can challenge any other Member's measures.

Moreover, in most cases it is not required to show trade or other economic effects to prove a violation of WTO provisions, although there are certain exceptions, for instance in the Anti-dumping and SCM Agreements, where a quantification of dumping/subsidy effects is required when calculating the amount of an anti-dumping or countervailing duty. The economic impact is legally irrelevant, for example, in respect of a *de jure* national treatment violation discernible from the text of the challenged law. This does not preclude that quantitative economic analysis may be submitted in such a case: if the case is about, say, a claim of tax discrimination under GATT Article III, empirical analyses of the competitive relationships within a given market may be undertaken by parties in order to address the question of whether foreign and domestic products at issue are "directly competitive or substitutable". However, once substitutability is established and *de jure* discriminatory treatment derives from the text of the challenged measure itself, a precise assessment of the trade effects is not necessary for a violation finding. By contrast, trade effects might also be relevant in examining a claim of de facto discrimination, i.e. situations where a policy measure, on the face of it, does not discriminate against products of foreign origin, but indirectly or implicitly may do so. This Subsection provides an example of a dispute for each of the economic questions identified in Section 2.

(i) Actionable subsidies and claims of serious prejudice: effect of policy measures on trade

Serious prejudice relates to the adverse effects caused to another Member's exports by actionable subsidies. The adverse effects in question could be in relation either to the subsidizing country's market or a third market. The central question is whether the subsidy is responsible for displacing or impeding the exports of the complaining Member or leads to a significant price undercutting, price suppression/depression or lost sales in the same market or has the effect of increasing the world market share of the subsidizing Member.[44]

[44] This has been paraphrased. See paragraphs (a)-(d) of SCM Article 6.3 for the precise wording.

The size of the effect on trade is of secondary importance. First and foremost, a complaining country needs to show that its trade flows are affected, for instance, because prices it obtained previously or could be expected to receive have been suppressed due to subsidization. There have only been three serious prejudice disputes to date, and in only one of them, the recent *US–Upland Cotton* case, has any party relied on economic modelling in presenting its claims and arguments. In that case, cotton subsidies by the United States were claimed to cause serious prejudice to the interests of Brazil (pursuant to SCM Articles 5(c) and 6.3(c) and (d)).

In support of its case, Brazil submitted the result of a simulation, and some elements thereof, performed by an external expert who adapted the Food and Agricultural Policy Research Institute (FAPRI) model (see Box 3), and on this basis estimated the impact of US cotton subsidies on the world price of cotton. The simulation performed by the expert looked at a whole range of support programmes – crop specific, non-crop specific, decoupled, price support directed at exports, etc. The expert concluded that for the period 1999-2002, all these support programmes had the effect of reducing the average world price by 12.6 per cent. The impact of the various programmes on the average world price differed, with those providing direct price support having a greater effect than the decoupled programmes, which provided support irrespective of market conditions. This is consistent with economic thinking which predicts that producers will respond strongly to price incentives whereas support that is not tied to prices or production levels will have less (or no) effect on production. But objections were raised about the changes made to the FAPRI model. It was claimed that the adaptations and modifications of the FAPRI model made it different from the FAPRI system, introduced some errors and exaggerated the results. An older and lower baseline was used which accentuated the changes. It was argued that differences in the methodology for estimating US crop acreage created a greater US production response and the choice of a more inelastic foreign demand estimate resulted in a bigger world price change (*US–Upland Cotton*, Panel Report, WT/DS267/R/Add.2: Annex I-9). These disagreements were technical in nature and reflected differences in the choice of the appropriate approach to modelling the question.

In the end, the panel decided to take the "analyses in question into account where relevant to (its) analysis of the existence and nature of subsidies, and their effects" (*US–Upland Cotton*, Panel Report: para. 7.1209). Importantly, however, the panel did not rely "upon the quantitative results of the modelling exercise – in terms of estimating the numerical value for the effects of the United States subsidies, nor indirectly, in (the) examination of the causal link" (*US–Upland Cotton*, Panel Report: para. 7.1205).[45] The panel was willing to grant that the outcomes of the simulations were consistent with the general proposition that subsidies distorted production and trade and that the effects of a subsidy may vary depending upon its nature, but was not willing to go beyond that. This points to an important impediment to the use of complex economic models in dispute settlement cases. When disagreements about a model turn on many technical issues, and when economists themselves give conflicting views about the issues, a panel may feel that it is not in a position to resolve those questions. In the *US–Upland Cotton* dispute, this difficulty was compounded by the fact that the FAPRI model, whether in documentary or electronic form, was not made fully available to the panel.[46] More fundamentally, a panel may conclude that economic analysis is not necessary for the resolution of the dispute before it. In this respect, the *US–Upland Cotton* panel found that the serious prejudice provisions do not require a precise quantification.

[45] The Appellate Body needed to address the question whether the panel took into account supply responses of third countries, as reflected in certain models that incorporate such responses (*US–Upland Cotton*, Appellate Body Report: para. 447). It noted that the panel had "indicated expressly that it had taken the models in question into account. [Footnote omitted, where reference is made, among others, to paras. 7.1205 and 7.1209 of the Panel Report] It would have been helpful had the panel revealed how it used these models in examining the question of third country responses. Nevertheless, we are not prepared to second-guess the Panel's appreciation and weighing of the evidence before it" (*US–Upland Cotton*, Appellate Body Report: para. 448).

[46] Based on our email exchanges with FAPRI-Missouri staff, no detailed documentation in the form of technical or working papers of the FAPRI cotton model is currently available.

Box 3: The Food and Agricultural Policy Research Institute (FAPRI) model

FAPRI was established in 1984 by a grant from the US Congress. It is used in the US to brief members of the US Senate and House Agriculture Committees on projections for US and world agricultural markets. In making its projections, FAPRI submits its preliminary baseline to a review process before a panel of experts, including employees of several agencies of the US Department of Agriculture. But the results of FAPRI baseline projections are not official projections. The US Department of Agriculture maintains its own model which it uses for similar 10-year baseline projections.

The FAPRI model is a multi-market model of world agriculture that has been used to make long-term projections (up to a horizon of ten years) on the path of world commodity prices, consumption, production and trade. Its major foci are crops, vegetable oils and fats, livestock and dairy and dairy products. The model incorporates the linkages between dairy, livestock, grain, and oilseed markets. Feed prices impact dairy and livestock supply decisions, and animal inventories have an impact on milk and meat production. The supply of dairy and livestock animals are used to determine demands for feed, which ultimately influence feed prices. Oilseed markets are linked to livestock markets through oilseed meal demand. Vegetable oils are substitutes in consumption and compete in final consumption for consumers' income. The FAPRI model solves for world prices by equating excess supply and demand in the world market (Babcock et al., 2002).

The starting point of FAPRI simulation is the long-term agricultural baseline, which is projected over a 10-year horizon. Consistency in the results of the suite of models is ensured by adopting a common assumption about the macroeconomic environment, trade and agricultural policies and world weather conditions, which are all exogenous variables in this baseline simulation. The most important global macroeconomic assumptions are those involving GDP growth and currency movements. The agricultural and trade policy assumptions include the likely trajectory of support programmes for agricultural products and the outcomes of regional and multilateral trade negotiations. For example, in its 2004 projection, the major policy assumptions include the nature of CAP reform, the timing of EU enlargement and implementation of the WTO accession commitments of China. Finally, the baseline assumes that average weather patterns worldwide will prevail, current technological trends will continue and that there will be no pandemics. Alternative policy scenarios (e.g. subsidies on upland cotton) can then be simulated and the effect on domestic and world prices and output compared against the long-tern baseline.

(ii) Directly competitive or substitutable products: effect of imports on domestic products

The national treatment principle is a central component of the WTO Agreement. Its basic idea is that once foreign products have entered the market, they should be treated no less favourably than like, directly competitive or substitutable domestic products, as the case may be. This principle implies that WTO Members are expected not to use internal policy measures in a protectionist fashion. The national treatment principle with respect to trade in goods is enshrined in GATT Article III. In a number of recent disputes invoking GATT Article III, quantitative economic analysis has been used to underline the arguments of one or both parties to the dispute, most notably in three cases involving taxation of alcohol: *Japan–Alcoholic Beverages II*, *Korea–Alcoholic Beverages* and *Chile–Alcoholic Beverages*. In these cases, parties have adduced quantitative economic analysis in order to strengthen their arguments on whether products were "directly competitive or substitutable".[47] In all three "alcohol cases" econometric and non-econometric evidence on price differences and cross-price elasticities has been used in this context.

[47] Once this was established, it could then be shown that the two products were not similarly taxed and that dissimilar taxation operated so as to afford protection to domestic production. See Horn and Mavroidis (2004).

If the term "directly competitive or substitutable" is meant to capture the extent to which an increase in the tax on the imported product benefits the domestic product in terms of increased sales, then the appropriate economic concept to measure the degree of direct competition or substitutability is that of cross-price elasticity. In order to obtain an idea of the cross-price elasticity between two products, data on the sales of product B at different levels of prices for product A are thus necessary. Indeed in all three alcohol cases reference was made to either actual demand and price changes or changes based on survey answers. In *Korea–Alcoholic Beverages*, for instance, the complainants argued that the applicable liquor tax rate on whisky had progressively been lowered from 200 per cent in 1990 to 100 per cent in 1996. During the same period, the applicable import customs duties were lowered from 70 per cent to 20 per cent. These tax and tariff changes were followed by a reduction of the prices for whisky and a spectacular increase in sales from 11 million litres in 1992 to 27 million litres in 1996. In addition, sales of soju (the Korean spirit subject to a lower tax rate than whisky most of which is imported) had grown at a lower pace than overall demand for distilled spirits and liqueurs. As a result, according to the complainants, soju had lost market share, mainly to the benefit of whisky. Whereas the market share of soju fell from 96.37 per cent in 1992 to 94.39 per cent in 1996, the share of whisky during the same period increased by a similar percentage, from 1.53 per cent to 3.14 per cent. The complainants concluded that this transfer of market share from soju to whisky showed that the two liquors were in competition with each other on the Korean market (*Korea–Alcoholic Beverages*, Panel Report: paras. 5.139 to 5.142).

This information on the evolution of prices and sales for whisky and soju is illustrative at best of the level of competition and substitutability between the two products. The description only contains information on two data-points, 1990/1992 and 1996. The price changes taking place in this period were apparently quite large and it is difficult to foresee whether and to what extent demand would have been affected by smaller price changes. Moreover, economic factors other than whisky prices may have had an impact on the demand for soju in the relevant period, such as changes in the price of soju itself or changes in the disposable income of consumers. If the relationship between the price of whisky and the demand for soju were to have been estimated econometrically as a cross-price elasticity, information on the demand for soju at a whole range of different whisky prices would have been needed as well as sufficient quality data on other variables that may affect the demand for soju (see Box 4).

In *Chile–Alcoholic Beverages* both parties provided evidence on cross-price elasticities based on econometric studies. In Chile's analysis the demand for pisco (a spirit made in Chile) was explained as a function of the price of whisky (the "cross-price" under consideration) as well as its own price, the prices of wine and beer and consumer income. Fifteen observations were used for this regression. This is significantly more information than what is typically contained in descriptive analyses of the sort discussed above in *Korea–Alcoholic Beverages*. But in order to obtain any reliable results from regression analysis, 15 data-points should probably be considered insufficient. The advantage of using this type of regression analysis is that it makes it possible to control for other influences affecting the demand of the relevant good, in this case consumer income and the prices of pisco, wine and beer. Yet, in order for results to be reliable, the list of variables included needs to be complete and the regression correctly specified with respect to its functional form. If enough data of sufficiently high quality were used and if the regression was correctly specified, "there would be no need to bring in any additional indicators, the econometric estimate would say all we need to know about the CPE (cross-price elasticity), and the CPE says all we need to know about the relationship between the two products" (Horn and Mavroidis, 2004: 62).

Unfortunately, these conditions are rarely satisfied. The availability of data is frequently a problem in econometric analysis and it is likely to be significant when it comes to estimating cross-price elasticities in the context of WTO disputes. One reason for this is the rather disaggregated level at which data would be needed in order to establish direct competitiveness or substitutability between two products. Such disaggregated data are often not even available for sufficiently long time periods in industrialized countries and much less so in developing countries. If they exist, such data are only collected by the relevant industries, who may be reluctant to make them available for WTO dispute settlement purposes if they fear that it may be used against their interests.[48]

[48] For instance, in *Chile–Alcoholic Beverages*, a third analysis of the market for pisco was discussed, the results of which showed that a 47 per cent drop in the price of whisky would lead to a 17 per cent drop in the sales of pisco. These results indicate the existence of a relatively high cross-price elasticity between whisky and pisco. Although these results had been widely publicized at the time they were obtained by the Chilean pisco industry, the industry did not make the study available to the *Chile–Alcoholic Beverages* dispute. See *Chile–Alcoholic Beverages*, Panel Report: paras. 4.238 – 4.248.

Where serious efforts are made to obtain high quality data and to refine the methods used in this type of exercise, regression analysis can be a powerful tool to obtain reliable information on the competitive relationship between two products. That said, in the "Alcohol" disputes, the interpretation of regression results and questions concerning the specification of regressions for the purpose of measuring cross-price elasticities were subject to considerable controversy. Thus, to date there is no standard approach to, nor general acceptance of, the use of this type of technique in WTO disputes involving issues of product substitutability.

Box 4: The use of econometric analysis to estimate cross-price elasticities

In order to establish whether two goods are "directly competitive or substitutable" it is useful to find out whether the two goods are characterized by a positive cross price elasticity (CPE). A positive CPE implies that the demand for one good (e.g. the domestic good) goes up if the price of the other good (e.g. the imported good) increases. In order to obtain information about the CPE between two products data on prices and demand for the relevant goods are needed. It shall be assumed that in the chart below the 15 dots represent 15 observations of price and demand combinations, that is, they show how much of good B was bought at different levels of price for good A. A simple look at the dots creates a strong impression that a positive relationship between the two variables exists. Why would it be useful to use econometric analysis to get information about the CPE?

Multiple linkages

It is highly unlikely that the demand for good B only depends on the price of good A. The relationship in the above chart may be purely due to the fact that the price for good B was going down at the same time. Econometric analysis makes it possible to filter out to what extent different factors affect the demand for good B. If the price of good A affects the demand for good B after having controlled for other variables, it is safe to say that a competitive relationship between the two goods exists.

Significant relationships

Econometric analysis makes it possible to pin down whether an observed relationship between two variables is likely to be a significant relationship or rather a coincidental one. Statistical significance is reflected in the so-called t-statistics. If, for instance, the *t-statistic* indicates that the price of good A is significant at the 1 per cent level as a determinant of the demand for good B, this means that there is a probability of only one per cent or less that the price of good A has no impact at all on the demand for good B.

Size of the cross-price elasticity

Econometric analysis not only allows us to see whether a cross-price elasticity between two goods is positive and significant, it also makes it possible to assign the CPE a number.

In *Japan–Alcoholic Beverages II*, the defendant submitted evidence based on econometric analysis and in *Chile–Alcoholic Beverages* both parties did. In both cases the defendant's tax system was accused of being in breach of GATT Article III, because it would put imported alcoholic beverages at a disadvantage compared to national alcoholic beverages, shochu in the case of Japan and pisco in the case of Chile. In both cases the econometric evidence presented focused on whisky as the imported alcoholic beverage.

In *Japan–Alcoholic Beverages II*, Japan submitted the result of econometric analysis using consumption data for 20 years based on household surveys by the Bureau of Statistics of the Japanese Management and Coordination Agency.[49] Using prices of shochu, whisky, beer, wine and sake, the household consumption expenditures, and the trend factor (i.e. a simple temporal indicator, capturing all sorts of evolutions in time, such as inflation, technological progress and growth) as seven explanatory variables, 16 different equations were developed in order to explain both shochu and whisky consumption. In *Chile–Alcoholic Beverages* the complainant, the EC, presented the results of a time series estimation carried out in 1995 using quarterly data for the period of 1985-1992 by the consultant firm Gemines ("Gemines 1995"). The defendant, Chile, presented the results of a time series estimation using annual data for 15 years. The output of Chile's regressions is reported in the Panel Report and is reproduced below in Box 5, which is a typical example of the output of a computer regression programme. It contains important information for the interpretation of the results and thus for the decision on whether two products are directly competitive or substitutable.

Box 5: Cross-price elasticity of pisco with whisky, wine and beer as estimated by Chile in *Chile–Alcoholic Beverages*

The regression was specified as follows:

$$\text{Demand-pisco}_t = \alpha+\beta\ \text{income}_t + \gamma\ \text{price-pisco}_t + \delta\ \text{price-whisky}_t + \theta\ \text{price-wine}_t + \lambda\ \text{price-beer}_t + \varepsilon_t$$

Statistics of the regression	
Multiple coefficient correlation	0.9878
Coefficient of R^2	0.9758
Adjusted R^2	0.9624
Observations	15

Analysis of coefficients					
	Coefficients	*Standard error*	*t-Statistic*	*Inferior 95%*	*Superior 95%*
Interception	3.5771	3.6554	0.9786	-4.6920	11.8461
Variable X 1 (Income)	-0.0072	1.2109	-0.0059	-2.7465	2.7321
Variable X 2 (Pisco Price)	-1.3109	0.4574	-2.8661	-2.3456	-0.2762
Variable X 3 (Whisky Price)	0.1248	0.5158	0.2419	-1.0421	1.2917
Variable X 4 (Wine Price)	0.5963	0.4030	1.4796	-0.3154	1.5079
Variable X 5 (Beer Price)	0.3622	1.2132	0.2985	-2.3823	3.1067

Size of the relevant parameter

Information on the cross-price elasticity between whisky and shochu/pisco is reflected in the parameter for the whisky price in a regression explaining the demand for shochu/pisco. In the equation presented in Box 5 above this is the parameter γ with an estimated value of 0.1248. This parameter should be positive if the two products are "directly competitive or substitutable" indicating that consumers buy more of the product if the price of the other product increases. It is not necessarily the case that the estimated value of the parameter

[49] Regressions and regression results have not been reproduced in the panel report and are not available to the authors. The discussion of the regression results is entirely based on the arguments by defendants and complainants represented in the panel report.

is equal to the cross-price elasticity. Sometimes it is necessary to perform further computations. Whether or not this is necessary depends on the specification of the regression. As a technical matter, only if all of the variables appear in logarithmic form (in so-called "logs") does the estimated parameter directly correspond to the cross-price elasticity. This is not the case for the value of 0.1248 in Box 5 (*Chile–Alcoholic Beverages*, Panel Report: para. 4.230). The cross-price elasticity can, however, easily be computed from this value. Does a positive cross-price elasticity imply that two goods are "directly competitive or substitutable"? It probably needs to be positive *and* "relatively high". The latter "threshold", above which goods are considered to be directly competitive or substitutable, may depend on the specific products at hand and vary quite substantially across sectors.[50]

Significance of the relevant parameter

The output in Box 5 also gives information as to whether the estimated parameter represents a purely coincidental relationship or a significant one. This information is contained in the column "t-statistic". As a rule of thumb, one can consider t-statistics above 1.65 or below -1.65 to indicate that the relationship is significant. These values imply that the probability of the estimated parameter being zero is lower than 10 per cent. The corresponding t-statistic is indeed far below 1.65 and, hence, the estimated parameter cannot be considered significant at the 10 per cent level. In *Chile–Alcoholic Beverages*, the study commissioned by the EC (Gemines 95) also finds a positive parameter, but the parameter is (according to a statement by Chile) not significant at the 5 per cent level.[51] In *Japan–Alcoholic Beverages II* the whisky price turned out not to be significant for the consumption of shochu, whereas the price of beer was found to have a significant influence on shochu consumption.

Variables included in the regression

Regression output like that presented in Box 5 also gives information on the way a regression has been specified. In particular it shows which variables have been included in the regression. In this particular case the price of pisco, whisky, wine and beer and the income of consumers have been taken into account. It is clear that a good's own price and consumers' income determine how much of a good is consumed. The inclusion of the price of wine and beer implies that these products are expected to have some kind of relationship with pisco, in this case they are probably expected to be substitutes. Japan, the defendant in *Japan–Alcoholic Beverages II*, includes seven explanatory variables in its regression that are supposed to have an influence on shochu consumption: prices of shochu, whisky, beer, wine and sake, the household consumption expenditures and a trend factor. The results of several regressions conducted led Japan to believe that higher beer prices increase the consumption of shochu, while changes in the price of whisky leave the consumption of shochu unaffected (*Japan–Alcoholic Beverages II*, Panel Report: para. 4.85).

It is important to make sure that all the relevant variables are included in such regressions. In *Korea–Alcoholic Beverages* the defendant argued that whisky was consumed primarily in high-class hotel bars, night clubs, room saloons, and karaoke bars, whereas diluted soju, when drunk away from home, was mainly consumed in Korean restaurants, mobile street vendors and inexpensive restaurants (*Korea–Alcoholic Beverages*, Panel Report: para. 5.247). If this is the case, one may consider to also include, for instance, the prices of meals in different types of restaurants and entry prices of various premises in a regression that is meant to explain the relationship between the price of whisky and the sales of soju.[52]

[50] The cross-price elasticity between Coke and Pepsi has, for instance, been estimated to be 0.52 (0.64 between Pepsi and Coke). See Gasmi et al. (1992). Other studies have estimated the cross-price elasticity between relatively large product groups like "food and housing", that may be less relevant for WTO dispute settlement purposes.

[51] *Chile–Alcoholic Beverages*, Panel Report: para. 4.236. The report does not contain information about the actual t-statistics and it is therefore not possible to know whether the estimated parameter may have been significant at the 10 per cent level.

[52] No regression analysis was carried out in the context of *Korea–Alcoholic Beverages*.

Fit of regressions

The coefficient for the "adjusted R-square" in Box 5 indicates the percentage of the variation in the sales of pisco that can be explained by the variation of the variables included in the regression. It is often called the "goodness" of fit, i.e. it is a measure of how well the regression results portray the real relationship. This coefficient can take values between 0 and 1 and the closer to unity the better. According to the above regression output, the price of pisco, whisky, wine and beer together with consumer income explain 96 per cent of observed variation in the demand for pisco.

In principle this is a very positive outcome. One interpretation of such a high R-square is that the relevant regression is properly specified and thus explains reality well. R-squares, however, tend to be higher in regressions with few observations, and the above regression only uses 15 data points, a fairly small number. Besides, time series regressions, that is, observations of relationships over time, often suffer from a problem called "autocorrelation" (which is related to the persistence of outside influences) leading to an overestimation of R-square. A high R-square may also be caused by "multicollinearity", i.e. an approximate linear relationship between two or more of the explanatory variables. In this particular case, the three price variables may be following a time trend, such as inflation affecting all prices. The low t-statistics point to multicollinearity more than autocorrelation, where t-statistics tend to be high. In any case, a particularly high R-square, rather than giving reassurance, may also raise suspicions about the reliability of the regression results.[53]

Reliability of regression results: autocorrelation and multicollinearity

The regressions performed in both *Japan–Alcoholic Beverages II* and *Chile–Alcoholic Beverages* were based on the analysis of time series. This implies that the observations were taken from different moments in time. Although household surveys make it in some cases possible to use cross-sectional data (i.e. observations taken from different households), cross-price elasticities have frequently been estimated with time series data. Unfortunately, time series data have certain characteristics that create problems for the interpretation and the reliability of results.[54]

In time-series data, random shocks (disturbances) have effects that often persist over more than one time period. An earthquake, flood, strike or war, for example, will probably affect the economy's operation in periods following the period in which it occurs. The persistence of such effects that are not included in the regression, but have an influence on the dependent variable leads to so-called autocorrelation of observations. Extra care needs to be taken in using regression techniques and interpreting results. Regressions suffering from autocorrelation tend to be characterized by high R-squares that overestimate the "goodness of fit" as well as t-statistics that do not accurately reflect the significance of the estimated relationship. If these problems are not corrected, the presence of autocorrelation in time-series data makes regression results unreliable. In *Japan – Alcoholic Beverages II*, this was an issue and some well-established methods were used to make the appropriate adjustments.[55]

Another issue related to time series data discussed in both *Japan–Alcoholic Beverages II* and *Chile–Alcoholic Beverages* is the problem of multicollinearity.[56] As noted above, this problem occurs when an approximate linear relationship exists between some of the explanatory variables, for instance between the price of whisky and the price of wine. This situation can arise for several reasons. The independent variables may all share a common

53 The issue of autocorrelation has been discussed in *Japan–Alcoholic Beverages II. See Japan–Alcoholic Beverages II*, Panel Report: paras. 4.87, 4.88, 4.169 and 6.31.

54 See for instance Harvey (1990) for a detailed discussion of the econometric analysis of time series and the many more caveats to be heeded in generating and interpreting time series regression results.

55 Most computer regression packages provide tests to detect autocorrelation. The most popular test is probably the Durbin-Watson test. A number of techniques exist to overcome the problems caused by autocorrelation and to obtain more reliable parameter values and t-statistics. The Cochrane-Orcutt technique, Durbin's two-stage method, the Hildreth-Lu search procedures and the Maximum Likelihood technique are among the most popular techniques. Both the Cochrane-Orcutt method and the Maximum Likelihood technique have been applied in *Japan–Alcoholic Beverages II*.

56 See *Chile–Alcoholic Beverages*, Panel Report: paras. 4.231, 4.70 and 4.235; and *Japan–Alcoholic Beverages II*, Panel Report: paras. 4.88, 4.169 and 6.31.

time trend, or one independent variable may be the lagged value of another that follows a time trend.[57] The European Communities, one of the complainants in *Japan–Alcoholic Beverages II*, alleged that a hot summer would increase the consumption of all beverages and thus lead to problems of multicollinearity (*Japan–Alcoholic Beverages II*, Panel Report: para. 4.89). As a result, the parameter estimates are not precise and the t-statistic cannot be relied upon for the significance of results.[58] The latter is the case, because the high correlation between the two variables may make it difficult to disentangle their separate effects, even though both are rightly included in the model. Hence, it is quite possible that according to the regression results neither variable is significant on statistical grounds, even though they both matter in reality. In cases such as the ones on alcoholic beverages, it would typically be the defendant claiming that imported and domestic goods (e.g. imported whisky and a domestically produced spirit) are not directly competitive or substitutable. If multicollinearity is an issue, it may mainly represent a problem for the defendant, as the finding of a low t-statistics could not easily be used as evidence that the price of the imported good did not affect the sales of the domestically produced good.

Economists often use a rule of thumb: If t-statistics are higher than 2 or lower than -2 for all the relevant variables, multicollinearity is not considered further. In order to determine a relationship of direct competition or substitutability, however, not only the significance of the relevant parameter is important but also its size. Even if the relevant price is found to be significant, i.e. if the rule of thumb can be applied, a problem remains when it comes to the interpretation of the estimated size of the parameter, as this value is not entirely reliable. It may change substantively when (one of) the correlated explanatory variables is excluded from the regression.[59] Unfortunately, it is not straightforward to solve problems of multicollinearity.[60]

Robustness tests

The discussion so far has shown that there is not just one way to estimate the relationship between variables using econometric methods. Instead a whole range of choices have to be made, including:[61]

- Which variables to include;
- Which functional form to use for the regression; [62]
- Which estimation technique to apply.[63]

Different approaches on these matters may lead to different findings. If only one approach is presented, it may create the impression that the approach is chosen that delivered the most suitable results. In order to forestall such suspicions, econometricians tend to first present results for their most preferred approach and then test whether these results are robust (i.e. uphold), when running additional regressions using alternative approaches.

In *Japan–Alcoholic Beverages II*, Japan presented results for a whole range of different approaches, including linear, log-linear and other models. Different techniques were also used, including techniques that address problems of, for instance, autocorrelation. Japan argued that the results of these regressions did not allow

57 Prices of different goods, for instance, are all affected in a similar way by the inflation rate. It could therefore be argued that inflation-adjusted prices should be used in regressions of the type discussed in this Section. Given the high level of disaggregation of the data used in these regressions, deflating with an aggregated consumer price index may, however, cause other problems.

58 This means that simple estimation methods do not provide the researcher with reliable estimates of the parameters. See Kennedy (1987).

59 This is also one of the indications used to detect the presence of multicollinearity. Another way to detect multicollinearity is to look at the correlation matrix of the independent variables. This matrix will, however, only help to detect high correlation between two variables and not correlation between a combination of three or more variables.

60 One way of approaching the problem is to try to formalize the relationship between the two correlated variables and to run so-called simultaneous equation regressions. Another approach is to formalize the relationship between two parameters (e.g. Koyck distributed lags).

61 Other issues exist that have not been discussed in this Section, for instance, the choice of the period for which variables are used. In disputes like the ones discussed here, that decision will to a large extent depend on the availability of relevant data.

62 The difference between fully linear, log-linear and other specifications, such as quadratic functions, will not be further discussed.

63 See the discussions on autocorrelation and multicollinearity.

for the conclusion that the consumption of shochu was affected by the price of whisky, unlike the price of beer, which was confirmed to exert significant influence on the consumption of shochu (*Japan–Alcoholic Beverages II*, Panel Report: para. 4.88). In *Chile–Alcoholic Beverages*, Chile only conducted two regressions in addition to the one presented in Box 5 above. Robustness of the results was checked by eliminating the insignificant variables, income and beer price, one after the other. The price of whisky was insignificant in all three specifications, whereas the price of wine became a significant determinant, once per capita income was eliminated from the regression (*Chile–Alcoholic Beverages*, Panel Report: paras. 4.226 and 4.227).

In both *Japan–Alcoholic Beverages II* and *Chile–Alcoholic Beverages*, the panel referred to the econometric evidence provided by defendants and/or complainants. In particular, in both cases the panel ruled that the products at stake should be considered directly competitive or substitutable,[64] even though the econometric evidence provided could have led to the opposite conclusion. In *Japan–Alcoholic Beverages II*, the panel referred explicitly to the above-mentioned problems of auto-correlation and multicollinearity in time-series analysis (*Japan–Alcoholic Beverages II,* Panel Report: para. 6.31). These problems had been pointed out by the complainants during the dispute and the panel noted that Japan had not succeeded in rebutting the criticisms advanced. Instead, the panel found that a consumer survey conducted by the complainants contained persuasive evidence of a "significant elasticity of substitution" between the products in dispute.

In *Chile–Alcoholic Beverages*, the panel referred to the results of the regression analyses submitted by both parties and discussed their relevance for the dispute. Among other factors the panel pointed out, that "a low estimated coefficient, as determined in the study submitted by the European Communities and the data from Chile, is not in itself conclusive that substitutability does not exist" (*Chile–Alcoholic Beverages*, Panel Report: para 7.77). Indeed, the panel concluded that the relevant products should be considered to be directly competitive or substitutable basing its decision, among others, on the production and marketing decisions of the pisco producers that, according to the panel, clearly showed "their desire to convey the image of pisco as a drink that competes with the best imported distilled spirits" (*Chile–Alcoholic Beverages*, Panel Report: para 7.85).

(iii) Causation analysis in trade remedy disputes: effect of imports on domestic producers

Although it might appear that a great deal of quantitative economics is required in trade remedy dispute resolution in the WTO, that is often not the case. This is because in anti-dumping, countervail and safeguards, it is the relevant national authorities who conduct the investigations in order to determine whether dumping, subsidies or import surges occur and cause injury to the domestic industry. All three Agreements contain procedural rules governing the investigation process up to the imposition of final measures, as well as substantive rules (some more detailed than others) about the analyses that must be conducted. Panels and the Appellate Body are not expected to re-investigate the case or to conduct a *de novo* examination. In the Anti-dumping Agreement, there is a special standard of review which reinforces the key role of investigating authorities in conducting the substantive analysis. Thus, in WTO dispute settlement concerning trade remedies, the issue is whether the authorities have abided by the pertinent WTO rules – for instance, whether authorities have evaluated all relevant factors, whether they have provided a reasoned and adequate explanation of how the facts support their determination, whether the investigation and conclusions are objective and unbiased. In trade remedy disputes, therefore, many claims concern alleged violations of procedural requirements, and the substantive violations alleged typically have to do with how a given part of an analysis was performed. Nevertheless, there is no guarantee that questions on the analytical and quantitative tools that have been applied cannot surface also at the panel level. This has been the case in safeguards disputes, in particular, disputes concerning the causation (and non-attribution) of injury.[65] Similar issues in respect of injury also arise in the context of disputes on anti-dumping and countervailing measures.

[64] In *Japan–Alcoholic Beverages II*, this was upheld by the Appellate Body. See *Japan–Alcoholic Beverages II, Appellate Body Report: p. 26)*. In *Chile–Alcoholic Beverages*, this aspect was not appealed. See *Chile–Alcoholic Beverages*, Appellate Body Report: para. 48.

[65] There are other examples. For instance, the rules of the Anti-dumping and SCM Agreements also require national authorities to ensure that anti-dumping and countervailing duties are not in excess of dumping and subsidy margins. This presupposes precise quantification of those margins and the economic methodology applied by national authorities is subject to panel review.

At the outset, the special standard of review in anti-dumping cases will briefly be explained. It will also be pointed out that trade remedy investigations, albeit often of a data-intensive nature, appear to require financial analysts and industry specialists rather than economists, and some of the quantitative methods frequently used by domestic investigating authorities, but not normally considered by WTO adjudicating bodies, will be mentioned. Perhaps most prominently, economists working in the field of contingency protection may be involved in inquiring into the existence of a causal link between rising imports – or dumped or subsidized imports – and injury to a domestic industry. In any of these types of investigations, economists might be called upon first to establish a correlation between the increasing trend in imports and the worsening situation of the domestic industry (as measured, for example, by sales, production, productivity, capacity utilisation, profits and losses, and employment) and, furthermore, to identify the influence of other factors on these indicators. Such questions have surfaced in some trade remedy disputes, particularly safeguards, and will be discussed in more detail.

Anti-dumping[66]

Article 17.6 of the Anti-dumping Agreement establishes a special standard of review for WTO dispute settlement that limits the scope of a panel's review regarding the methodology used by national investigating authorities in establishing the facts. Specifically, Article 17.6(i) states: "If the establishment of the facts was proper and the evaluation was unbiased and objective, even though the panel might have reached a different conclusion, the evaluation shall not be overturned".[67] As a result, panels are mostly concerned with seeing that the terms set out in the agreement are followed and not with the conclusions reached by the investigating authorities.

This can be illustrated in a number of decisions bearing on Article 3.5 of the Agreement.[68] Under Article 3.5, if the domestic industry is found to be injured by the dumped imports, the investigating body must examine other relevant factors that may have contributed to the injury of the domestic industry. In the case of *US–Hot-Rolled Steel*, the Appellate Body reversed the panel's findings that US investigating authorities properly ensured that the injurious effects of the other factors had not been attributed to the dumped imports. It based this ruling on an interpretation (analogous to the one it had previously reached in the *US–Lamb* and other safeguard disputes) that under the causation/non-attribution requirements contained in Article 3.5 of the Anti-Dumping Agreement, investigating authorities need to separate and distinguish the injurious effects of the other factors from the injurious effects of the dumped imports. So, the question at issue was not whether the national authorities' conclusions were right, but whether this separation and distinguishing was undertaken. The Appellate Body also noted, however, that the Anti-Dumping Agreement does not prescribe the process by which Members choose to engage in separating and distinguishing the relevant effects (*US–Hot-Rolled Steel*, Appellate Body Report: paras. 223-224).

In sum, so far there has not been much quantitative economic analysis, as defined in this essay, in WTO dispute settlement proceedings on anti-dumping matters. Certainly, calculations of a data-intensive nature are required to determine dumping margins or declines in profits, output, market share, etc., but this is the task of national authorities. If a party wants to make the case that the defendant acted with bias or that the establishment of facts was improper, it may provide such evidence. Within the national procedures of some Members, parties as well as authorities make regular use of econometric analysis and economic models as a complement in their injury determinations, in particular in order to test the causal relationship between dumped imports and the economic performance of the domestic industry and to separate out other factors causing injury. Given the

66 The discussion of issues pertaining to injury in the context of anti-dumping are relevant to the same issue in the context of countervailing measures, as the WTO injury provisions for countervail are identical to those for anti-dumping.

67 In the same vein, Anti-Dumping Agreement Article 17.6(ii) provides that "[w]here the panel finds that a relevant provision of the Agreement admits of more than one permissible interpretation, the panel shall find the authorities' measure to be in conformity with the Agreement if it rests upon one of those permissible interpretations."

68 Article 3.5 of the Anti-Dumping Agreement provides: "It must be demonstrated that the dumped imports are, through the effects of dumping, as set forth in paragraphs 2 and 4, causing injury within the meaning of this Agreement. The demonstration of a causal relationship between the dumped imports and the injury to the domestic industry shall be based on an examination of all relevant evidence before the authorities. The authorities shall also examine any known factors other than the dumped imports which at the same time are injuring the domestic industry, and the injuries caused by these other factors must not be attributed to the dumped imports."

absence of multilateral rules requiring, or even directly applying to, the use of such analytical tools, however, there is little scope for dispute settlement over their use or non-use as such in investigations. Box 6 describes a number of analytical techniques that are sometimes used by national authorities in their trade remedy investigations. As noted, however, these normally would not need to be considered or replicated by WTO adjudicating bodies in order to resolve the dispute before them.

Box 6: Analytical tools in trade remedy investigations

A number of analytical, financial and statistical tools have been used in trade remedy investigations. These include shift-share, variance analysis, income statements and Granger-causality regressions. Some of these are more familiar to financial analysts and corporate planners than to economists.

Income statement

This is a basic financial tool to show whether a firm is earning profits or incurring losses from its operation.

Shift-share

Shift share analysis is used to split change in an industry into its different components. For instance, suppose that the performance of an industry depends on overall growth in the national economy and on the strength of international competition. Thus, the change experienced by an industry between two periods in time (initial and current period) can be decomposed into the contributions made by each of these factors. This decomposition is carried out by establishing a counterfactual where the industry is assumed to grow at the same rate as the national economy, with the share of imports keeping pace. The difference between the current share of imports in the industry and its share in the counterfactual then gives an indication of the importance of import competition to the industry's performance. It is a method that may be applied in safeguard investigations. Its principal advantage is its simplicity and economy in data requirements. However, while it can suggest connections between events, it does not establish statistical correlation (given a sample size of two) and it certainly does not prove causality.

Variance analysis

Customarily part of a financial or management analyst's toolkit, variance analysis identifies what material factors contributed to a difference between a firm's planned and actual budgets. Companies normally prepare a budget on which they base their projections about revenues and costs. These projected earnings and costs are based on assumptions about volume of sales, average prices, materials and labour required, the prices of those inputs and overhead. In most circumstances, actual earnings and costs would depart from the projected budget, sometimes widely, and favourably or unfavourably. Variance analysis seeks to identify which factors – volume of sales, price, wages, etc. – contributed the most to the divergence. In trade remedy investigations, they can be used to show the importance of a particular action, such as dumped imports, to a firm's injury (losses). This can occur for example if the variance analysis shows that a major factor in the decline in the actual income of the company was the reduction in average prices.

Shift-share and variance analysis are most useful in investigations where the products are reasonably homogeneous and where the imports and local production are highly substitutable (e.g. industrial or agricultural commodities having little product differentiation).

Regressions and Granger-causality

Regression models seek to determine statistically the relationship between a dependent variable and a set of independent or explanatory variables. A statistically significant result means that the relationship

between the dependent and the explanatory variables is not simply due to chance. The regression allows the user to know whether there is a positive, negative or no relationship between the explanatory and dependent variables. It also allows the user to quantify the relationship – how will a unit change in the independent variable affect the value of the dependent variable. It serves an important purpose in controlling for other factors that may have an influence on the dependent variable.

One specific regression model that is used in trade remedy investigations is the Granger-causality model. An economic variable x, say dumping, is said to Granger-cause another variable y, say losses to an industry, if past values of x provides information for predicting current and future values of y. In the context of a vector autoregression (VAR), which is the manner in which Granger-causality is carried out by economists, x is said to Granger-cause y if the addition of past values of x to a regression, involving a range of other explanatory variables to predict future values of y, results in an improvement in the prediction (e.g. a statistically significant reduction in the mean square error). It is important to note that this notion of causality is concerned with how information is sequenced in time and how useful it proves in prediction. For some, this may not agree with our ordinary understanding of what it means for one thing to cause another, although it is interesting to note the affinity with certain philosophical concepts of causality, e.g. Hume's characterization of causality as constant conjunction rather than necessary connection. There is furthermore the question of whether Granger-causation alone will be sufficient evidence of a causal connection for an investigating authority.

An important use of this tool in trade remedy investigations in establishing whether dumping, subsidies or increased imports cause injury to domestic industry. Its principal strength is that it establishes a statistically significant correlation between two variables, say between prices for the goods at issue versus the world price of influential substitutes, which can be used to measure adverse domestic price effects attributable to the dumped goods versus other factors. The basic idea is that if the prices of competing, non-subject goods are accounting for most of the variations in domestic prices of the like product, then the residual variation arguably associated with the dumped goods may not be of material significance. Since the method requires time series data, observations must be available or sampled at regular intervals for it to be used since the reference period in trade remedy investigations is often relatively short. If one adopts a rule of thumb that at a bare minimum 30 (better, actually, 80 in times series analysis) observations (or more, particularly if there are long lags in the VAR) are necessary, then for Granger- causality to be used in a trade remedy investigation, the data must be available on a monthly or quarterly basis. Requiring data to be available on a weekly or fortnightly basis may be necessary in some but not all investigations.

Safeguards

The standard of review of safeguard investigations, which is the general standard of review applying to all WTO Agreements other than the Anti-Dumping Agreement, is given by Article 11 of the DSU. Article 11 charges the panel to "make an objective assessment of the matter before it, including an objective assessment of the facts of the case and the applicability of and conformity with the relevant covered agreements, and make such other findings as will assist the DSB in making the recommendations or in giving the rulings provided for in the covered agreements."[69] In the view of the Appellate Body, while this standard requires a panel to conduct a detailed examination of the substance of the investigation, such an examination does not constitute a *de novo* review (*US–Lamb*, Appellate Body Report: para. 106).

[69] See also *US–Lead Bars*, Appellate Body Report: para. 45 on the appropriate standard of review for disputes under the SCM Agreement. Just what this means in practice has been clarified in a number of Appellate Body rulings, first with reference to Article 4.2 of the Safeguards Agreement and, subsequently, in regard to the entire Safeguards Agreement and obligations under GATT Article XIX. See *US–Steel Safeguards*, Appellate Body Report: para. 276.

The Appellate Body has outlined a three-part test for how causation analysis, and in particular non-attribution analysis, should be conducted by authorities in safeguard investigations.[70] While the Appellate Body has emphasized that there is no single methodology that must be used in conducting the causation analysis, panels and the Appellate Body in safeguard disputes examine whether the test has been properly applied by investigating authorities. First, the injury caused by increased imports is to be distinguished from the injury caused by "other factors". Second, authorities must then attribute to increased imports, on the one hand, and to other relevant factors, on the other, the injury caused to domestic industry. As a final step, they must then determine whether the causal link exists between increased imports and serious injury, and whether this causal link involves a genuine and substantial relationship of cause and effect between these two elements (*US–Wheat Gluten*, Appellate Body Report: para. 69).[71]

In *US–Line Pipe*, for instance, the defendant (US) readily admitted that there was a decline in demand of line pipe that largely resulted from reduced oil and natural gas drilling and production activity and contributed to the serious injury experienced by the domestic industry. Yet, it did not consider the decline in oil and natural gas activities to be a greater contributing factor to the industry's serious injury than the imports (*US–Line Pipe*, Panel Report: para. 7.288). This assertion was rejected by the panel (and, later, the Appellate Body). It noted that the injurious effects of the decline in the oil and gas industry were not separated from the ones due to increased imports. It was not enough to examine whether the relevant factor was a more important cause of serious injury than increased imports. In particular, the relative causal importance of the injurious effects of each other factor should be compared separately against the injurious effects of increased imports and not against the injury caused by increased imports and the remaining other factors together (*US–Line Pipe*, Panel Report: para. 7.289).

It is in connection to causation that in at least one dispute, parties have advanced, and the panel has considered, arguments in favour of the use of quantitative economics. In the *US–Steel Safeguards* dispute, in evaluating whether the investigating authorities had conducted a proper causation analysis, the panel addressed arguments by parties on the question of whether quantification is required and on the use of econometric models. The defendant (United States) had argued that the Agreement on Safeguards did not require quantification, and that quantification would be impossible to conduct. While the panel noted that the text of the Agreement on Safeguards did not require quantification it said that both the Agreement on Safeguards and relevant jurisprudence anticipated that quantification might occur.[72] The exact form which quantification should take would depend upon the complexity of the situation under consideration. The more complex the situation, the more necessary a sophisticated analysis would become. Whatever approach or model was adopted, it should be applied in good faith and with due diligence.

In a different context (i.e. not in regard to causation analysis) of the *US–Steel Safeguards* case, a model was used by the US investigating authorities (the US International Trade Commission, USITC) prepared an economic model, similar to ones it had used over a long period of time (USTR, 2002b), as one element in the evaluation of remedy options under Article 5 of the Safeguards Agreement, i.e. in order to show that the safeguard measures were not applied beyond the extent necessary (*US–Steel Safeguards*, Panel Report: para. 7.1566, footnote 3619). With this model, the effects of trade remedies on supply and demand conditions and ultimately prices in the affected industry can be modelled, including through impacts of downstream and upstream industries. Again, results strongly depend on the values of the key parameters, namely the

[70] The relevant provisions are contained in Article 4.2(b) of the Safeguard Agreement, which provides as follows: "The determination referred to in subparagraph (a) [on serious injury] shall not be made unless this investigation demonstrates, on the basis of objective evidence, the existence of the causal link between increased imports of the product concerned and serious injury or threat thereof. When factors other than increased imports are causing injury to the domestic industry at the same time, such injury shall not be attributed to increased imports."

[71] See also *Argentina–Footwear (EC),* Appellate Body Report: para. 144; *US–Lamb*, Appellate Body Report: paras. 178-181 and 185-186; *US–Line Pipe*, Appellate Body Report: paras 208, 215, 217 and 262; *US–Steel Safeguards*, Appellate Body Report: footnotes 494-495 to para. 481, paras. 483 and 489; and *US–Wheat Gluten*, Appellate Body Report: paras. 67-70.

[72] The panel stated that "quantification may be particularly desirable in cases involving complicated factual situations where qualitative analyses may not suffice to more fully understand the dynamics of the relevant market … [and that] the requirement in Article 4.2(a) that evaluated factors be of a 'quantifiable nature' implies that at least some of the factors assessed in the non-attribution exercise will be quantifiable and, in those circumstances, should be quantified" (*US–Steel Safeguards*, Panel Report: paras. 10.336-10.337). See also *US–Steel Safeguards*, Panel Report: paras. 10.340 and 10.707.

Armington elasticity of substitution as well as the aggregate price elasticities of demand and supply of the domestic industry (USITC, 2002). Criticisms by complaining parties were levelled both at the fact that the model would result in an overestimation of the tariff required to restore the domestic industry to profitability and at the non-use of such a model in the causation and non-attribution analysis (*US–Steel Safeguards*, Panel Report: paras. 7.1649 ff). On the first issue, some of the simplifying assumptions of the model were attacked. It was noted, for instance, that treating imports and domestic production as "perfect substitutes" exaggerated the amount by which the average unit values of imports would need to be increased to put the industry in a state of non-injury (*US–Steel Safeguards*, Panel Report: para. 7.1663). In regard to the second assertion, parties referred to the abundance of data on which to base a quantification of the causes of injury to the domestic industry, on the use by the USITC economic staff of this type of model in earlier anti-dumping investigations and to the advantages of quantification, whenever other explanations seem counterintuitive (*US–Steel Safeguards*, Panel Report: para. 7.1527). For reasons of judicial economy, the panel ultimately did not need to consider claims under Article 5. But proceedings such as these illustrate that it cannot be excluded that panels may have to consider economic technicalities that parties challenge in each other's argumentation.

Analytical techniques that may be relevant to causation in trade remedy cases

As noted above, although the applicable standards of review are different for anti-dumping disputes on the one hand and for countervailing duty and safeguards disputes on the other, the Appellate Body made it clear in *US–Hot-Rolled Steel* that the requirement to separate and distinguish the various factors causing injury, and their respective effects, which it first expressed in the context of safeguards, is not limited to that context. A number of commentators have considered the kinds of analytical techniques that might be relevant to the issues referred to in the three-part test.[73]

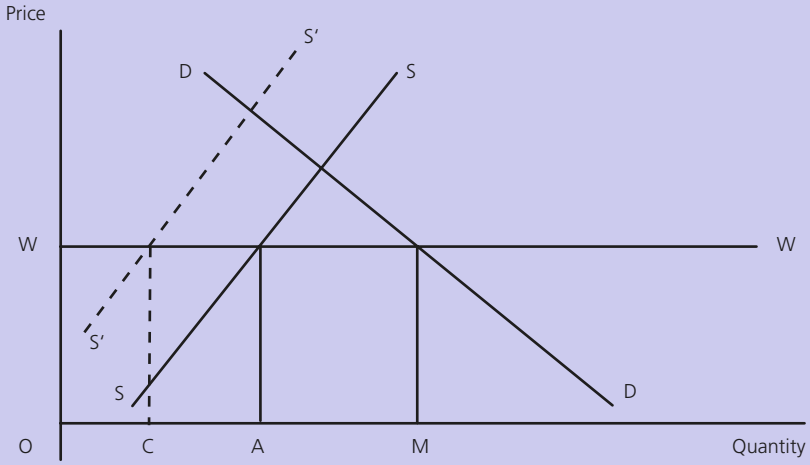
Although the Appellate Body's three-part test seems straightforward, Sykes (2003) has critiqued WTO jurisprudence for not providing useful guidance on the causation issue.[74] One criticism is that there is a tendency to equate correlation with causation. But a second and more fundamental criticism is that an analytical framework for establishing when imports cause serious injury to domestic industry is necessary because in many instances both are endogenous variables. In other words, both rising imports and injury to domestic injury can be the result of some other (third) factor. In these cases, although there is correlation between imports and injury, there is no causal link. These points can be clarified with diagrams depicting a simple demand and supply framework, as discussed by Irwin (2003) (see Box 7). For example, an increase in the cost of inputs to domestic production (which shifts the supply curve upward) can lead to both increased imports and lowered profitability and employment. But while there is a correlation between imports and injury, there is no causal connection, because, by assumption, the cause of the injury was a negative supply shock. In this analytical framework, imports can be a cause of injury when there is increased competition from foreign suppliers which shifts the supply of imports downward (to the right). Imports can also be a cause of injury if there is a reduction in tariffs, or in general, a relaxation of import barriers arising from a programme of trade liberalization. Authors like Irwin (2003) and Sykes (2003) highlight that the task of causation analysis is then to distinguish conceptually the latter case from those other instances when imports and injury are correlated but not causally linked.

73 Besides the relatively simple techniques presented in the following, some academics have also proposed more complex approaches, such as simultaneous equation models. See, in particular, Prusa and Sharp (2001); also Grossman (1986) and Pindyck and Rotemberg (1987).

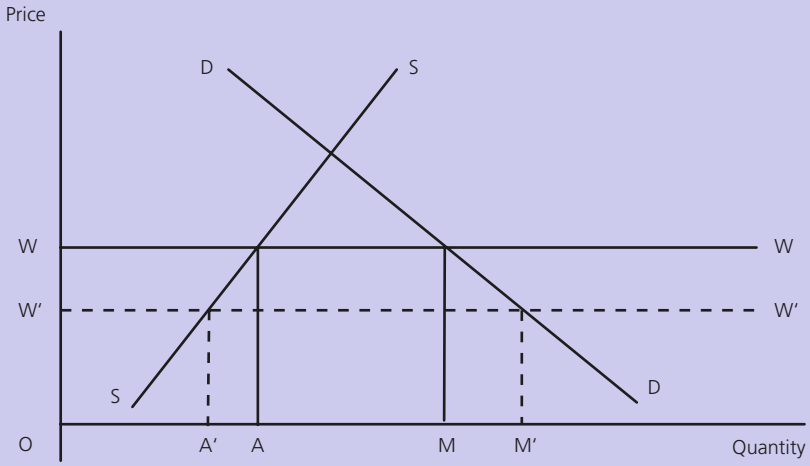
74 As clarified above, there are certain areas where the WTO Agreements give discretion to the investigating authority as to the type of analysis that must be conducted and the type of methodology that has to be applied. The mandate of panels and the Appellate Body is to review determinations made by investigating authorities (including the analysis and methodologies used) for their consistency with the WTO Agreements.

Box 7: A simple analytical framework on causation

The Charts below (based on Irwin, 2003: pp.28-29), show one simple approach to distinguish under what circumstances rising imports may be considered to "cause" injury to domestic industry and under what circumstances rising imports and injury to domestic industry may be by-products of some other cause. It is assumed that the importing country is small, i.e. unable to affect world price.



DD and SS are the domestic demand and supply of the product. WW is the world market price of imports. Initially, consumption is at OM, domestic production at OA and imports at AM. Suppose that there is a dramatic increase in the price of an input to this industry. The effect will be to shift the supply curve to the left (S'S') leading to both lowered output (OC), employment and profits to the domestic industry as well as rising imports (CM). In this case there will be a correlation of rising imports and injury to the domestic industry, but it is clear that the trends are a consequence of a third factor (a domestic supply shock). So in this case, rising imports do not cause injury.



Now consider an improvement in the competitiveness of foreign suppliers which lowers the world market price from WW to W'W'. This leads to an increase in imports (M'M') and a contraction in domestic output (to OA'), and in employment and profits. It is this second case, where rising imports may be seen as causing injury to domestic industry. Here an argument could be made that correlation implies causation.

Irwin (2003) applied a tableau like the one in Table 3, which is based on such an analytical framework, to show what the predicted pattern of changes would be on domestic price, production, consumption and imports if (a) demand, or (b) supply or (c) imports is the initiating cause. Concretely, he looked at the predicted pattern of changes in four recent US safeguard investigations to see whether imports were indeed a causal factor in them. These cases were *US–Wheat Gluten*, *US–Lamb*, *US–Line Pipe* and *US–Steel Safeguards*. He finds that apart from *US–Lamb*, the other three cases suggested that imports were a causal factor.

Table 3
Pattern of changes depending on cause

Cause	Price	Production	Consumption	Imports
Domestic demand increases	No change	No change	↑	↑
Domestic supply reduction	No change	↓	No change	↑
More import competition	↓	↓	↑	↑

Note: Consistent with Box 7, it is assumed that the importing country is small – unable to change world prices.

Using also the basic demand supply framework of Box 7, Kelly (1988) has proposed a way of quantifying the impacts of demand shifts, domestic supply shifts and import competition to the domestic industry. The result is a decomposition of the reduction in domestic output (a proxy for the injury suffered by domestic industry) to the contribution made by demand changes, supply-side shocks and imports. The only additional pieces of information required for the quantification are elasticities of demand and supply. If the importing country is a large country, i.e. changes in imports have an impact on world price, and so faces an upward sloping import supply curve, then information on the import supply elasticity would be needed as well.

Kelly's (1988) method seeks to produce numerical estimates of the contribution made by each factor and to provide an ordering of their relative importance. One possible problem with the Kelly (1988) method is that the apportionment it produces is quite broad or general – i.e. the contribution made by demand factors, supply-side factors and import competition. In actual safeguards investigations, investigating authorities look at more specific factors. For example, in the case of *US–Lamb*, the alternative cause of serious injury was the termination of government subsidies to lamb and sheep farmers.

5. CONCLUSIONS

From the above discussion, especially of some of the arbitration cases, such as *US–FSC (Article 22.6 – US)* or *US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)*, a number of lessons may be drawn on how quantitative economic analysis can assist the dispute settlement process. First and foremost, where quantitative models were employed, they seem to have provided useful benchmark values against which qualitative outcomes could be checked. This is true despite the lack of absolute precision due to inherent difficulties in empirical work. For instance, a range of possible elasticity values may drive the modelling results, but still give a good impression of the direction and magnitude of trade effects and confirm a theoretical penchant or intuitive guess. Also on the positive side, quantitative economics need not be utterly complex. Comparative static partial equilibrium approaches seem sufficient in WTO dispute settlement, and general equilibrium considerations even out of place, since it is clear that "second-round" effects of a measure are not normally taken into account in the process of determining a breach of obligations or in arbitrating on the level of countermeasures.

The discussion of these arbitration cases, but also of, for example, *Japan–Alcoholic Beverages II*, *Chile–Alcoholic Beverages* or *US–Upland Cotton* suggests that if models are submitted, panels or arbitrators may feel compelled to consider a number of technical details. For example, which of two competing approaches is more adequate? What should the model specification be? What is the range of error introduced by sectoral aggregation? How good is the quality of data provided? How reliable are the results? While these questions call for the experience and technical skills of trade economists and econometricians, WTO dispute settlement is above all about determining well-reasoned outcomes on the basis of agreed legal texts. Empirical economic analysis rarely, if ever, can provide clear-cut answers. But, at a minimum, it can strengthen parties' argumentation before panels and increase the comfort level of arbitrators in making an award.

Experience to date has confirmed that quantitative economic analysis cannot determine dispute settlement outcomes. Where quantitative analysis is used, it can certainly help to inform legal reasoning. Quantitative economics can help to avoid misinterpretation when economic rationality is counter-intuitive and less than obvious, although pertinent to the substance or direction of legal reasoning. But quantitative economic analysis will always play a supporting role to legal reasoning. As noted above, quantitative analysis is frequently beset by inherent methodological difficulties, the existence of competing approaches of apparently equal validity but that yield different results, simplifying assumptions and data limitations. Although analytical techniques and data will continue to improve, the supporting role of quantitative economics in dispute settlement will in our view remain essentially the same, even though these techniques may come to be used more intensively in the future.

All in all, there is a limited, but encouraging record of how quantitative economic analysis has been employed in dispute settlement proceedings. One reason why the use of quantitative economics may intensify in the future is that cases seem to become more and more "fact-intensive". Parties are not subject to restrictions as to the type of evidence they wish to furnish, and panels themselves have often requested more detailed factual information. Hence, it is possible to discern a trend towards a higher level of technical sophistication upon which the legal argumentation is founded. Of course, this does not relate only to economic data and analysis. But, given the nature of WTO Agreements, market competition and trade impacts are usually at issue, and in the context of certain legal provisions, quantitative economic analysis may be called for in the future, where so far this has not been so. If understood as a complementary tool to acquire better insights into the effects of policies on trade or of imports in the domestic market, there is no reason to believe that economic analysis could not make a bigger contribution to an effective functioning of the dispute settlement process.

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APPENDIX TABLES

Appendix Table 1
WTO cases referenced in this essay

Short Title	Full Case Title and Citation
Argentina–Footwear (EC)	Appellate Body Report, *Argentina – Safeguard Measures on Imports of Footwear*, WT/DS121/AB/R, adopted 12 January 2000, DSR 2000:I, 515
Argentina–Footwear (EC)	Panel Report, *Argentina – Safeguard Measures on Imports of Footwear*, WT/DS121/R, adopted 12 January 2000, as modified by the Appellate Body Report, WT/DS121/AB/R, DSR 2000:II, 575
Brazil–Aircraft (Article 22.6 – Brazil)	Decision by the Arbitrators, *Brazil – Export Financing Programme for Aircraft – Recourse to Arbitration by Brazil under Article 22.6 of the DSU and Article 4.11 of the SCM Agreement*, WT/DS46/ARB, 28 August 2000, DSR 2002:I, 19
Canada–Aircraft Credits and Guarantees (Article 22.6 – Canada)	Decision by the Arbitrator, *Canada – Export Credits and Loan Guarantees for Regional Aircraft – Recourse to Arbitration by Canada under Article 22.6 of the DSU and Article 4.11 of the SCM Agreement*, WT/DS222/ARB, 17 February 2003
Chile–Alcoholic Beverages	Appellate Body Report, *Chile – Taxes on Alcoholic Beverages*, WT/DS87/AB/R, WT/DS110/AB/R, adopted 12 January 2000, DSR 2000:I, 281
Chile–Alcoholic Beverages	Panel Report, *Chile – Taxes on Alcoholic Beverages*, WT/DS87/R, WT/DS110/R, adopted 12 January 2000, as modified by the Appellate Body Report, WT/DS87/AB/R, WT/DS110/AB/R, DSR 2000:I, 303
EC–Bananas III (US) (Article 22.6 – EC)	Decision by the Arbitrators, *European Communities – Regime for the Importation, Sale and Distribution of Bananas – Recourse to Arbitration by the European Communities under Article 22.6 of the DSU*, WT/DS27/ARB, 9 April 1999, DSR 1999:II, 725
EC–Bananas III (Ecuador) (Article 22.6 – EC)	Decision by the Arbitrators, *European Communities – Regime for the Importation, Sale and Distribution of Bananas – Recourse to Arbitration by the European Communities under Article 22.6 of the DSU*, WT/DS27/ARB/ECU, 24 March 2000, DSR 2000:V, 2237
EC–Hormones (US) (Article 22.6 – EC)	Decision by the Arbitrators, *European Communities – Measures Concerning Meat and Meat Products (Hormones), Original Complaint by the United States – Recourse to Arbitration by the European Communities under Article 22.6 of the DSU*, WT/DS26/ARB, 12 July 1999, DSR 1999:III, 1105
EC–Hormones (Canada) (Article 22.6 – EC)	Decision by the Arbitrators, *European Communities – Measures Concerning Meat and Meat Products (Hormones), Original Complaint by Canada – Recourse to Arbitration by the European Communities under Article 22.6 of the DSU*, WT/DS48/ARB, 12 July 1999, DSR 1999:III, 1135
Japan–Alcoholic Beverages II	Appellate Body Report, *Japan – Taxes on Alcoholic Beverages*, WT/DS8/AB/R, WT/DS10/AB/R, WT/DS11/AB/R, adopted 1 November 1996, DSR 1996:I, 97
Japan–Alcoholic Beverages II	Panel Report, *Japan – Taxes on Alcoholic Beverages*, WT/DS8/R, WT/DS10/R, WT/DS11/R, adopted 1 November 1996, as modified by the Appellate Body Report, WT/DS8/AB/R, WT/DS10/AB/R, WT/DS11/AB/R, DSR 1996:I, 125
Korea–Alcoholic Beverages	Appellate Body Report, *Korea – Taxes on Alcoholic Beverages*, WT/DS75/AB/R, WT/DS84/AB/R, adopted 17 February 1999, DSR 1999:I, 3
Korea–Alcoholic Beverages	Panel Report, *Korea – Taxes on Alcoholic Beverages*, WT/DS75/R, WT/DS84/R, adopted 17 February 1999, as modified by the Appellate Body Report, WT/DS75/AB/R, WT/DS84/AB/R, DSR 1999:I, 44
US–1916 Act (EC) (Article 22. 6 – US)	Decision by the Arbitrators, *United States – Anti-Dumping Act of 1916, Original Complaint by the European Communities – Recourse to Arbitration by the United States under Article 22.6 of the DSU*, WT/DS136/ARB, 24 February 2004
US–FSC (Article 22.6 – US)	Decision by the Arbitrator, *United States – Tax Treatment for "Foreign Sales Corporations" – Recourse to Arbitration by the United States under Article 22.6 of the DSU and Article 4.11 of the SCM Agreement*, WT/DS108/ARB, 30 August 2002
US–Hot-Rolled Steel	Appellate Body Report, *United States – Anti-Dumping Measures on Certain Hot-Rolled Steel Products from Japan*, WT/DS184/AB/R, adopted 23 August 2001, DSR 2001:X, 4697
US–Hot-Rolled Steel	Panel Report, *United States – Anti-Dumping Measures on Certain Hot-Rolled Steel Products from Japan*, WT/DS184/R, adopted 23 August 2001 as modified by the Appellate Body Report, WT/DS184/AB/R, DSR 2001:X, 4769

Short Title	Full Case Title and Citation
US–Lamb	Appellate Body Report, *United States – Safeguard Measures on Imports of Fresh, Chilled or Frozen Lamb Meat from New Zealand and Australia*, WT/DS177/AB/R, WT/DS178/AB/R, adopted 16 May 2001, DSR 2001:IX, 4051
US–Lamb	Panel Report, *United States – Safeguard Measures on Imports of Fresh, Chilled or Frozen Lamb Meat from New Zealand and Australia*, WT/DS177/R, WT/DS178/R, adopted 16 May 2001, as modified by the Appellate Body Report, WT/DS177/AB/R, WT/DS178/AB/R, DSR 2001:IX, 4107
US–Line Pipe	Appellate Body Report, *United States – Definitive Safeguard Measures on Imports of Circular Welded Carbon Quality Line Pipe from Korea*, WT/DS202/AB/R, adopted 8 March 2002
US–Line Pipe	Panel Report, *United States – Definitive Safeguard Measures on Imports of Circular Welded Carbon Quality Line Pipe from Korea*, WT/DS202/R, adopted 8 March 2002, as modified by the Appellate Body Report, WT/DS202/AB/R
US–Offset Act (Byrd Amendment) (Brazil) (Article 22.6 – US)	Decision by the Arbitrator, *United States – Continued Dumping and Subsidy Offset Act of 2000, Original Complaint by Brazil – Recourse to Arbitration by the United States under Article 22.6 of the DSU*, WT/DS217/ARB/BRA, 31 August 2004
US–Offset Act (Byrd Amendment) (Canada) (Article 22.6 – US)	Decision by the Arbitrator, *United States – Continued Dumping and Subsidy Offset Act of 2000, Original Complaint by Canada – Recourse to Arbitration by the United States under Article 22.6 of the DSU*, WT/DS234/ARB/CAN, 31 August 2004
US–Offset Act (Byrd Amendment) (Chile) (Article 22.6 – US)	Decision by the Arbitrator, *United States – Continued Dumping and Subsidy Offset Act of 2000, Original Complaint by Chile – Recourse to Arbitration by the United States under Article 22.6 of the DSU*, WT/DS217/ARB/CHL, 31 August 2004
US–Offset Act (Byrd Amendment) (EC) (Article 22.6 – US)	Decision by the Arbitrator, *United States – Continued Dumping and Subsidy Offset Act of 2000, Original Complaint by the European Communities – Recourse to Arbitration by the United States under Article 22.6 of the DSU*, WT/DS217/ARB/EEC, 31 August 2004
US–Offset Act (Byrd Amendment) (India) (Article 22.6 – US)	Decision by the Arbitrator, *United States – Continued Dumping and Subsidy Offset Act of 2000, Original Complaint by India – Recourse to Arbitration by the United States under Article 22.6 of the DSU*, WT/DS217/ARB/IND, 31 August 2004
US–Offset Act (Byrd Amendment) (Japan) (Article 22.6 – US)	Decision by the Arbitrator, *United States – Continued Dumping and Subsidy Offset Act of 2000, Original Complaint by Japan – Recourse to Arbitration by the United States under Article 22.6 of the DSU*, WT/DS217/ARB/JPN, 31 August 2004
US–Offset Act (Byrd Amendment) (Korea) (Article 22.6 – US)	Decision by the Arbitrator, *United States – Continued Dumping and Subsidy Offset Act of 2000, Original Complaint by Korea – Recourse to Arbitration by the United States under Article 22.6 of the DSU*, WT/DS217/ARB/KOR, 31 August 2004
US–Offset Act (Byrd Amendment) (Mexico) (Article 22.6 – US)	Decision by the Arbitrator, *United States – Continued Dumping and Subsidy Offset Act of 2000, Original Complaint by Mexico – Recourse to Arbitration by the United States under Article 22.6 of the DSU*, WT/DS234/ARB/MEX, 31 August 2004
US–Steel Safeguards	Appellate Body Report, *United States – Definitive Safeguard Measures on Imports of Certain Steel Products*, WT/DS248AB/R, WT/DS249AB/R, WT/DS251AB/R, WT/DS252AB/R, WT/DS253AB/R, WT/DS254AB/R, WT/DS258AB/R, WT/DS259AB/R, adopted 10 December 2003
US–Steel Safeguards	Panel Report, *United States – Definitive Safeguard Measures on Imports of Certain Steel Products*, WT/DS248, WT/DS249, WT/DS251, WT/DS252, WT/DS253, WT/DS254, WT/DS258, WT/DS259, adopted 10 December 2003, as modified by the Appellate Body Report, WT/DS248AB/R, WT/DS249AB/R, WT/DS251AB/R, WT/DS252AB/R, WT/DS253AB/R, WT/DS254AB/R, WT/DS258AB/R, WT/DS259AB/R
US–Upland Cotton	Panel Report, *United States – Subsidies on Upland Cotton*, WT/DS267/R, and Corr.1, 8 September 2004
US–Upland Cotton	Appellate Body Report, *United States – Subsidies on Upland Cotton*, WT/DS267/AB/R, 3 March 2005
US–Wheat Gluten	Appellate Body Report, *United States – Definitive Safeguard Measures on Imports of Wheat Gluten from the European Communities*, WT/DS166/AB/R, adopted 19 January 2001, DSR 2001:II, 717
US–Wheat Gluten	Panel Report, *United States – Definitive Safeguard Measures on Imports of Wheat Gluten from the European Communities*, WT/DS166/R, adopted 19 January 2001, as modified by the Appellate Body Report, WT/DS166/AB/R, DSR 2001:III, 779

B INTERNATIONAL TRADE IN AIR TRANSPORT: RECENT DEVELOPMENTS AND POLICY ISSUES

1. INTRODUCTION

Air transport, like other transport services, is associated with international trade in two distinct ways. First, air transport is traded as a service in its own right. Second, it is a key intermediate service for many other kinds of trade, in the domain of both goods and services (such as tourism). Numerous studies have highlighted the importance of an efficient, effective and reliable air transport infrastructure, especially in developing countries, to ensure the materialization of the gains from trade (WTO, 2004). These studies also highlight the important role of international civil aviation in contributing to the development process and its role in the leisure and commercial decisions of many people. This importance is expected to increase as a result of technological innovation, deregulation and enhanced market access for foreign companies, which are all making air transport more accessible to a wider set of customers in a broader range of countries.

Despite the importance of air transport services and the fact that air transport has, for a long time, had a certain appeal to the human population, the industry appears to be in a constant struggle for survival. Media reports consistently highlight the fact that the industry is rarely profitable. When major carriers get into trouble, they make the news and when they collapse, they have widespread economic and social consequences, especially in the context of employment loss and in some cases, loss of face when it is a national carrier that folds.[1]

The news is, of course, not always bad. Low cost carriers (LCC), through a new business model, have made air travel more accessible both domestically and internationally in certain regions by establishing new services and servicing existing routes at a much lower cost. Also, the unveiling of the Airbus 380 aircraft in early 2005, the largest passenger aircraft in the world, is predicted to transform the industry the same way that that the Boeing 747 did 30 years earlier.[2] Complementing the mechanical innovations is the rapid acceptance of the internet as a means by which air transport business can be conducted.

Government policy towards international air transport has not stood still. However, addressing the challenge of ensuring a competitive international air transport industry has not been easy. A set of wide ranging policies targeted at deregulating entry, increasing foreign ownership, liberalizing market access and easing infrastructure restrictions have been tried by a number of national governments at different levels of development. The success of these policies has varied. No unique formula exists to satisfy the sometimes conflicting goals of ensuring adequate delivery of international air transport services and profitability. Consequently, a number of outstanding issues and questions remain as to the role that the international system can play in ensuring competition.

The purpose of this essay is to review developments in the international air transport industry and examine their impact on international trade in air transport services and trade in goods and services in general. This is accomplished by, first, clarifying the mechanisms by which air transport contributes to international trade (Section 2). This is followed by a review of the economics of the international air transport system (Section 3). These two steps in the analysis are brought together in Section 4, which assesses the nature of competition in the international air transport industry and its implications for international trade.

A clear message from the analysis is that the two key policy issues facing the industry are how to ensure competition (Section 5) and to continue to debate whether or not multilateral rules on market access in international air transport would make a positive contribution to the efficient functioning of the trading system (Section 6).

[1] Recent high profile collapses include Ansett Airlines in Australia in 2001 and Air Afrique in 2002. Air Afrique was owned by 11 West African countries.

[2] A modified version of the Boeing 747 which is capable of non-stop trans Pacific flights, the 747-400, was launched in 1989.

2. INTERNATIONAL TRADE IN AIR TRANSPORT SERVICES

The traditional approach to sectoral trade analysis is to examine the pattern, volume and value of international trade. This approach, however, is difficult for the international air transport sector, due to the paucity of data and the complexity of the industry. For example, data on the number of passengers transported from one country to another can be recorded as an import or an export, depending on the origin of the passengers and the nationality of the company that transports them. Furthermore, the expenditures of the passengers in the country where they disembark can also have balance of payments implications. Consequently, direct and indirect expenditures can be classified according to a number of categories, creating an estimation problem.

Despite these limitations, the available data on the characteristics and performance of the industry are indicative of the kinds of results that one would obtain if a full set of trade data was available. This Section, therefore, adopts a more general approach by using generic air transport data to identify the broad linkages between the industry and international trade patterns.

(a) Output and performance of the industry

The performance of the air transport industry depends on the same broad factors that determine economic performance. These include growth in gross domestic product (GDP), growth in international trade in goods and services, and growth in other industries that use air travel as a mode to transport cargo and people. In this context, the sustained economic growth experienced by the world economy in the past two decades and the strong performance of international trade has translated into a strong positive trend for international traffic.

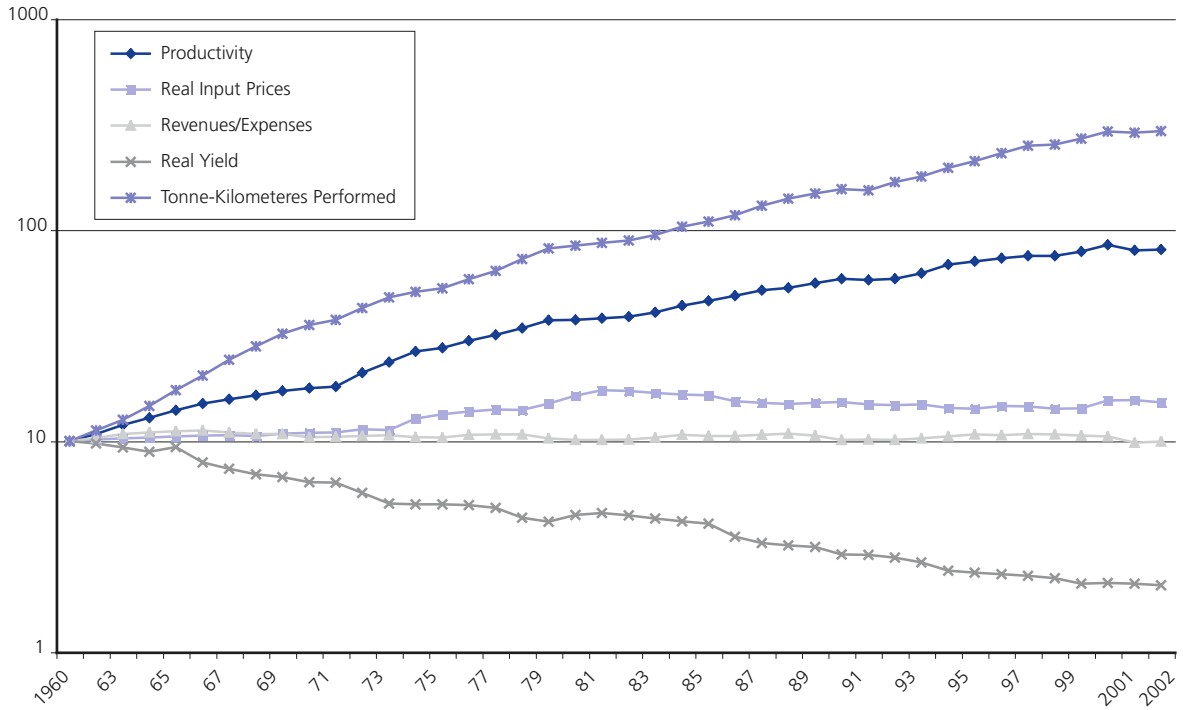
Industry specific factors are also important in determining performance. Here, the air transport industry is no different from other industries - exogenous shocks can exert positive and negative effects on its performance. Events such as those that occurred on 11 September 2001 are an example of how an external event can have significant consequences for the industry. Similarly, the rapid rise of the use of the internet, especially for direct business to customer contact, is another example.

Chart 1 captures the overall economic performance of the industry during the past 40 years, using a number of indicators. First, overall traffic in the industry, as measured in tonne kilometres performed (TKPs) has increased steadily.[3] The only two exceptions are in 1991 and 2001. Second, real yields have been declining as revenues over expenses have been static. Taken together, these two indicators, suggest that the financial performance of the industry has been fairly static in absolute terms and declining when measured in logs as in the Chart. This weak performance is against a backdrop of increases in costs of inputs, such as fuel and labour, and productivity gains.

A broader set of performance indicators, for a more recent time period and specifically for international travel are presented in Table 1. These data show that international travel, as a share of total travel, is becoming increasingly important. In 1991, international travel accounted for 23.5 per cent of all passengers carried. In 2002, this figure had risen to 34 per cent. Similar increases were recorded for passenger-kilometre data and freight-kilometre data. In aggregate, international air transport accounts for 68 per cent of the total-tonne-kilometres performed by the industry.

[3] A tonne-kilometre is defined as the carriage of one tonne for one kilometre. Accordingly, if three tonnes were carried for two kilometres, this would be six tonne-kilometres.

Chart 1
Performance of the air transport industry, 1960-2002
(Logarithm scale)



Source: ICAO.

Table 1
International output of scheduled airlines, 1991-2002

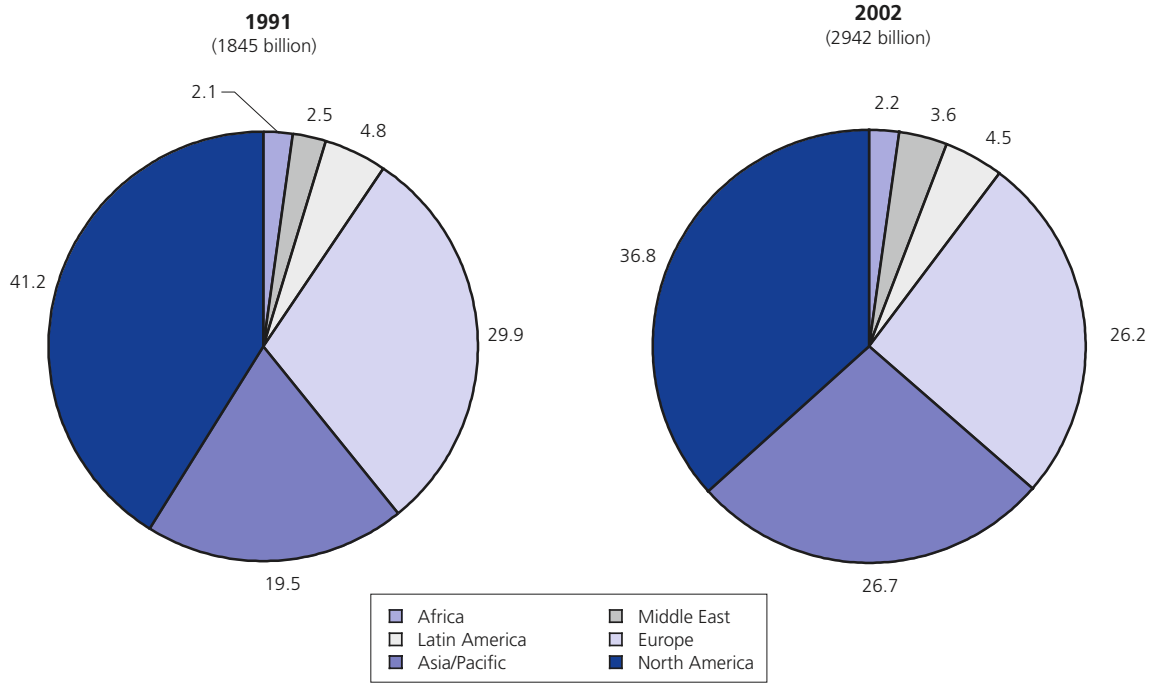
	Passengers carried		Passenger-kilometres		Freight tonnes carried		Freight-tonne kilometres		Total tonne-kilometres	
	Millions	Share of total (per cent)	Millions	Share of total (per cent)	Millions	Share of total (per cent)	Millions	Share of total (per cent)	Millions	Share of total (per cent)
1991	266	23.4	861530	46.7	8.5	48.6	46410	79.3	128280	55.6
1992	299	26.1	982490	50.9	9.3	52.8	50750	81.0	143600	59.3
1993	319	27.9	1047380	53.7	10.3	56.9	56050	81.9	155490	62.0
1994	347	28.1	1143180	54.4	11.8	57.6	64700	83.8	173080	63.3
1995	375	28.8	1249160	55.6	13.0	58.6	70340	84.6	189430	64.4
1996	412	29.6	1380680	56.8	13.6	58.6	75510	84.7	206870	65.2
1997	438	30.1	1468150	57.1	15.7	59.5	87740	85.3	227390	66.1
1998	458	31.1	1512040	57.5	15.8	59.6	87050	85.5	231440	66.4
1999	493	31.6	1622250	58.0	17.3	61.6	93280	85.8	247610	66.8
2000	538	32.5	1778110	58.9	18.8	62.3	101520	86.1	271400	67.7
2001	532	32.8	1715740	58.6	18.0	62.9	95950	86.7	259520	67.3
2002	545	33.7	1732160	58.9	19.0	64.4	100590	86.2	265650	67.8

Note: Share of total refers to the sum of domestic and international figures. Total tonne-kilometers is the aggregate of passengers, freight and mail carried.
Source: ICAO.

A noticeable feature of the data in Table 1 is the growth in international output, measured in terms of either passengers or volume. One explanation of this feature is the number of structural and regulatory changes that occurred during the 1990s. These included the combined effects of deregulation and liberalization in some major countries and the introduction of new forms of business (discussed in Section 4).

The Asia Pacific region, which accounts for a significant portion of the air transport industry, also suffered a serious setback in 2001, attributable partly to the effects of the Severe Acute Respiratory Syndrome (SARs) in China and Hong Kong, China. These effects were sufficiently severe for Cathay Pacific Airways, which is based in Hong Kong, China, to have at one point considered grounding its entire fleet.

Chart 2
Percentage distribution total tonne kilometres of scheduled traffic according to region of airline registration, 1991-2002



Source: WTO based on ICAO data.

Chart 2 shows the changing share of traffic by region, measured in terms of passenger traffic. In the 11 years between 1991 and 2002, the Asia Pacific region experienced the largest increase in international traffic and now accounts for a quarter of world traffic. North America, which is dominated by the United States still accounts for a third of the traffic. Although Europe's share declined, it is still 26 per cent. The remaining regions of the world account for just over 10 per cent of world traffic. Airlines from the Middle East are an example of companies that are taking advantage of the demand for international travel, relative to domestic travel. Chart 2 shows that that region has increased its share of world traffic from 2.5 per cent to 3.6 per cent.

The strong concentration in air transport across the three regions is also reflected in the direction of travel. Table 2 shows that the most travelled international route is the North Atlantic, which accounts for approximately 19.2 per cent of total international traffic. The next two most important routes, between Europe and Asia/Pacific and within the Asia/Pacific region, account, respectively, for 16.5 per cent and 13 per cent.

Table 2 also provides data on the operating and financial characteristics of the different routes. It indicates that the larger aircraft are utilized on routes with larger shares of traffic and longer flight stages. For example, in 2002 the busiest route, with an average length of 5737 kilometres, is serviced with aircraft with an average of 258 seats. The route with the largest average number of seats is the North/Mid-Pacific route, which also has the longest length of flight stage. That route also has one of the lowest passenger costs per passenger kilometres.

The figures in Chart 2 and Table 2 are a strong indication that the demand for air transport depends significantly on per capita GDP. The regions with the higher per capita GDP, Europe and North America, account for almost two-thirds of world traffic. Furthermore, the Asia Pacific region, which experienced the highest GDP growth rates and trade growth rates during the 1990s, have increased their share of traffic markedly.

Table 2
Basic operational data and financial results for scheduled passenger services by international route groups, 1998 and 2001

	Operational data										Financial results[2]					
	Number of airlines (1)		Percentage of world's international traffic (available seat-km) (2)		Average length of flight stages (km) (3)		Average number of seats per aircraft[3] (4)		Average passenger load factor (percentage points) (5)		Average revenue (cents) per pass-km[4] (6)		Average passenger costs (cents) per pass-km (7)		Ratio revenue/ costs[4,5] (8)	
Route group (short title)	1998	2001	1998	2001	1998	2001	1998	2001	1998	2001	1998	2001	1998	2001	1998	2001
All world international routes	386	473	100.0	100.0	2037	2050	231	224	69	70	7.81	7.24	8.0	7.92	0.97	0.91
International route groups																
North-Central America	34	34	1.9	1.8	1553	1629	171	161	69	71	7.8	7.7	8.9	9.4	0.90	0.80
Central America	21	22	0.2	0.2	713	815	128	131	...	...	...	...	...	...	...	...
North America	64	60	4.4	3.8	1330	1378	134	126	64	65	7.6	7.7	9.5	10.5	0.80	0.75
North-South America	38	45	4.2	3.4	2807	3044	202	194	59	64	8.1	8.0	8.3	8.5	0.95	0.95
South America	30	32	0.7	0.7	1069	1198	145	141	58	60	11.5	9.8	12.4	11.6	0.95	0.85
Europe	171	199	11.5	12.9	953	983	136	131	65	65	16.9	13.7	15.6	14.0	1.10	1.00
Middle East	18	18	0.4	0.5	783	826	180	187	...	57	...	14.0	...	14.5	...	1.00
Africa	53	54	0.7	0.6	1131	1225	159	148	...	...	...	...	...	...	...	...
Europe-Middle East	62	66	2.5	2.7	2657	2789	212	212	63	65	9.9	8.5	10.0	9.1	1.00	0.95
Europe-Africa	89	105	5.1	5.4	2678	2729	234	241	69	71	7.6	6.9	7.9	6.9	0.95	1.00
North Atlantic	68	66	19.2	19.2	5624	5737	268	258	77	74	6.6	6.0	6.5	6.8	1.00	0.90
Mid-Atlantic	29	35	3.3	3.6	5584	5969	302	299	75	77	5.5	4.9	6.0	5.9	0.90	0.80
South Atlantic	23	20	2.3	2.4	5377	6724	287	265	71	71	6.7	5.7	7.0	6.5	0.95	0.90
Asia/Pacific	105	104	12.7	13.0	1978	2070	263	267	65	69	7.7	7.6	7.8	7.4	1.00	1.00
Europe-Asia/Pacific	121	124	16.8	16.5	4857	5029	298	303	72	74	6.2	5.7	6.5	6.2	0.95	0.90
North/Mid-Pacific	30	27	12.4	11.5	6662	6864	342	331	71	72	4.9	5.0	6.0	6.5	0.80	0.80
South Pacific	15	17	1.7	1.8	6093	6630	349	318	69	72	5.8	5.2	5.9	6.0	0.95	0.90

[1] Excluding operational and financial data attributed to supersonic and propeller-driven aircraft.

[2] The margins of uncertainty which should be considered in relation to these results are discussed in Appendix Table 2 at the end of this Section. For routes between and within Central America and Caribbean and within Africa, the representation was inadequate to justify separate presentation, but the data have been included in the world averages.

[3] As defined by available seat-kilometres divided by aircraft-kilometres flown.

[4] These figures do not generally include incidental operating revenues. For all international routes, that part of this additional revenue which may be directly attributed to international passenger traffic is about 0.14 and 0.19 cents per passenger kilometre for 2000 and 2001, respectively. On individual route groups, it may represent up to an additional 4 and 5 per cent over the average passenger revenue quoted for 2000 and 2001, respectively.

[5] Rounded to the nearest twentieth for individual route groups.

Source: ICAO.

Table 3
Leading traders in international air transport, 2002

	Passenger		Freight		Other		Total	Air transport as percentage of total commercial services trade
	Dollars (Millions)	percentage of total	Dollars (Millions)	percentage of total	Dollars (Millions)	percentage of total		
Exports								
Extra-EU (15)	18967	63	4280	14	6639	22	29894	10
USA	16291	74	5787	26	n.a	n.a	22078	8
Japan	2561	33	2287	29	3018	38	7867	12
Canada	2021	64	n.a	n.a.	1145	36	3165	8
Russia	1142	53	486	22	534	25	2161	16
Taipei, Chinese	486	26	1306	70	78	4	1870	9
China	1114	67	539	33	n.a	n.a.	1653	4
Malaysia	966	81	163	14	69	6	1198	8
Mexico	689	68	n.a	n.a.	327	32	1016	8
Pakistan	465	72	50	8	128	20	643	43
Israel	281	54	127	24	114	22	522	5
Imports								
Extra-EU (15)	14066	54	3046	12	9095	35	26147	9
USA	19189	80	4878	20	n.a	n.a.	24067	11
Japan	8309	74	1994	18	962	9	11265	11
Canada	2398	64	1352	36	n.a	n.a.	3749	8
China	1308	37	2190	63	n.a	n.a.	3498	8
Taipei, Chinese	1224	59	262	13	591	28	2077	9
Mexico	1027	52	270	14	676	34	1973	12
Russia	271	22	559	45	401	33	1230	5
Israel	773	64	83	7	345	29	1201	11
Malaysia	712	74	n.a	n.a.	249	26	961	6
Argentina	388	67	74	13	113	20	575	13

Source: WTO based on IMF and Eurostat data. Refers only to economies that report these data.

A country breakdown of total and international traffic for 1993 and 2003 is provided in Appendix Table 1. It shows that the United States ranks first in every category and that seven of the top ten countries in terms of total tonne-kilometres performed (TKP) are developed countries. The importance of the US to the global air transport industry is illustrated by the fact that its total TKP is nearly six times larger than Germany, the second ranked country. In terms of international TKP and passenger kilometres performed (PKP) the United States posted figures twice as large as those of the second ranked countries.[4]

A number of observations about the interests of different countries in international air travel can also be made about the data in Appendix Table 1. The first is the importance of the domestic market to geographically large countries. For example, in the United States, international TKP accounts for only 33 per cent of total TKP and international PKP accounts for 25 per cent of total PKP. Similarly, international TKP and PKP for Australia are 63 and 56.8 per cent respectively and for Canada they are 61.5 and 57.6 per cent respectively. This pattern is not specific to developed countries. Similar figures are reported for Brazil, India and China.

In contrast, small economies report very low domestic figures and very high international figures. Hong Kong, China and Singapore are at the extreme in this regard. As city states, their domestic market is non-existent. Nevertheless, the demand for air travel in these economies is such that even on the basis only of international figures, both rank in the top 10 in the world in terms of either TKP or PKP.

The concentration of global air transport traffic in East Asia, North America and Western Europe is reflected in their dominance in the rankings of airlines in terms of passenger traffic (Appendix Table 2) and in cargo (Appendix Table 3). Current available forecasts of international travel indicate that this concentration will continue (Appendix Table 4).

[4] For international TKPs the second ranked country was Germany and for international PKP the second ranked country was the United Kingdom.

(b) International trade in air transport services

Air transport can have direct and indirect impacts on international trade, since it covers all air transportation services that are performed by residents of one economy for those of another, involving the carriage of passengers, the movement of goods (freight), rentals (charters) of carriers with crew, and related supporting and auxiliary services.[5] A threefold classification, which distinguishes between passenger, freight and other transactions is used.

Passenger services covers all services transacted between two foreign economies in the international transportation of non-residents by resident carriers and that of residents by non-resident carriers. Passenger services performed within an economy by non-resident carriers such as fares that are part of a package are also included in this definition.[6] Freight services are calculated on the basis of costs incurred to export or import goods through air transport. This includes the freight involved in other countries as long as the freight originates or is delivered in the reporting economy. All other transactions that are not listed in passenger or freight are included in the other category.

The indirect impact of air transport is captured in two ways. The first is through expenditure by non-residents on goods and services purchased in a foreign economy. This component, which is most commonly associated with tourism, can be facilitated through air transport, or other modes of travel. The second is through expenditure on goods related to the air transport industry, but not directly linked to the movement of persons.

Although the collection of data on international trade in air transport is still in its infancy, the available data show that air transport is an important component of world trade. Table 3 presents data on imports and exports of air transport as they relate directly to services trade. Indirect trade through the travel category and expenditures that can be classified as being on goods is ignored. When the available data are aggregated, air transport can be shown to account for approximately 10 per cent of world trade in services. For some developing countries, such as Pakistan, air transport accounts for as much as 43 per cent of services exports.

One of the most noticeable features of the Table is the dominance of the EC and the United States in both imports and exports. The Table also shows that passenger traffic is by no means the dominant aspect of international trade in air transport for all countries. While it accounts for as much as 81 per cent of total air transport exports for Malaysia, the same figure for Japan is 33 per cent and for Chinese Taipei is 26 per cent. Similarly varying figures can also be found in the import data. Passenger traffic is only 54 per cent of ECs total air transport imports, but the figure is 80 per cent for the United States.

The figures in Table 3 refer to aggregate trade in services. In this context, the role of small developing countries, such as the 50 countries classified by the United Nations as Least-Developed, may seem limited. In reality, however, air transport is extremely important to them as a means by which they can export their tourism services and their products.

The importance of air transport for tourism is illustrated by the fact that in 2000 half of the total international arrivals for tourists in Africa arrived by air (ATAG, 2003). The comparable figure for Latin America and the Caribbean is 55 per cent (ATAG, 2003). This figure indicates very clearly that developments in the air transport sector have direct implications for the tourism industry.

5 Some related items that are excluded from transportation services are freight insurance (included in insurance services); goods procured in ports by non-resident carriers and repairs of transportation equipment (both are treated as goods, not services); repairs of railway facilities, harbours, and airfield facilities (included in construction services); and rentals or charters of carriers without crew (included in operational leasing services).

6 Other items included in this definition are charges for excess baggage, vehicles, or other personal accompanying effects; expenditures on food, drink, or other items passengers purchase on board carriers; and passenger services such as rentals of aircraft.

The other mechanism by which air transport affects international trade is through the carriage of cargo. One estimate is that 40 per cent of the value of world merchandise trade and 2 per cent of its volume is carried by air (OECD, 1999). Furthermore, the daily shipment of air freight in 2004 reached 1.9 million tons, which is three times higher than the value in 1992, with an average annual growth of 11.1 per cent.[7]

These figures make intuitive sense, since it would be more profitable to ship products that have the dual characteristics of being time sensitive and that have a high value to weight ratio via air. Such products include electronic items and high tech instruments. Also, a recent development which is extremely important to developing countries is the use of air freight to export cut flowers, live trees/plants and fish (OECD, 1999). Air freight has allowed many developing countries to have access to distant markets in a more timely fashion. Kenya, Zimbabwe and Zambia, for example, export their fresh vegetables and horticultural products by air to Europe. Similarly, countries in the South Pacific use air freight to access customers in Australia, Japan and the United States.

3. ECONOMICS OF THE AIR TRANSPORT INDUSTRY

The air transport industry possesses a number of structural characteristics which determines its performance. First and foremost among these is the set of barriers to entry, both structural and regulatory. Second is the nature of competition itself – transporting passengers or cargo from one destination to another involves a number of choices, not the least of which is the pair of destinations to service (or routes). Once this is done, the capacity of the aircraft needs to be selected, as well as the frequency of the flights. This Section presents an overview of some of the main economic aspects of the industry.

(a) Market structure

The air transport industry, like other similar industries such as maritime transport and telecommunications, depends to a degree on fixed costs in order to operate.[8] Fixed costs are expenditures that need to be incurred prior to the delivery of a service and are independent of output. Once these costs have been incurred the average cost of producing output will decrease as output increases.

Fixed costs can partly explain why certain pairs of destinations are served.[9] Since a firm has to invest in capacity in order to provide a service, it will do so only in markets or city pairs where there is a sufficient market. They can, under certain circumstances, also act as a structural barrier to entry, since incumbent firms that have already incurred fixed costs and have large levels of output will be able to produce at a lower per unit cost.[10] A related factor associated with declining average costs is the density, or size of the market. A city-pair with a low level of traffic can be serviced more efficiently with smaller aircraft. In contrast, a city-pair with more dense traffic could be serviced with a larger aircraft that could provide the service at a lower cost per seat.

The air transport industry is large and diverse and encompasses firms of all sizes. Most people are familiar with the large airlines that fly the large aircraft. In reality, there are over 900 airlines operating, some of which fly only small aircraft over small distances. Regardless of the volume of traffic (either cargo or passenger), the existence of fixed costs can, but not always, act as a deterrent to entry, thereby reducing the number of operating firms that would otherwise be in the market.

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7 These figures are published by the Air Cargo Management Group, www.cargofacts.com, 31 December 2004.

8 It is also important to take into account the reversibility of the fixed costs. In cases where the fixed costs cannot be recovered (called sunk costs), such costs are more likely to act as a barrier to entry.

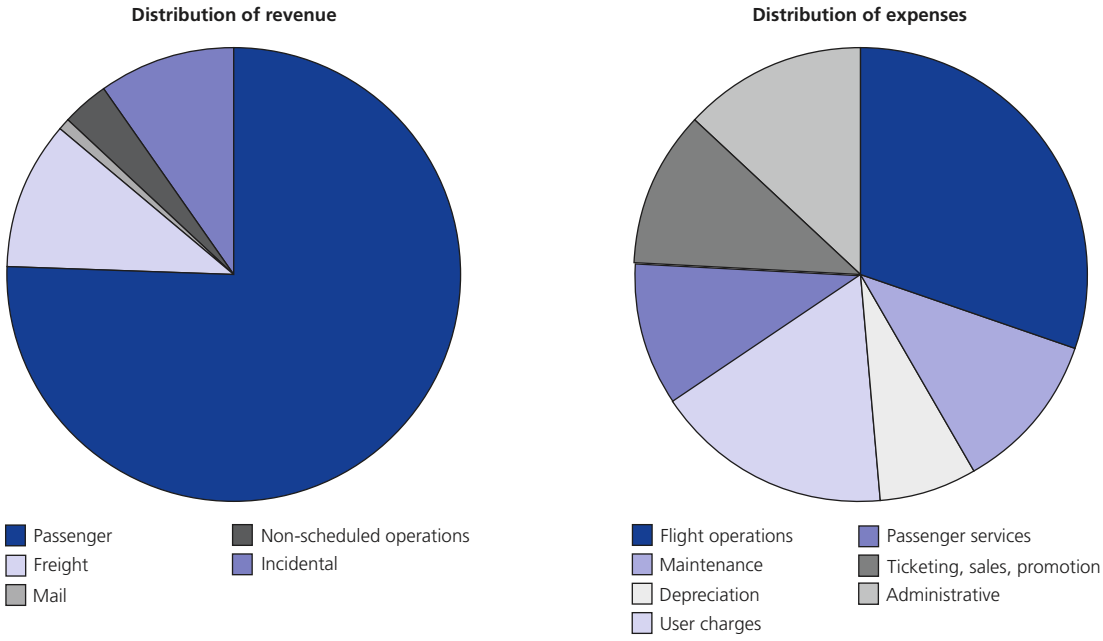
9 This is assuming a homogenous product. Product differentiation will be discussed below in the context of competition

10 It should be noted, however, that in many cases aircraft are leased and not owned by airlines. This means that airlines need not be tied down by the costs of the aircraft and can expand and contract their fleet in response to demand conditions, depending on the terms of their lease.

Not surprisingly, much of the focus and analysis is on the nature of competition in the markets where large national carriers have been operating for a considerable length of time. This analysis typically isolates the oligopolistic behaviour of the firms. But, as is now well known, the number of firms in a market may not necessarily be an accurate indicator of competition. Even markets with a small number of firms could be "contestable" if the level of entry barriers is low.

On the demand side it is important to note that consumers often have particular requirements, relating to such matters as the time of delivery, either in terms of the specific day, the time of day, or the specific time of the year. For example, a ticket between any two international city pairs is typically more in demand during holiday seasons such as Christmas, or during the summer break in either hemisphere. Therefore, the varied nature of demand is an important determinant of the output of the industry.

Chart 3
Distribution of operating revenues and expenses, 2002



Source: ICAO.

The price elasticity of demand is an indicator that is often used to differentiate between types of demand.[11] Table 4 summarizes elasticity values from a wide variety of studies in different segments of the market for air transport services. The results indicate that the median values correspond to the fact that demand differs across consumers and also by type of flight. In general, the demand for business class is price inelastic and more inelastic than economy class, except for long-haul domestic business class (Canada, 2001). It should be noted that these studies were conducted at different points in time, using different sample sizes and for different markets.

With respect to the cost side, Chart 3 indicates that over time the aggregate cost structure of airlines has not changed much, although it may have for specific airlines. Flight operations, including the cost of aircraft and running expenses are approximately 45 per cent of total costs. Ground costs, or indirect costs account for the remainder of the expenses. The two most public aspects of the cost structure of airlines are fuel and labour. Although labour is not listed separately in Chart 3, some estimates suggest that it accounts for almost 40 per cent of total costs. Therefore, as fuel prices increase, or pressures on profitability arise, airlines not surprisingly seek to reduce labour costs in conjunction with increased productivity.

[11] The price elasticity of demand is defined as the percentage change in quantity demanded caused by a one per cent change in price. Since the demand curve, which measures the relationship between price and quantity demanded is negatively sloped, the value of the price elasticity of demand is always negative. Accordingly, only the absolute value of the price elasticity of demand is important. Demand is said to be price elastic if the value is greater than one, inelastic if it is less than one and unit elastic if it is equal to one.

Table 4
Summary of absolute elasticity values

Category	Elasticity Values All Studies		Elasticity Values Passing grade studies	
	Median		Median	
	(1st quartile)	(3rd quartile)	(1st quartile)	(3rd quartile)
Own-price: Long-haul international business	0.265 0.475	0.198	0.265 0.475	0.198
Own-price: Long-haul international leisure	0.993 1.65	0.535	1.040 1.700	0.560
Own-price: Long-haul domestic business	1.150 1.428	0.836	1.150 1.428	0.836
Own-price: Long-haul domestic leisure	1.120 1.472	0.887	1.104 1.228	0.787
Own-price: Short/medium-haul leisure	1.520 1.745	0.885	1.520 1.743	1.288
Own-price: Short/medium-haul business	0.730 0.798	0.608	0.700 0.783	0.595
Income Elasticity	1.390 0.840	2.169	1.140 0.807	2.0489

Source: Industry Canada.
Note: Passing grade studies are studies, wich the authors deem to have passed certain academic quality criteria (http://www.fin.gc.ca/consultresp/Airtravel/airtravStdy_e.html).

(b) Technology

Although all industries are impacted by technological change, few are affected more so than the air transport industry. The travelling public can now readily identify with booking air tickets on the internet, or checking the delivery date of the package that they are expected to send or receive. One of the most significant and tangible impacts of technology has been the evolution of the capacity and range of the aircraft. In 1935, the most modern aircraft in commercial service was the Douglas Corporation DC-3, which had a speed of 346 km/hr and a range of 563 kilometres. Since then, a number of aircraft were developed that changed not only the industry, but people's lives. For example, in the immediate post-World War II era the dominant plane was the Lockheed Constellation that cut the time to travel from one coast of the United States to the other to under seven hours. This revolutionalized the industry, but the Constellation's performance gave way to the jet age and the Boeing 707. The spectacular pace of technological development continued through to the early 1970s when, arguably, the most visible and famous aircraft of all, the Concorde, entered service. This supersonic aircraft created a new era for air travel, but ended when the plane was taken out of active service in 2003. In 2006 the largest commercial aircraft, the Airbus A380, is expected to enter into service with a seating capacity of 555. It will also have a range of 14,500 kms.

A key aspect of the development of new aircraft has been the ability to lower the cost of air travel and increase its accessibility to a wider set of consumers. This has been achieved through two mechanisms. First, through more fuel efficient and otherwise cost-effective aircraft. Second, by changing the composition of the fleet. A broader choice of aircraft types has made it easier for airlines to penetrate different international markets.

When air travel first commenced it was limited only to the wealthy. As the cost of air travel continues to decline relative to other modes of transport, such as rail and road transport, it will broaden its customer base. This issue will be taken up in the next Section, which examines competition in the air transport industry.

Technological developments have not been limited to the speed, range and capacity of aircraft. In recent years, one of the most influential technological developments in the industry was the strengthening of business to customer links through the internet. Four different approaches to exploiting the advantages of information technology can be identified (ICAO, 2003):

- Websites established by travel agents as an extension of their normal services;
- Website travel agents that do not have conventional "bricks and mortar" outlets;
- Websites managed by groups of airlines;
- Websites of the airlines themselves.

Each of these channels have been effective when measured in terms of their share of total ticket sales. Some airlines have relied exclusively on the internet to sell their tickets. These airlines, called Low Cost Carriers (LCC) sell a significant share of their total sales through the internet. This results in a saving in the distribution costs of tickets as well as strengthening the links between the company and the customer.

Perhaps the most significant aspect of increased ticket sales through the internet has been the impact on increased transparency in ticket pricing. As noted in Table 4, the demand for leisure tickets is price elastic. Therefore, leisure customers have an incentive to search out the lowest cost ticket. The internet allows for a quick and easy comparison of prices, which forces airlines to be more transparent and more competitive in the price offerings.

Travel agents have also been forced to become more transparent in terms of their fees. The growth of internet has resulted in airlines reducing and in some cases eliminating the commissions paid to travel agents. As a result, customers now pay travel agents directly for the services they provide. This change may induce further substitution away from the traditional bricks-and-mortar service provided by travel agents.

(c) Infrastructure

International air transport is a complex industry, whose success and efficiency depends upon a range of factors, including government policy. The transport of people and cargo are only one component of the sector. The sector also includes various ancillary services, such as airport, ground handling, leasing and catering. Furthermore, the industry must also take into account the negative effects that it has on the environment. This Section examines how the management of airports and environmental considerations affect the performance of the industry.

(i) Airports

The location of airports and the availability of landing slots are fundamental determinants of which routes airlines choose to service. Furthermore, as indicated in Chart 3, airport charges are an important component of total air carrier expenses, accounting for approximately 4 per cent of total costs.

Given the continued growth in air traffic, capacity constraints at a number of airports has become an issue over the past decade. A number of high growth international ports, such as Hong Kong, China (1998), Osaka (1994), Kuala Lumpur (1998) and Shanghai (2002) have built new airports to deal with the problem. Capacity expansion possibilities for a number of major ports are limited, however, creating a congestion problem.[12] Some of these limitations include environmental, physical and other constraints. London's Heathrow airport is particularly notable for the capacity constraint problem. After decades of struggling to deal with congestion, the authorities have decided to build a new terminal and a short runway.[13] Nevertheless, the allocation of landing/takeoff slots at Heathrow, as at other airports, has direct competition policy implications. A number of airlines have made increasing use of secondary airports in order to circumvent the problem of congestion.

In the absence of capacity expansion, the only way to address airport congestion is through a mechanism for slot allocation. If such a mechanism is not efficient and transparent, slot allocation could create an anti-competitive environment by favouring certain carriers. One mechanism used in international air transport is the IATA Airline Schedule Coordination Conference, but this is voluntary. This mechanism is widely used. The only notable exception is some airports in the United States for the allocation of international slots.

[12] Some of these new airports have taken advantage of changes in land-use in order to construct their airport, while others such as Hong Kong, China have had to undertake land reclamation projects. The Osaka airport is built 5 kilometers from shore in 20 meters of water.

[13] The United Kingdom approach to handling the airport capacity problems is detailed in the White Paper entitled *The Future of Air Transport*, 16 December 2003 http://www.dft.gov.uk/

(ii) Environment

Isolating how much of the air transport environmental footprint is associated specifically with international traffic is difficult. This depends upon a variety of factors, such as the location of airports, the size of aircraft, the age of aircraft and flight schedules. Traffic between large international airports is characterized by larger long-range aircraft, which are louder and have greater emissions than smaller aircraft. In general, however, newer aircraft are estimated to be 70 per cent more fuel efficient than 30 years ago. For example, the two newest passenger aircraft destined to service predominantly international routes, the Boeing 787[14] and the Airbus A380, are boasting the smallest environmental footprint of any aircraft to date.

Specific environmental issues associated with the air transport industry come under two broad headings – flight operations and ground operations. In terms of flight operations, the two main issues are emissions arising from the combustion of aviation fuel and noise.[15] In terms of ground operations, these are noise, traffic congestion, land use and waste.

Air transport, both domestic and international, has a local and global impact on the environment. Local impacts include aircraft noise and air noise problems. The construction of new airports or airport expansion will obviously exacerbate the problem. A global environmental impact relates to fuel use. The environmental effects of air transport services are not limited to flight and ground operations. They can include the environmental damage arising from the manufacture of aircraft.[16]

The air transport industry, however, is not unique in having to address environmental sustainability issues. The approach that appears to have been adopted across the industry is one that is consistent with a more general acceptance that environmental considerations must be taken into account in the context of all economic activity.

(d) Regulatory environment

(i) Domestic regulation

The immediate post World War II regulatory environment for air transport was one of very strict government controls on entry and firm behaviour. International routes, as well as capacity and tariffs to be charged, were highly regulated. Since then, a clear and unambiguous trend in the domestic and international air transport industry has been towards deregulation and liberalization. This Section reviews some relevant trends in the industry in the domestic context, which have been an important driver of change in the international sphere. The various approaches that have been adopted to govern the industry at the international level are discussed in Subsection 6.

In the past, the domestic airline sector in many countries was subject to extensive regulation of fares, entry and exit (Button, 1990). This reflected a prevailing view that competition in this sector was unworkable or inherently unstable. Evidence also suggests that, in many cases, regulation responded to political pressures from incumbent carriers seeking to limit entry and maintain higher-than-competitive fares (Stigler, 1971; Jordan, 1972). In any case, in the 1970s and 1980s the prevailing approach to regulation was increasingly questioned. Economic studies documented the costs that regulation entailed (Jordan, 1970; Douglas and Miller, 1974; Findlay, 1985; Jordan, 1982) and made the case that competitive markets subject to minimal regulation were a viable and preferable alternative (Douglas and Miller, 1974; Economic Council of Canada, 1981).

One of the first countries to liberalize its domestic market was the United States, which adopted the *Airline Deregulation Act* in 1978. This legislation largely eliminated controls on entry, exit and pricing in the US domestic airline sector. The statutory test to be met for carriers to enter new markets was changed from the

[14] Until 28 January this model was referred to as the 7E7.

[15] Aircraft emissions include carbon dioxide, nitrogen oxides, sulphur dioxide, unburned hydrocarbons and water vapour. All of these have local and/or global environmental effects.

[16] Boeing and Airbus each publish environmental statements on their websites; www.boeing.com and www.airbus.com, which indicate the extent to which they take environmental considerations into account in their production techniques.

pre-existing restrictive one of "public convenience and necessity" to the more liberal standard of "fit, willing and able". Whereas the former had served as an effective barrier to entry, under the latter new entrants were required simply to establish their financial and operational competence. This led to extensive competitive entry and far-reaching structural changes in the US domestic airline sector. Some lessons from this experience are highlighted in Box 1. The US example also generated interest in similar policy changes in other countries, leading eventually to new policy approaches and a change in thinking elsewhere regarding the appropriate scope of government intervention in this sector (Stanbury, 1989; Anderson *et al* 1998).

Box 1: Lessons from the US experience with airline deregulation: the viability and benefits of competition

Some of the specific lessons to emerge from analyses of the effects of deregulation in the US may be summarized as follows:

- A key benefit of deregulation was to promote new entry into particular markets, by both existing and start-up carriers. From 1978 to 2003, 129 new carriers entered the industry (Jordan, 2005);

- Enhanced freedom of entry and competition resulted in substantial improvements in performance, including an average 30-33 per cent reduction in fares for consumers in real, inflation-adjusted terms (Winston, 1998; Kahn, 2002). Significant productivity gains were also achieved, in part through new competitive strategies and operational adjustments made possible by the enhanced freedom of operations that deregulation provided (Borenstein, 1992; Kahn, 2002);

- Although many individual carriers (both large and small) have come and gone, deregulation has not led to significant reductions in service for small towns and rural communities. On the contrary, the number of scheduled departures available to such towns and communities has increased by 35-40 per cent (Kahn 2002);

- Deregulation has increased the need for effective application of competition (antitrust) law in the airline sector, particularly with respect to mergers and strategic alliances. In a deregulated environment, mergers and alliances are a key means by which carriers can (potentially) preserve or enhance their market power. In a number of actual cases where airline mergers were allowed to proceed, concentration in city-pair markets increased and consumer welfare was diminished (Morrison and Winston, 1990; Borenstein, 1992; Jordan, 1988; Kahn, 2002);

- A related finding with implications for economic policies in this and other sectors is that the mere elimination of regulatory barriers to entry has not generally proven sufficient to prevent higher-than-competitive pricing in the airline sector – actual competition in city-pair markets is required (Joskow et al., 1994; Morrison and Winston, 1990). This has called into question the so-called "contestability hypothesis" which implied that the mere threat of entry would often suffice;

- Contrary to fears expressed at the time, there is no evidence that deregulation resulted in lower safety levels for consumers (Jordan, 1997; Kahn, 2002). In fact, air travel is now demonstrably safer than in the pre-deregulation period. While this may be due in part to extraneous developments (e.g., improved technology), it at least makes clear that deregulation did not usher in an era of heightened risks for passengers. In making sense of this picture, it is important to note that deregulation in the US did not involve any relaxation of legislated safety controls administered by the Department of Transportation and other authorities; rather, it focused on the economic aspects of regulation (i.e., the above-mentioned controls on entry, exit and pricing).

In continental Europe, deregulation started later than in the US and followed a slower pace. The 1992 Single Market initiative played a key role in the implementation of greater freedom of entry and pricing. Subsequently, various regulations issued by the European Council, reinforced by relevant enforcement actions and policy advocacy by the EC Commission, have further promoted freedom of pricing and operational flexibility across the Community (Button, 1990; Goldstein, 2001). Since then extensive competition from low cost carriers has triggered significant fare reductions for consumers in many intra-EC city-pair markets for passenger air service. Most recently, intra-EC deregulation has been complemented by a major external market-opening initiative by the EC Commission (for further discussion, see Section 6, below).

In Africa, efforts to promote investment in necessary infrastructure and achieve more efficient service within the region have achieved mixed results. According to Goldstein (2001), the continent has historically trailed behind regulatory reforms implemented in the civil aviation sector in the rest of the world, both among the OECD economies and in Asia and Latin America. This has impeded efforts to increase tourism flows, attract FDI and enhance export performance. He suggests that a specific deficiency has been a lack of attention to competition promotion and enforcement, a choice that has put at risk the potential welfare gains from privatization and related changes in ownership and governance structures. In some cases, particularly in Sub-Saharan Africa, the safety of air transport services has also been a concern. Reflecting this, improving airline safety while promoting efficient international linkages has been a focus of various US initiatives in the region (Goldstein, 2001).

The foregoing brief discussion of approaches to regulation, deregulation and regulatory cooperation in the domestic air transport sector highlights a number of lessons. First, the record indicates clearly that the elimination of restrictions on entry, exit and pricing in domestic air transport in many countries has been associated with substantial improvements in performance. This may have implications for the remaining regulatory barriers to market access in international aviation markets. Second, unless particular attention is given to the maintenance of competition through the enforcement of relevant laws and other measures, the potential benefits of deregulation may be attenuated. This important issue is further elaborated in subsequent Sections of this essay. Third, it is important that necessary safety-related and other technical regulations be separated from economic regulation of entry and pricing. Liberalization with regard to the latter need not and should not imply compromises with respect to the former. Fourth, regional integration and cooperation can be important tools for promoting pro-competitive changes in regulatory structures, particularly in the context of smaller, developing countries. Finally, as with respect to all aspects of governance, credible institutions are essential.

(ii) Privatization

One observer of international air transport policy has noted that owning a national flag carrier was for many years akin to having membership in the United Nations. This remark highlights the prevailing public policy view towards airlines. A similar view often holds on airports. Thus, international air transport was dominated in the past by publicly owned carriers transporting freight and passengers to and from publicly owned airports.

Arguably the two biggest catalysts for change occurred during the 1980s. These were the process of deregulation in the US domestic market (see Box 1) and strong economic growth in the Asia Pacific region. The first of these factors led to a re-thinking of how national governments should regulate the air transport industry and the second ensured that any assessment of the air transport industry had to accommodate the phenomenal growth in international trade and income, which was being driven largely by the Asia Pacific region. One of the first airlines to be privatized during this period was British Airways (1982). This was followed by Japan Air Lines that same year and a number of other airlines in developed countries such as Australia (Qantas), Canada (Air Canada), Germany (Lufthansa) and France (Air France). Developing countries such as Singapore and Malaysia privatized their airlines in 1985 (Bowen and Leinbach, 1996).

The trend towards privatization, while strong, is not universal, nor has it been an easy policy to implement for some countries. The Government of India, for example, stated its intention to privatize its national carriers

Indian Airlines and Air India. However, more than five years later, it is still trying to do so.[17] Also, Air Jamaica has recently returned to government control after a nine year experience with privatization.[18]

(iii) Foreign ownership

Against the backdrop of increasing growth in world traffic and financial pressures, a key development in the past decade has been to ease restrictions on the foreign ownership of international carriers. Therefore, a key strategy to increase competitiveness is not only to privatize, but also to allow foreign entry. Table 5 provides a snapshot of foreign ownership regulations applied by different countries. It shows that the practice is not uniform, with different countries applying different limits. Certainly, complete liberalization of foreign ownership regulations has not occurred; on the contrary, such regulations remain a barrier to a more competitive international airline industry.

It should also be noted that the experience of different countries with foreign owernship regulation has been mixed. British Airways purchased an equity stake in Qantas (Australia), once the Australian government permitted foreign entry, but has since sold this stake. In Latin America, LAN, which is based in Chile, has affiliate airlines in the Dominican Republic, Ecuador and Peru.

Liberalizing foreign investment regulations is perhaps one of the most contentious issues in the governance of the international air transport industry. The current system of regulation, which will be discussed in more detail later in Section 6, allows many national governments to grant market access only to designated 'national' airlines. Many people argue that foreign investment liberalization acts as an anchor to growth in the industry. Furthermore, the restriction of equity alliances amongst air carriers can create an incentive to engage in non-price competition in the form of non-equity alliances.

(iv) State aid

There is an on-going debate about the role of state aid in the international air transport industry. This debate cuts across many different aspects of the industry, such as aircraft manufacturing, competition amongst airports and assisting the financial survival of airlines. One of the most prominent issues in this debate in the international trade context is the role played by governments in the manufacture of aircraft.[19] Brazil and Canada are two of the most important exporters of short-range commuter aircraft, with approximately up to 150 seats. In 2002, Canada successfully argued that Brazil's use of government funds to subsidize exports of Brazilian aircraft were inconsistent with its commitments under the Agreement on Subsidies and Countervailing Measures.[20] In 2002, Brazilian won a similar challenge under the same agreement against the Canadian government's use of its funds to subsidize exports of Canadian aircraft.[21]

The European Communities (EC) and the United States are also in the midst of a dispute with respect to the production of large civil aircraft.[22] In 1992, the two parties – the only producers of such aircraft – signed an agreement to limit the use of government funds in their respective large industries. In January 2005, the two parties have reached an intermediary agreement on steps towards resolving their disagreements (Box 2).[23]

17 "More Passages to India", *Economist*, 2 December, 2004. www.economist.com. "India moves to modernise its market", *Airline Business*, February 2005.

18 "Air Jamaica returns to state control", *Airline Business*, February 2005.

19 Gary Becker, "Airline bailout sets a bad precedent", *Newsweek*, 26 November, 2001, p. 28. Also, "Bush signs airline bailout package", www.cnn.com, 23 November, 2001.

20 Full details can be found in WTO document WT/DS46.

21 Full details can be found in WTO document WT/DS222.

22 There is no precise definition of large aircraft. In most cases, references are made to aircraft with more than 100 seats that are designed to travel between large hubs. The aircraft models at the centre of the *Brazil-Canada* dispute are designed to travel between smaller ports that are a shorter distance apart with a smaller passenger and freight loads.

23 http://www.ustr.gov/Document_Library/Press_Releases/2005/January/Statement_of_U.S._Trade_Representative_Robert_B._Zoellick_Regarding_US-EU_Agreement_on_Terms_for_Negotiation_to_End_Subsidies.html

Table 5
Foreign ownership regulations in air transport, 2002

Country	Limit	Notes
Argentina	49%	In the case of Aerolineas Argentinas, 85% shareholding by Interinvest (Spain, US etc.) was allowed.
Australia	49%	There are no foreign ownership restrictions for purely domestic operators. For Australian international operators, foreign shareholder participation is limited to 49% "unless this is contrary to the national interest". Qantas is regulated under the provisions of the Qantas Sale Act of 1992. Aggregate foreign ownership is limited to 49% with up to 35% allowed to be held by foreign airlines, with a maximum of 25% for any single foreign airline.
Brazil	49.50%	Since 1997 (previously 20%).
Canada	25% (voting)	Exceptions may be granted by the competent regulatory authorities.
Chile		No restriction but airline must have its principal place of business in Chile.
China	35% (25% voting)	Since May 1994, intended to change to 49%.
Czech Republic	49%	At least 51% shares and voting are owned and controlled by nationals.
EU Member States (15)	less than 50%	Bound by EU Regulation 2407/92 (community carrier) for investors from non-EU Member States, but no restriction on investments from EU Member States.
Japan	33.33%	Japanese carriers must be owned, controlled and managed by more than two-thirds by Japanese nationals.
India	40%	40% in private domestic airlines, but investments from foreign airlines or airport investors are not allowed since April 1997.
Indonesia		Initially 49%, abolished by a Presidential decree in 2000.
Kenya	49%	
Korea, Rep. of	less than 50%	Raised from 20% to 49.99% on 12 February 1998, provided that effective control remains with Korean nationals.
Malaysia	45%	Applied to Malaysia Airlines, changed from 30% to 45% in July 2000.
Mexico	25% (voting)	Since 1994 allows over 25% limit if investment through firms where foreign investment is less than 50% of voting stock.
New Zealand	49%	Since 1996, 25% for single foreign airline, and 35% for total foreign airlines. At least 50% ownership and effective board control by Australian and/or New Zealand nationals (SAM airline).
Peru	70%	Since 1997.
Philippines	40%	Airlines are considered to be public utilities. All executive and managing officers must be nationals.
Poland		Air Law of 1962 (Article 65a) requires authorization by the Minister of Transport and Maritime Economy.
Russian Federation		In 1997 the Russian Government introduced rules which would bar foreign majority ownership in joint venture airlines.
Singapore		There are no formal restrictions on ownership of Singapore companies.
Switzerland	40%	After joining the European Common Aviation Area (ECAA), same rules as for EU Member States.
Taipei, Chinese	33%	Domestic airlines, 50% apply to air-cargo since 1997.
Turkey	49%	Turkish airlines must be incorporated in Turkey and majority-owned, controlled and managed by Turkish nationals.
Thailand	49%	Requirement of state ownership in Thai International reduced from 70% to 51%. Angel Air's foreign equity limitation was changed from 15% to 30%.
United States	49% (25% voting)	Two-thirds of the board of directors must be nationals and effective control must be national. Could be subject to control test.

Sources: ICAO, IATA.

Not surprisingly, airports with excess capacity will compete to obtain business. If the competition is intense, airports could resort to incentives that may be regarded as subsidies. This issue is illustrated in a recent case involving Charleroi airport near Brussels and Ryannair, a LCC based in Ireland. The European Commission ruled that the authorities of Charleroi airport, a public company, offered financial incentives to Ryannair that were exclusive. Accordingly, Ryannair had to pay back some of the funds. The result of the ruling is that the airport could still offer incentives, but had to do so in a non-discriminatory fashion.

Box 2: US-EU Agreement on terms for negotiation to end subsidies for large civil aircraft

1. The objective is to secure a comprehensive agreement to end subsidies to large civil aircraft producers in a way that establishes fair market competition for all development and production of LCA in the European Union and the United States.

2. At present, the companies concerned in the EU are Airbus and its principal shareholders, and in the US, Boeing.

3. The Agreement will be negotiated within three months.

4. (a) The Agreement will be negotiated between and apply to the United States and the European Union.

   (b) These parties will subsequently work together to broaden the agreement to include as parties other countries with civil aircraft industries, or countries with risk-sharing roles relevant to the objective of the Agreement.

5. (a) During the negotiations the parties will not request establishment of WTO panels relating to the pending disputes.

   (b) During the negotiations, within the time frame foreseen in paragraph 3 above, the parties will make no new government support commitments for LCA development or production.

6. The parties will use the definition of subsidies in the ASCM. The parties will agree an illustrative list of subsidies to be covered by the Agreement which elaborates the ASCM definition. They will use this list to reach agreement on which form of subsidy should be prohibited, actionable or permitted.

7. The Agreement will be enforced through transparency and strong dispute settlement procedures.

8. In negotiating the Agreement the parties will establish agreed terms and conditions under which either may withdraw at a future date. On the one year anniversary of the Agreement, the parties will review its operation, including whether progress on international participation in it is sufficient to prevent circumvention of its objectives and to justify its continuation.

Source: European Commission and Office of the United States Representative.

The ruling has broader implications in the context of the development of new city-pairs and airports that are publicly owned. One consequence of the development of LCC, in addition to stimulating growth and lowering prices, has been the creation of city-pairs which contribute to regional development. A concern here is that if regional airports are limited in how they compete against each other, especially through limits on fiscal incentives, the LCC model may not survive.

A third area of state-aid that has received attention is direct contributions to airlines to ensure their financial survival. The airline industry experiences cyclical fluctuations in its profitability. In addition, events such as 11 September, 2001 and SARs can exacerbate an already poor financial situation. The extent to which governments should be permitted to provide financial assistance to some of its airlines has caused considerable debate. A recent case is the provision by the United States of $15 billion available to its airlines two weeks after 11 September, 2001 events.[24] A similar issue has arisen in the European Community in the context of the Italian government seeking ways to ensure the survival of Alitalia. A number of measures that it has contemplated have been controversial with a number of other European governments.

[24] Airline Transportation Safety and System Stabilization Act, Pub. L. No. 47-102, I, § 103(b)(2)(A), http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=107_cong_bills&docid=f:h2926enr.txt.pdf

These three forms of state-aid – to aircraft manufacturing, airports and airlines in financial difficulty – will not disappear in the near future, nor will the controversy over their use. In the context of this essay, one of the more important aspects of this question is how far international cooperation will limit the impact of subsidization on international trade patterns.

(v) Market access

Market access in international air transport is defined by a number of variables, including the designation of carriers, the entry of these carriers on specific routes and the flexibility to establish capacity and prices on routes. As a starting point, the industry has defined eight different types of international air traffic, which it has called freedoms (Box 3). These range from the first freedom to overfly another country to the right to carry freight and passengers on domestic routes in a foreign country. The freedoms have evolved from the basic sovereign right possessed by every country to regulate air traffic within its borders. Exercise of this right means that national governments have the right to decide which carriers have access to the various freedoms and in which manner.

The granting of the first two freedoms has typically not been controversial.[25] Similarly, granting the third and fourth freedoms has not been controversial in a bilateral context, although the terms and conditions of access have traditionally been quite restrictive. The failure of the multilateral approach in 1944 resulted in mercantilist market access bargaining among nations. This means that states typically enter into negotiations with the intention of securing significant market access gains, while at the same time minimizing their concessions. The end result is an agreement that results in little liberalization. This appears to have been the case for the first bilateral agreement, Bermuda I, (Loy, 1996).

The Bermuda I Agreement was the template for the international air transport industry until 1978, when the US and the UK signed another Agreement (Bermuda II). This also was characterized by a substantially high level of intervention over capacity, fares, frequency, routes and type of plane and therefore limited market access. Granting third and fourth freedoms with only one flight per day is very different from granting the same freedoms without any restrictions on how and where the service is delivered.

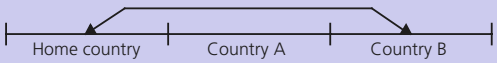
Section 6 reviews the various approaches different governments have taken to liberalize market access. These approaches have remained predominantly bilateral, but become more liberal with respect to pricing, capacity and routes. One area where they have not been ambitious is in the national designation of the carrier allowed to take advantage of the liberal provisions. This issue is linked directly to foreign ownership. A bilateral agreement that restricts the carriers which are allowed to take advantage of additional liberalization may not achieve the desired objectives.

[25] The manner in which the Russian Federation charges for First Freedom access has been the matter extensive debate (WTO S/C/W/163/Add.3, p. 9).

Box 3: Air freedom rights in air services agreements

FIRST FREEDOM

To overfly one country en-route to another

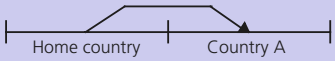


SECOND FREEDOM

To make a technical stop in another country

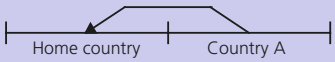
THIRD FREEDOM

To carry freight and passengers from the home country to another country



FOURTH FREEDOM

To carry freight and passengers to the home country from another country



FIFTH FREEDOM

To carry freight and passengers between two countries by an airline of a third country on route with origin / destination in its home country

SIXTH FREEDOM

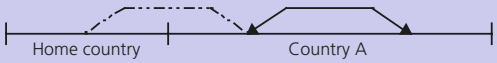
To carry freight and passengers between two countries by an airline of a third country on two routes connecting in its home country

SEVENTH FREEDOM

To carry freight and passengers betweeen two countries by an airline of a third country on a route with no connection with its home country

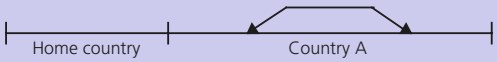
EIGHTH FREEDOM OR CABOTAGE

To carry freight and passengers within a country by an airline of another country on a route with origin / destination in its home country



TRUE DOMESTIC

To carry freight and passengers within a foreign country with no connection with the home country



(e) Summary comments

Each of the four broad issues identified above impact the pattern, volume and value of trade in international air transport. Together, they define the operating environment within which passenger and cargo carriers must operate. A clear picture of deregulation and liberalization in the domestic and international markets emerges, despite the fact that most national governments have not allowed full foreign ownership of their airlines. This trend and its positive consequences for prices and efficiency has been well documented in a number of studies that have examined the policy structure governing international air transport.

Gonenc and Nicoletti (2000, 2001) and Doove et al. (2001) are amongst the most recent studies to show that limitations on market access for international air carriers raises prices.[26] The Doove et al. (2001) study, for example, examined the effects of restrictions in 35 economies and found that the price increase for domestic fares arising from these restrictions ranged from 3 to 22 per cent. Indeed, they show that the more restrictive the regime, the higher price premium on air fares. For example, the US has the most liberal regime and was found to have the lowest premiums. These findings support the conclusions of Forsyth's (1998) general review

[26] See also Dresner and Tretheway (1992), which contains similar conclusions.

of the issues. Oum and Yu (1995,1998), show that the more liberal the regulatory environment, the more efficient will be the airline. Gonenc and Nicoletti (2001) come to similar conclusions after analysing business and discount fares in 100 city-pairs.

Air cargo is another aspect of air transport that is affected by various forms of regulation. Recent research has shown that the trend towards more liberalized agreements can have an impact on freight costs and thereby on the costs of conducting international trade transactions. For example, a reduction in transport costs of 8 per cent is estimated to increase trade by 10 per cent (Micco and Serebrisky, 2004).

4. COMPETING IN THE AIR TRANSPORT INDUSTRY

The previous Section showed that the regulatory and external environment within which air carriers are operating is changing rapidly. This Section examines some of the mechanisms by which airlines are responding to this changed environment.

(a) Networks

A number of changes in how services are delivered in the air transport industry have occurred in the past 30-40 years. In the pre-jet era, international air transport services were offered in a network that could be described as linear, or point to point. Intermediate points were used for refuelling stops. Once the technical capability of aircraft and choice of aircraft expanded, intermediate stops were by-passed to shorten the travelling time between two points, and where feasible, separate routes were established between the intermediate stops and the final stops. As demand for air transport services grew larger, cities started to establish their airports as hubs and develop feeder services into their international airports. The delivery of transport services has now reached the stage where a final destination point can be serviced through a number of hubs that were not on the original linear transportation network.

The concept of hubs and spokes is not new to international air transport. As indicated before, global air traffic can be divided into three main regions – East Asia, Europe and North America. Initially, each region had one or two major hubs, but as demand for air travel grew and the cost of providing international services declined, more hubs were established. As a result, places such as Hong Kong, China and Singapore, which do not have a domestic base, survive on the basis of being hubs for traffic to Europe or the South Pacific.[27] In this context the third and fourth freedoms that they have negotiated in their bilateral agreements are important for the profitability of their airlines. It also means that these two economies are in a strong position to demand fifth freedoms.

An important aspect of competing in the presence of fixed costs is the decreasing returns that come from increasing output, or from agglomerating different activities. The experience of the United States' domestic market, which is one of the largest markets for air travel in the world, shows that carriers that compete solely on the basis of hubs rely on their 'spoke' markets to feed traffic into the hubs. A consequence of this strategy, is that if the different spokes are not connected by an airline, then that airline could result in competitors entering to service this gap. A similar situation could arise in international markets.

The conditions of establishment are quite different in domestic and international air transport. This is because in domestic markets countries can simply exercise their sovereign right to control air traffic over their air space and between points that are origins or destinations within their territory. In international markets, networks can only be established through cooperation with other governments. This means that entry in international

[27] Much is written about the emergence of the hub and spoke model in the domestic market for air transport in the United States. When the market was heavily regulated many of the major cities were serviced. However, these services were typically very expensive and service was infrequent. After deregulation, the hub and spoke model emerged as the basis on which the major carriers competed. While there was some competition between the various spokes, this was difficult to maintain due to the possible conflict of servicing both the spokes and the hubs.

markets faces considerably higher barriers than in domestic markets, where in most countries domestic airlines can enter and exit relatively freely. As discussed later, these barriers will affect the type of international network that an airline may wish to establish. A network with spokes that are in different countries is more difficult to establish than an international hub with domestic spokes.

(b) Price competition

The emergence in Western Europe and the United States of the low cost carrier (LCC) concept has had a profound impact on how airlines compete. The traditional model of a full-service airline that delivers a range of services has been under threat for the past two decades by a new business model, which emphasises lower price tickets, but correspondingly lower levels of services.

The basic hypothesis driving the LCC model is that passengers are purchasing travel between two points, as opposed to a bundle of services in addition to the travel. By offering cheaper fares to passengers and full information about the reduction in services, a number of airlines such as Virgin Blue in Australia, Southwest in the United States and Easyjet and Ryanair in Europe have become quite successful.

As suggested by their name, LCCs obtain their advantage by lowering their costs. This can be achieved a number of ways, especially if an airline is new. Older, more established international airlines that are referred to as national airlines, or legacy airlines, have cost structures that make them less nimble in responding to competitive pressures.[28] Of these, labour costs, which account for up to 40 per cent of total costs, appear to be one of the most significant. Another cost advantage is in the efficient use of aircraft. Long-haul flights require consolidation of routes in order to make the provision of the service profitable. LCCs, so far, have focused predominantly on short-haul flights of less than two hours in duration. By selecting only one type of route to service, LCC can also reduce costs by using a single aircraft type. This not only lowers maintenance costs, due to the uniformity of service, it also leads to a reduction in the time on the ground to service and unload an aircraft (Gillen and Lall, 2004).

One of the most visible and tangible means by which LCCs have been able to compete is by using direct customer contact to sell their services. The availability of secure purchasing on the internet has provided a number of novel ways by which potential customers can examine their travel options. By cutting out travel agents, LCCs do not have to pay commission and in many cases, an electronic ticket is issued, which means the airline can save on administration charges. The use of the internet to book airline tickets is not confined to LCCs. Legacy carriers and now also some travel agents are making extensive use of the internet. The end result is that the effect of the internet on air travel is to make the pricing of air tickets more transparent, since customers can easily compare price quotes, thereby ensuring that prices remain a key strategic competition tool for airlines.

The concept of an international LCC, if the EU is counted as one market, is still in its infancy, but appears to be showing strong growth, especially in East Asia (Hooper, 2004). This is not altogether surprising given the demand for air travel in that region and the number of countries involved. Recent entrants into the South-East Asian market using the LCC model include airlines based in Indonesia, Malaysia, Singapore and Thailand. The expansion of the European Community to 25 countries has also resulted in a number of LCC entrants, based in the new states, attempting to take advantage of the single aviation market.[29]

China and India are two of the largest and fastest growing markets for international air travel in developing countries. As of yet, neither has an LCC, although media reports indicate that a number of enterprises are considering establishing an LCC in the next two to three years.

[28] The evolution, impact and future of LCC airlines is examined in "Low-cost airlines: Turbulent Skies", *Economist*, 8 July, 2004.

[29] "Spreading Wings: Yet more low cost startups", *Economist*, 13 May 2004.

(c) Non-price competition

While the deregulation of the industry has promoted healthy price competition, the existence of a number of regulatory entry barriers has triggered new forms of non-price competition among airlines on international routes. Of these the most common is the formation of non-equity alliances. An argument can be made that such alliances are simply pro-competitive responses to entry barriers against foreign airlines. In the absence of outright establishment, or a controlling share of another international airline, alliances that involve codesharing and the coordination of schedules across networks can provide a number of benefits.

From the carriers' perspective, some of the principal reasons for codesharing are:

- to achieve a better display position in computer reservation systems in cases where a codeshare is treated as an on-line service with a higher priority in listing than interline service;
- in the context of an increasingly competitive environment, to form some kind of cooperative links with other carriers to maintain, protect and improve market positions;
- to achieve better presence on routes carriers do not fly, as an inexpensive marketing tool;
- to enable joint operation carriers to operate a viable service where traffic volumes do not justify individual operations, and to obtain feeder traffic;
- to foster competitiveness by drawing traffic within the orbit of codesharing partners; and
- to obtain increased market access to points hitherto restricted by capacity provisions in bilateral air services agreements.

From the passengers' perspective, potential advantages are:

- the convenience of coordinated schedules, allowing for improved connections;
- possible shorter elapsed journey time;
- shared terminals between partner carriers facilitates transfer;
- the possibility of lower fares or greater choice of special fares;
- single carrier supervision of the through journey; and
- common frequent flyer programmes.

Table 6 illustrates the current landscape of alliances across international carriers. In 2002 there were five major alliances, but now after consolidation in the industry, only three exist: Oneworld, Star Alliance and SkyTeam. An important feature of these alliances is the inclusion of a major airline from one of the three important regions for air traffic. This way, each airline can claim to have a hub in the region that can be used to connect with hubs in other regions. For example, for the Oneworld alliance, American Airlines uses its hubs in the US for the alliance, as does British Airways for Europe. In East Asia and the Southern Pacific, the hubs are Hong Kong, China (Cathay Pacific) and Sydney (Qantas).

(d) Implications for international trade

The picture that has been painted by the previous Sections is of a dynamic air transport industry. The industry has shown resilience, responding positively to the many challenges it has faced. A pro-competitive environment has emerged from the systematic move towards privatization and deregulation. The implications for international trade are clear – as tariffs and restrictions to international trade in goods and services are reduced, there will be a greater demand for air transport.

While the growth prospects for air transport look positive, what is not predictable is the pattern of trade in international air transport. Two, perhaps competing, views exist as to what the landscape of air traffic will look like in the medium term. One is the view that demand will be accommodated by a few very large international

Table 6
Alliances between air carriers

SKYTEAM			
Members	Passengers (Thousands)	RPKS[1] (Scheduled Millions)	ASKS[2] (Scheduled Millions)
Aeromexico	8835	12982	19965
Air France	44405	99863	131719
Alitalia	22259	28170	39023
Continental	39856	94783	125593
CSA	3344	4784	6622
Delta	84124	143478	192975
KLM	18741	56555	71366
Korean Air	21270	39936	58284
Northwest	52788	110199	142573
Total	**295622**	**590750**	**788120**

STAR ALLIANCE			
Members	Passengers (Thousands)	RPKS[1] (Scheduled Millions)	ASKS[2] (Scheduled Millions)
Air Canada	19857	59018	79630
Air New Zealand	10123	22689	31041
ANA	43388	52077	81297
Asiana	11703	16156	23781
Austrian Airlines	6895	14537	20387
bmi	9113	6514	9972
Blue1	628	411	920
LOT	3252	5434	7592
Lufthansa	44477	96617	124166
SAS	26537	26733	39480
Singapore Airlines	13124	63816	88580
Spanair	5831	5143	7979
TAP Air Portugal	5841	12012	16837
Thai	16623	44773	63952
United Airlines	66526	167136	217798
US Airways	41251	60736	82870
Varig	11329	26081	36605
Total	**336498**	**679883**	**932887**

ONEWORLD			
Members	Passengers (Thousands)	RPKS[1] (Scheduled Millions)	ASKS[2] (Scheduled Millions)
Aer Lingus	6596	9963	12271
American	88798	193135	265199
British Airways	34815	100426	137483
Cathay Pacific	9991	42727	59224
Finnair	5556	8641	13792
Iberia	25087	41956	55930
LAN	5509	13255	19013
Qantas	23520	68923	89064
Total	**199872**	**479026**	**651976**

[1] RPKS – Revenue passenger kilometers.
[2] ASKS – Available seat kilometers.
Note: All data sourced from IATA WATS 2004; figures relate to 2003. TAP Air Portugal joins the Star Alliance in March 2005.
Source: IATA.

hubs, which will be serviced by a number of smaller ports (spokes). If this view prevails, then the smaller ports, which would be predominantly lower income developing countries, would look to gaining access to the hubs in order to export their goods and services.

Another view is that while the hub and spoke system will not disappear, increased demand will be accommodated through point-to-point service. In this view, the traffic volumes between hubs will be substituted by traffic volume that "closes the spokes".

These differences in predictions are best embodied in the commercial ambitions of the two largest aircraft manufacturers: Airbus and Boeing. Airbus subscribes to the view that hub traffic necessitates larger aircrafts as these hubs face capacity constraints. Boeing, on the other hand, predicts that medium size, long range aircraft that will be needed so that points can be serviced regardless of distance.

In reality, there is no reason why both views cannot co-exist. As indicated before, air traffic is heavily concentrated within and between three regions. It will continue to grow that way. However, one aspect of this growth is the extent to which smaller, lesser developed countries will be marginalized from the infrastructure that they require to integrate into the world trading system. Two prime examples of the difficulties that these countries face relate to demand for tourism and fresh fruit and vegetable exports.[30] The tourism industry is very competitive and many small economies are highly dependent on air traffic to sell their tourism services. A hub and spoke system that increases the time and number of connections to potential customers could prove detrimental to their best efforts. Similar difficulties and problems arise in the case of time-sensitive exports such as fresh fish, flowers, fruits and vegetables. Many countries such as Fiji, Kenya and Zimbabwe rely on exporting such products to markets that are a considerable distance away, such as Europe in the case of African countries and Australia, Japan and the United States in the case of the South Pacific countries. For these countries, a point to point system would serve their interests better, but only if it is cost competitive for them.

A more efficient air transport system would promote development in Africa by facilitating trade, attracting investment, encouraging tourism and boosting cultural links, both within Africa, and between Africa and other regions of the world (Goldstein, 2001). Currently, African consumers enjoy a reasonable degree of choice (and therefore competition) on major Africa-Europe routes and within particular sub-regions of the continent, while service between major destinations in different parts of Africa is much less developed (ATAG, 2003).

Expanding service options in developing countries is likely to require a complex mix of interdependent policy initiatives, including further privatization, liberalization of market access at least within the region and eventually multilaterally, infrastructure investment, and competition advocacy. These reforms, in turn, are likely to require enhanced intergovernmental cooperation through appropriate regional and multilateral bodies. Strengthened product market competition (and hence improved efficiency) would also enhance the attractiveness of developing country carriers as possible partners in international alliances – generating further benefits for their service suppliers and consumers.

5. THE ROLES OF COMPETITION LAW AND RELEVANT ENFORCEMENT AUTHORITIES

The state of competition in the international air transport sector is a function of many variables, some of which have already been described in previous Sections of this essay. These include changing technology and demand conditions, the availability of necessary infrastructure and (very much) the conditions governing access to markets. As described above, for many years, the degree of competition in the international air transport sector has been limited by constraints on entry and (in some cases) pricing that are embodied in bilateral air service agreements. These, in turn, derive from the "piecemeal bilateralism" approach to international regulation of this sector that was adopted at the Chicago Convention in 1944 (see further discussion in Section 6, below). However, the state of competition in air transport also depends on firm strategies and behaviour and on public policies in relation to such strategies and behaviour (i.e., on the application of competition law and policy). The latter will be the subject of this Section.

More specifically, this Section of the essay will explore key conceptual, practical and empirical issues relating to the regulation of competition in the air transport sector. The primary focus will be on issues that have arisen

[30] See Milner et al. (1998) for a review of how transport costs can act as an export tax in developing countries.

regarding the maintenance of competition in international passenger air transport.[31] The following issues will receive particular attention:

- the role of mergers, joint ventures and strategic alliances (including code-sharing arrangements) in the airline sector, their implications for competition and their treatment by competition authorities;
- the implications of antitrust immunity for the International Air Transport Association (IATA) and individual code-sharing arrangements for the assessment of arrangements in this area;
- issues concerning the possibility of inter-airline collusion, including through electronic tariff publishing and related channels;
- the treatment of predatory conduct (i.e., practices through which firms may seek to exclude potential rivals from markets) in the airline sector; and
- the contribution of competition advocacy – i.e., interventions by national competition authorities and other parties with related interests in national and international policy-making processes – in the international air transport sector.

The discussion will also touch briefly on issues concerning overlapping national jurisdiction regarding the maintenance of competition in the air transport sector, and the need for appropriate cooperation mechanisms in this regard.

The overall purpose of this Section of the paper is to provide a sense both of the various ways in which competition in the air transport sector can be adversely affected by anti-competitive practices, and of the ways in which such practices can be deterred/remedied by the application of sound competition rules. As will be seen, effective regulation of anti-competitive practices (in air transport as in other economic sectors) requires a discerning approach by relevant authorities which identifies structural amalgamations and conduct that are genuinely harmful to competition (and therefore to consumers) without coming in the way of efficient inter-lining arrangements, necessary re-structuring or pro-competitive pricing and other practices. The policies enforced by the competition authorities of leading jurisdictions with experience in this area seek to reflect this balance. The advocacy function of competition agencies in the context of the air transport sector will also be discussed. A key theme in this connection concerns the interaction of enforcement and advocacy concerns and, specifically, the role that competition agencies can play in promoting pro-competitive policy changes in this sector.

(a) The role of mergers, joint ventures and strategic alliances in the airline industry

The regulation of mergers, joint ventures and strategic alliances in the airline and other industries must be approached with caution: it is widely recognized that such arrangements can, in particular cases, be a legitimate tool for the re-allocation of resources and for achieving more efficient service. In fact, competition authorities typically find that most mergers and related arrangements in their respective economies are benign or even beneficial in terms of their impact on competition; it is only in a small minority of such cases that intervention by public authorities is warranted (Anderson and Khosla, 1995). Nonetheless, experience in the air transport sector indicates that both mergers and strategic alliances can create market power, reducing the benefits of market liberalization and raising fares/reducing service levels for consumers (Borenstein, 1990 and 1992; Morrison and Winston, 1989 and 1990; and Jordan, 1988 and 2002). The effects of particular mergers or similar arrangements depend, very much, on the circumstances prevailing in particular markets; accordingly, they are normally evaluated on a "rule of reason" or case-by-case basis. The challenge for relevant authorities is to identify and take appropriate action regarding the minority of such arrangements that pose a genuine threat to competition without coming in the way of the larger subset that is competitively benign or may result in better service for consumers (see, e.g., Bingaman, 1996; Nannes, 1999).

[31] It should be noted that, in addition to the issues that are discussed below, the question of state aids (subsidies) for industry falls within the purview of competition authorities in some jurisdictions (notably the European Community). However, the main focus of this Section is on private anti-competitive practices rather than on state measures that limit competition.

Merger analysis in the air transport sector (as in other industries) typically begins with delineation of the relevant product and geographic markets. The purpose of this exercise is to identify the range of products or services that consumers view as reasonable substitutes for the products or services of the merging firms (or firms participating in a joint venture, strategic alliance or similar arrangement). Typically, competition authorities find that relevant markets for the analysis of airline mergers and other arrangements are no larger than city-pair routes.[32] Relevant markets may be narrower than city-pairs if, for example, not all flights on a given city-pair route are viewed as adequate substitutes for each other, perhaps because the departure or arrival times are inconvenient for specific business-related purposes (Bingaman, 1996). Another approach is to define the relevant product market as the provision of transportation services between particular city-pairs, recognizing that (particularly given the role of the Internet) tickets for such services can be sold over wide geographic areas (see, for related discussion, Jordan, 1975).

Once the relevant markets have been delineated, the implications of a proposed merger or strategic alliance for prices and the extent of consumer choice in the markets are assessed.[33] A particular focus of concern for relevant authorities regarding the maintenance of competition in the passenger air transport sector relates to mergers that would eliminate competition from existing "hub carriers" – i.e., airlines that serve a large number of cities in a region through "hub and spoke" systems (McDonald, 2004). However, concerns can also arise with regard to mergers in which smaller carriers that provide a source of competition in niche markets are absorbed by competitors.

In addition to the number of competitors serving a particular city-pair route and their respective market shares, an important consideration in the analysis of any merger is the feasibility of entry into the market by new competitors. In the early years of airline deregulation, particularly in the United States, it was often assumed that barriers to entry in the airline industry were minimal in that key assets such as aircraft were readily transferable across markets. Indeed, the airline sector was widely cited as a leading example of a "contestable" market – i.e., a market in which entry is so easy that any effort to exercise market power by raising fares above competitive levels will be forestalled by the possibility of "hit and run" entry (see, e.g., Baumol et al. 1982 and Bailey, 1981). However, this view of the industry has since been largely rejected in both relevant economic literature (see, e.g., Borenstein, 1992) and in the work of competition law enforcement officials (see, e.g., Willig, 1991 and Nannes, 1999). This reflects a recognition that barriers to entry in this sector – arising, for example, from the impact of the hub and spoke system, a scarcity of take-off and landing slots or other airport infrastructure for some city-pairs and (in the view of some observers) reputation effects (i.e., a reputation for price-cutting in response to competitive entry) – are more extensive than previously thought (see Nannes, 1999, for a careful discussion).

Even in cases where intervention is deemed to be warranted, competition authorities typically are prepared to consider possible measures for redressing the anti-competitive impact of relevant arrangements that stop short of barring a merger or other transactions altogether. For example, concerns regarding the anti-competitive effects of a merger have, in a number of cases, been addressed through measures such as making available additional take-off and landing slots at airports to facilitate entry by new competitors. This is sometimes referred to as a "fix-it first" approach. An example of the use of this approach in the airline sector – namely in the Air France/KLM merger - is provided in Box 4.

[32] As Bingaman points out, "A passenger who needs to travel from Washington to Kansas City will not go to Cleveland instead if fares to Kansas City increase."

[33] See US Department of Justice and Federal Trade Commission (1997).

Box 4: A conditional approval of a merger with trans-national effects in the airline industry: the Air France/KLM case

In September 2003, Air France and KLM announced plans to merge their ownership and coordinate their operations, while remaining nominally separate carriers. The merger would create the world's largest airline, as measured by revenue.

Because Air France and KLM were members of competing alliances (SkyTeam and Wings, respectively), the merger would also (potentially) have created the incentive and ability to coordinate the activities of all carriers belonging to these alliances. Therefore, in the US, it was analysed as a worldwide merger of alliances, requiring examination of the likely effects on hundreds of city pairs.

In negotiations by the parties with the European Commission, the two carriers reached agreement on a set of commitments to alleviate possible anti-competitive effects in both intra-Europe and beyond Europe markets. These included a surrender of 47 landing and takeoff slot pairs, a "frequency freeze" (agreement to refrain from increasing frequency on affected routes to give new entrants a fair chance to establish themselves) and assurances by the Dutch and French governments that they would give traffic rights to other carriers wishing to stop over in Amsterdam or Paris. Based in part on the remedies exacted by the EC Commission, the US Department of Justice did not seek to prohibit the merger.

Source: EC Commission (2004a) and McDonald (2004).

In addition to mergers, superior efficiency can sometimes be achieved through strategic alliances or code-sharing arrangements. Such arrangements may comprise little more than one airline allowing another to sell seats on its planes on a route in which it cannot compete directly (essentially, an interlining arrangement). Alternatively, they can involve a much more comprehensive integration of marketing and operations including joint decisions on fares, capacity and scheduling.

The treatment of code-sharing arrangements under competition law involves the same principles as that of airline mergers. As Bingaman (1996) states:

> "To antitrust law enforcement authorities, code-sharing agreements are simply forms of corporate integration that fall somewhere between outright merger and traditional arm's length interlining agreements. As with mergers and acquisitions, ...code-sharing has the potential to be significantly pro-competitive – it can create new service, improve existing service, lower costs and increase efficiency, all to the benefit of the travelling public. By the same token, code-sharing can also be a mask for anticompetitive arrangements between actual or potential competitors to allocate markets, limit capacity, raise fares, or foreclose rivals from markets, all to the ultimate injury of consumers. The ability to distinguish the latter from the former is crucial for aviation policy-makers and antitrust enforcement authorities."

In circumstances where an alliance does not involve any tangible efficiencies or joint services that would not otherwise be provided its effects may be analogous to a cartel (i.e., a pure price-fixing or market-sharing arrangement), in which case it may be appropriate that it be prohibited outright.[34]

In sum, both mergers and related arrangements such as code-sharing or strategic alliances are normally evaluated by competition authorities on what is known as a case-by-case or "rule of reason" basis. Under this approach, arrangements are normally deemed acceptable to the extent that they provide enhanced efficiency or new services that would not otherwise be available to consumers. On the other hand, where such arrangements reduce or eliminate competition between carriers serving the same markets, the relevant authorities may require concessions to alleviate the anti-competitive effects or even seek to prohibit the arrangement outright.

[34] On the distinction between "naked" price-fixing cartels and potentially benign cooperative arrangements between firms, see Bork (1978), chapter 13.

(b) The implications of bilateral air service agreements and of antitrust immunity for the International Air Transport Association (IATA)/individual strategic alliances/code-sharing arrangements for competition policy

As discussed in Section 4 above, bilateral air service agreements are an important factor bearing on the state of competition in the air transport sector generally. Such agreements can also have specific implications for the enforcement of competition law. In particular, where such agreements limit the possibility of entry into international city-pair routes by carriers that have not served that route in the past, they will increase the likelihood that mergers or strategic alliances between incumbent firms serving that route will be viewed with suspicion (since they reduce or eliminate the possibility that an attempt by the merging firms to exercise market power will be defeated by competitive entry). On the other hand, where bilateral agreements adhere to the principle of "Open Skies" and provision is made for the sharing of airport landing and take-off rights to facilitate new entry, a bilateral air service agreement can help to allay concerns regarding potential anti-competitive effects of mergers or alliances (Bingaman, 1996 and Nannes, 1999). This illustrates the interaction between the need for and scope of competition law intervention and the degree of competition that is provided by the applicable regulatory framework. An example of the relevance of bilateral air transport agreements for competition law enforcement is provided in Box 5.

Box 5: The interaction between bilateral air service agreements and competition law enforcement: the British Airways/American Airlines alliance

In January 1997, British Airways and American Airlines applied to the US Department of Transportation (DOT) for approval to enter into a major new alliance involving extensive code-sharing and coordination of passenger and cargo service between Europe and the US. The proposed alliance was subject to hearings by the Department of Transportation (DOT), with input from the Department of Justice (DOJ). A critical question in the review was how many take-off/landing slots and related facilities would have to be made available for new entrants. The Department of Justice took the position that the DOT could find that the alliance was in the public interest if slots and ground facilities sufficient to allow for 24 daily round trips by other carriers (not party to the alliance) were made available. The DOT proceeding was suspended in the autumn of 1998 when it was determined that the UK was not prepared to come forward with proposals for an open-skies agreement.

In a second round of proceedings, in late 2001, the DOJ urged the DOT to impose various divestitures and other conditions on the proposed airline alliance, in order to protect consumers. At the same time, the Department called for replacement of an existing, restrictive air service treaty between the United States and the United Kingdom with a full 'Open Skies' arrangement which would remove government restrictions on entry and pricing while also emphasizing the need for freeing up airport landing 'slot' allocations. In response to a subsequent decision by the DOT, the two airlines abandoned their proposal. Although plans for a more comprehensive alliance were withdrawn, the two airlines have subsequently engaged in limited code-share arrangements (not covering transatlantic services to London) and continue to participate together in the "Oneworld" alliance.

These developments illustrate the inter-related effects of competition law enforcement and advocacy activities in a deregulated environment, in addition to the potential significance of market-opening agreements.

Source: Nannes (1999), US Department of Justice (2001), Monti (2003) and British Airways (2004).

A further complicating factor in analysing mergers, code-sharing and similar arrangements in the airline industry from the perspective of competition authorities relates to the role of the International Air Transport Association (IATA) and related exemptions for both IATA rate conferences and individual code-share arrangements from national competition laws. The implications of IATAs immunity for competition law enforcement are discussed by Bingaman (1996):

> "Under the [US] Merger Guidelines, we examine the extent to which a merger or joint venture arrangement will increase the likelihood that the firms remaining in the market will be better able to coordinate their behavior in a way that harms consumers.... IATA tariff conferences ... make it easy (and legal) for member carriers to agree expressly on prices in markets where they compete. Thus, the presence of IATA tariff coordination in affected markets may lead the Department to challenge code-sharing between horizontal competitors in situations where otherwise it would not. Moreover, if a proposed code-share agreement has both procompetitive and anticompetitive effects, the Department considers, as part of its overall competitive analysis, whether continued IATA membership is necessary to achieve any benefits and whether withdrawal from IATA would reduce any harm. In particular, we evaluate whether a code-share alliance setting its fares independent of IATA would constitute a less anticompetitive alternative means by which the benefits of the alliance can be achieved."

In 2004, the Competition Directorate-General of the EC Commission undertook a public consultation into the implications of continued exemption of IATA tariff and slot conferences. The consultation process generated numerous inputs from industry and consumer groups (see EC Commission, 2004b and, for background, Stragier, 2002). Subsequently, DG Competition has released a discussion paper in which it refers to the "very high restrictive potential" of IATA Tariff Conferences while also suggesting that any potential consumer benefits from the Conferences are limited (EC Commission 2005a).

With regard to antitrust exemptions for code-sharing arrangements, the question arises as to why an exemption would be needed for arrangements that genuinely provide enhanced service or lower prices for consumers, given that competition authorities recognize the potential for such arrangements to have pro-competitive effects and seek to challenge only those that are detrimental to consumers. In this regard, Bingaman (1996) states as follows:

> "It is not necessary for code-share partners to receive antitrust immunity for any agreement that would not violate the antitrust laws; and conduct that would violate the antitrust laws should not be permitted, much less immunized. From our perspective, [the Department of Justice] will continue to review all code-share agreements, including those where the parties seek immunity, and seek to prevent any anticompetitive agreements from being implemented."

(c) Issues concerning the possibility of collusion in this sector, including through electronic tariff publishing and related channels

A key means through which competition can be thwarted in any industry is that of a cartel (i.e., a price-fixing or market-sharing arrangement). In the past decade and a half, extensive evidence has surfaced that cartels operate in many industries. Moreover, the scope of their operations is often international or even global. Where present, cartels impose heavy costs on all affected economies – especially on developing economies that may lack effective tools to address them.[35]

In the case of the airline sector, collusion or price coordination has sometimes been facilitated by electronic tariff information systems. Such systems provide up-to-the-minute information on fares charged by competing carriers on particular routes. While this can obviously serve important efficiency-related purposes, it can also facilitate price coordination by providing instantaneous information on competitors' responses to fare changes (including both fare-matching and departures from an agreed cartel price). As shown in Box 6, concerns relating to the use of electronic tariff systems (specifically, systems operated by the Airline Tariff Publishing Co.) to facilitate price-fixing have arisen in both the United States and Brazil.

[35] In a study prepared for the World Bank, Levenstein and Suslow (2001) found that, in a single year, known cartels operated in industries accounting for up to $81 billion in developing countries' imports. Furthermore, where present, cartels increased the price of such imports in the range of 20-30 per cent above competitive levels. International cartels appear to be particularly prevalent in the agri-food sector and in relation to industrial input goods. Such cartels impose a multi-billion dollar burden on developing countries annually, see Evenett (2003).

Box 6: Allegations of airline price fixing in the US and Brazil: the role of computerized tariff information systems

In December 1992, the US Department of Justice (DOJ) sued eight of the largest US airlines and the Airline Tariff Publishing Company (ATP) for price fixing and operating ATP, the airlines' jointly-owned fare exchange system, in a way that facilitated collusion. Two specific causes of action were alleged. First, the defendant airlines were alleged to have engaged in various combinations and conspiracies with other airline defendants, including agreements, understandings, and concerted actions to increase fares, eliminate discounted fares, and set fare restrictions for tickets purchased for domestic air travel. Specifically, it was alleged that ATP's computerized fare exchange system had been used to: (i) exchange proposals and negotiate fare changes; (ii) trade fare changes in certain markets in exchange for fare changes in other markets; and (iii) exchange mutual assurances concerning the level, scope, and timing of fare changes. Second, it was alleged that the defendant airlines and ATP had conspired and reached an agreement to operate the system in a way that unnecessarily facilitated coordinated interaction among them in order to (i) communicate more effectively with one another about future fare increases, restrictions, and elimination of discounted fares; (ii) establish links between proposed fare changes in one or more city-pair markets and changes in other markets; and (iii) monitor each other's changes, including changes in fares not available for sale, and (iv) reduce uncertainty about each other's pricing intentions. In the event, a negotiated consent decree with the parties required the defendants to institute an anti-collusion compliance program and restricted their ability to communicate proposed fare changes through ATP for a period of ten years.

According to Owen (2003), years later, a similar set of concerns, possibly involving electronic tariff publishing and more traditional forms of collusion, arose in Brazil. In August 2003, the presidents of Brazil's four major airlines met together in a hotel. Five days after the meeting, the fares charged by all four airlines for flights between the central airports of Rio de Janeiro and Sao Paulo increased by 10 per cent. Subsequently, the airlines argued that the price increase was attributable not to any actual collusion but to independent "price-matching" facilitated by electronic tariff filing.

Source: McDonald (2004) and Owen (2003).

The foregoing is not, however, to deny that electronic tariff systems can provide major efficiency and consumer benefits. In a more recent case, the US Department of Justice analysed the question of whether practices of Orbitz, a travel website owned by five major domestic airlines, were likely to facilitate price coordination. Of particular interest was a "most favored nation" (MFN) clause that required the owners and charter associates of Orbitz to provide it with any publicly available fares that the carriers listed on their own websites or on other online travel sites. The Department of Justice found that this clause did not result in higher fares or create market dominance for Orbitz (McDonald 2004).

(d) The treatment of predatory conduct and exclusionary practices in the airline sector

A further important aspect of the application of competition policy and rules in the air transport sector concerns the treatment of predatory or exclusionary practices (i.e., practices through which firms may seek to exclude potential rivals from markets). These are practices that may be employed by incumbent firms to drive competing firms out of the market or (perhaps more frequently) to prevent entry by new competitors. The practices employed may include selective price cuts, targeted expansions of capacity, the exercise of control over access to necessary infrastructure (e.g., in the case of airlines, take-off and landing slots, counter facilities, etc.) and other actions.

Generally speaking, competition authorities approach allegations of predatory conduct with a degree of scepticism. This reflects a widespread view, supported by relevant scholarly literature, that predatory strategies are costly to implement and uncertain in the pay-offs that they yield (for development of this basic perspective, see Easterbrook (1981) and references cited therein). More specifically, enforcement experience and relevant literature highlight that efforts to exclude existing or potential competitors from a market through price-cutting or capacity expansions are unlikely to be profit-maximizing strategies for the firms involved in the absence of barriers that prevent subsequent entry (or re-entry) of competitors when the alleged predator(s) eventually seeks to raise its prices above competitive levels (as it must do eventually if its losses from the period of predation are to be recouped). In some jurisdictions this has led to the adoption of legal approaches to the assessment of alleged predatory conduct that emphasize the identification of such barriers and the feasibility of "recoupment" as a necessary condition for a finding of predation (see, for example, the leading US decision on this matter, *Brooke Group Ltd. v. Brown and Williamson Tobacco Corp.*, 509 U.S. 209, 113 S. Ct. 2578 (1993)).

Nonetheless, modern approaches to competition law enforcement at least recognize the possibility that predation may be a viable strategy for incumbent firms, in some circumstances. This is based, in part, on the view that a "reputation for predation" may itself serve as the necessary barrier to post-predation entry, at least in some cases (Milgrom and Roberts, 1982). In this regard, Nannes (1999) argues that the airline industry may be more than usually susceptible to successful predation:

> "The airline industry exhibits certain characteristics that make a predatory theory more than merely "plausible." First, hub carriers dominate hub markets, as demonstrated by market share. Second, hub carriers appear to be in a position to exact high fares, as demonstrated by hub premiums. Third, hub carriers can easily respond to entry by start-up carriers by increasing capacity and reducing fares in affected markets virtually overnight. Fourth, hub carriers have an incentive to act before start-up carriers develop a foothold in the hub: it is obviously easier to drive a carrier out before it gets established in the market. Fifth, a start-up carrier is likely to have limited capital and is thus vulnerable to predatory practices.... Sixth, a hub carrier "defending its turf" against encroachment by a start-up carrier in a few markets can create a "reputation for predation" that deters start-up carriers from entering its many other hub markets; this can significantly alter the "cost-benefit" predation calculation for a hub carrier in a way uncharacteristic of most other industries. In short, a "recoupment scenario" is not implausible at all."

The view that the airline industry is particularly susceptible to predatory pricing is not shared by all observers (see, for sceptical perspectives, Bamberger and Carlton, 1999 and Lall, 2005). Nonetheless, in recent years, the airline industry has been the focus of repeated allegations of predatory conduct and the possibility of predation has been widely viewed as a problem worthy of attention in this industry (Nannes, 1999; Fones, 1997; Ross and Stanbury, 2001 and Stragier, 2002).

It is noteworthy, though, that proven instances of successful predation remain rare. In the US, the Tenth Circuit Court of Appeals upheld a district court's grant of summary judgment for the defendant in a high-profile case of alleged predation against American Airlines (*U.S.v. AMR Corp.*, 335 F.3d 1109 (10th Cir. 2003)). In Canada, allegations that Air Canada had engaged in predatory acts against two low-cost start-up carriers (WestJet and CanJet) in 2000 and 2001 were recently settled (see Box 7).

A different set of issues falling in the broad category of (potential) exclusionary practices is raised by airline frequent flier (loyalty) programmes, which were introduced in the US in the early 1980s and were adopted by the majority of carriers providing transcontinental service in the 1990s.[36] While popular with consumers (especially business travellers), such programmes raise potential concerns from the standpoint of competition and economic efficiency. In economic-theoretic terms, such programmes take advantage of a principal-agent problem resulting from the fact that, especially for business travel, fares and schedules are frequently travel selected by parties other than those responsible for payment (Levine, 1987). They create strategic

[36] A closely-related set of issues is raised by the role of incentive arrangements provided by airlines for travel agents. For discussion, see Borenstein (1992) and Ross and Stanbury (2001).

advantages for larger airlines or inter-firm alliances in that the value of the rewards generated to individual flyers is enhanced by the range of markets served. They also reduce the threat of potential competition, by enhancing travellers' costs (in terms of foregone rewards) of switching to alternative carriers (Borenstein, 1992). Reflecting such concerns, the use of a frequent flier program in Swedish domestic air transport has been condemned by the Swedish Competition Authority (Arhel, 2004).

Box 7 : Allegations of predatory conduct in Canadian airline markets

In March 2001, the Canadian Commissioner of Competition filed an application with the Competition Tribunal seeking an order prohibiting Air Canada from operating flights on certain routes in eastern Canada at fares that did not cover their avoidable costs. For convenience, the case was divided in two parts. Phase one dealt with the application of an "avoidable cost test" in such cases. Phase two would have determined if Air Canada had actually engaged in culpable conduct under section 79 of the Canadian Competition Act dealing with abuse of a dominant position.

In June 2003, the Tribunal released its decision regarding phase one of the case. The Competition Bureau, which supports the Commissioner, has indicated that it believes that the principles established in the decision will be relevant for future cases of a similar nature. However, in light of the passage of time and significant changes that had occurred in the industry, the Commissioner decided that it would not be in the public interest to pursue the second phase of the case.

Source: Canada, Competition Bureau (2004)

On the other hand, the argument has been made that depending on factors such as market shares and the wider competitive environment, frequent flier programmes can sometimes enhance the financial performance of carriers and thereby enable them to cover their fixed costs without generating adverse consequences for efficiency and competition (Liu et al., 2000).

(e) The evolution of national and international policies governing the air transport sector: the potential contribution of competition advocacy activities

As emphasized in other parts of this study, competition and efficiency in the air transport sector depend significantly on national and international policies governing market access and foreign investment in this sector in addition to the competitive strategies of firms and related responses by competition authorities. Although broadly speaking, in the past two decades the international air transport sector has evolved in favour of freer entry and pricing, many obstacles to competition remain, particularly those embodied in national polices and bilateral air service agreements that limit entry, foreign investment and the services that foreign-based carriers can provide. As noted, questions have also been raised about the implications for competition and consumer welfare of continued exemption for IATA rate conferences from national competition laws.

Such issues clearly go beyond the role of competition law enforcement, in that they are principally concerned with government measures that affect competition and implicate decisions by national legislatures and other policy-making bodies. Nonetheless, competition authorities may have a role to play in relation to these questions as well. Competition authorities often provide valuable input to wider policy questions impinging on competition and the efficient functioning of markets, through their advocacy functions. The term "advocacy functions" refers to the role of competition authorities in providing input to public policy development processes, especially processes potentially impacting on the operation of markets, whether through testimony before legislative committees, intervention in public hearings or regulatory proceedings, the preparation of research studies, or other means. This is a well-established role of competition agencies at least in many jurisdictions (Anderson and Jenny, 2005). Indeed, in the past, the reform of government

measures affecting competition in the airline sector has been a key focus of competition advocacy activities at the national level, at least in the United States and Canada (Anderson et al., 1998). The pursuit of similar reforms at the international level could imply the commissioning of research and the conduct of advocacy activities aimed at promoting further pro-competitive changes, both nationally and internationally. Experience suggests that such "cooperation to promote competition" will be vital to establishing more efficient air transport systems internationally and particularly in the developing world, as discussed in the conclusion of the previous Section.

For competition advocates, a natural focus of attention concerning the air transport sector is the restrictions on foreign investment that are embodied in relevant regulatory legislation of many countries. More broadly still, in research undertaken for a recent official review of the Canadian Transportation Act and related policies and regulations, Ross and Stanbury (2001) have raised the fundamental question whether consumers are well served by the present network of often-restrictive bilateral air service agreements, underpinned by the 1944 Chicago Convention, which constitute the core of the international regime for civil aviation. Ross and Stanbury (2001) state:

> "The "Chicago system" is a closed one – access to international air travel markets is granted only by governments (usually on a reciprocal basis) by means of bilateral agreements. It is not too strong to say that all international trade in aviation services is forbidden, except that which is specifically permitted in a web of bilateral agreements. The system is an utter anomaly to the world's fast liberalizing trading system. It is based on the economic ideas of mercantilism which focus on the protection and promotion of domestic economic interests."

In a similar vein, Havel (1997) observes that "There is ... a basic systemic incompatibility between the Chicago idea of zero sum diplomatic exchanges and a free market system ...".

Clearly, the foregoing observations go beyond the purview of competition authorities and competition policy *per se*. The issue raised by Ross and Stanbury (2001) is whether the world community can find a better approach to governance of the international passenger air transport sector than the present patchwork of (in many cases) restrictive bilateral agreements. Taking the point further, Ross and Stanbury (2001) themselves suggest that "There is no serious reason why air travel should not be part of WTO agreements". Of course, this is a multi-faceted question which, if at all, would need to be resolved by WTO Members collectively (see related discussion in Section 6 below). To the extent, however, that competition authorities concern themselves with all measures that impede the competitive process to the detriment of consumers, they may have a contribution to make in advocating reforms in this area, as well.

Apart from the issue of competition advocacy regarding the policy framework for the international air transport sector, a further set of questions concerns the possibility of enhanced coordination in the application of national competition policies and legislation in this and other sectors. As is evident from the above discussion of the treatment of international airline mergers and strategic alliances, in many cases the resolution of concerns regarding the competitive effects of such arrangements will implicate the laws and enforcement authorities of more than one jurisdiction. In such circumstances, the potential arises for conflicts in enforcement approaches. More broadly, it may be argued that expanded cooperation arrangements, whether in the WTO or another forum, are needed to address the international collective action problems that are posed by transnational cartels, mergers and abuses of a dominant position in diverse industries (see, for related background, Clarke and Evenett, 2003, Birdsall and Lawrence, 1999, Anderson and Jenny, 2005). Such arrangements may be particularly important to protect the interests of smaller developing countries that are especially vulnerable to anti-competitive practices and are not party to the existing bilateral cooperation arrangements that link the competition authorities of major developed countries. For the present, however, WTO Members have clearly decided against initiating any negotiations on this issue in the framework of the WTO, as part of the current round of multilateral negotiations (the Doha Round).[37]

[37] Decision adopted by the WTO General Council on 1 August 2004 (WT/L/579, 2 August 2004).

(f) Concluding remarks

Measures to address private anti-competitive practices are an important adjunct to efforts to liberalize international air transport markets. As outlined in this Section and in the related discussion of past experience with deregulation in the US domestic airline industry, extensive experience indicates that the potential benefits of liberalization/freer entry in airline markets will be eroded if carriers are permitted to create unwarranted market power through mergers, joint ventures and strategic alliances or to collude or engage in predatory or other anti-competitive actions. The logical response to this concern is the implementation of competition laws administered by competent authorities. As indicated in this Section, the sound application of competition law in this sector does not involve sweeping intervention or blanket prohibition of practices such as mergers or code-sharing that can, depending on the circumstances, generate significant efficiency gains and benefits for consumers; rather, it requires a discerning approach by relevant authorities which deals with structural amalgamations or conduct that are genuinely harmful to competition without coming in the way of efficient inter-lining arrangements, necessary re-structuring or pro-competitive pricing and other practices. Competition authorities also have a role to play in promoting wider policy changes to promote competition and efficiency in the airline sector, through their advocacy functions. This is another respect in which the role of competition policy can contribute to and reinforce the goals of international trade liberalization.

6. GOVERNANCE OF THE INTERNATIONAL AIR TRANSPORT INDUSTRY

The first attempt at governing international air transport took place shortly after the first manned airplane flight in 1903. Although no agreement was reached, this attempt set the stage for a number of additional conferences aimed at regulating international air transport. The most important achievement in this area was the successful conclusion of the 1944 Chicago Conference. The outcome of that conference is known as the Chicago Convention and is still in effect today. It has set the stage for how countries regulate international air traffic in order to meet their specific national objectives.

Despite its longevity, the Chicago Convention has come under criticism as a constraint to the development of international air transport. To some, the system developed in 1944 was deemed not conducive to the evolving and changing nature of the air transport industry. In 1946 the United States and the United Kingdom concluded a bilateral agreement known as Bermuda I. As a result of conflicting views about its contents, the overall result was a cautious bilateral agreement that provided for substantial government intervention in the establishment of routes, capacity and tariffs. Since then the system has evolved to the point where by June 2004, more than 3,500 bilateral agreements have been signed involving more than a 100 countries. In addition, in 1995 the General Agreement on Trade in Services (GATS), which is administered by the World Trade Organization (WTO) came into effect. As a result, a number of different bilateral, regional and multilateral instruments exist today, creating a complex system of governance. The purpose of this Section is to review the different approaches to market access and identify a set of issues facing policy makers at the international level.

Regulating international air transport has traditionally involved policies covering market access, pricing and capacity. Recent bilateral agreements, however, have liberalized many aspects of pricing and capacity, leaving market access as one of the principal issues that is still heavily regulated. The next Subsection reviews market access issues. This is followed by an examination of the trend by countries to sign bilateral agreements and how air transport is treated in the GATS.

(a) Bilateral 'Open Skies' and regional agreements

As explained above, the international air transport system is governed by a system of bilateral agreements. In 1992, however, when the United States signed a bilateral with the Netherlands containing more liberal provisions than the existing bilaterals, the term 'open skies' was coined. This term is to a large extent a misnomer, since it reflects the fact that the agreements are more liberal, but does not mean that they provide binding access to the parties in respect of all the freedoms listed in Box 3.

Nevertheless, when compared to the existing regime the US initiative was clearly a step toward liberalization, albeit in a discriminatory fashion against third countries. By 2002, the United States had signed 59 open skies bilateral agreements. The main principles of the open skies agreements are outlined in Table 7. Open Skies agreement are not limited to the United States. A number of countries have also signed such agreements (Table 8).

Table 7
Main open skies principles

Combined passenger/cargo services	All-cargo services
Complete exchange of the five basic traffic rights (including 5th freedoms)	Same liberal provisions on traffic rights and rates (same regime as for combination carriers)
Free market access for designated carriers (free determination of routes, capacity, frequency)	Pro-competitive' ground support (self-handling, intermodal rights, user charges)
Freedom of fares and rates (double-disapproval if threat to competition)	Liberal treatment of non-scheduled cargo services (the least restrictive charter regulations of the two countries apply)

Source: OECD, DSTI/DOT (99), 1 June 1999.

Despite the step towards liberalization created by the implementation of the open skies agreements, there are many detractors who claim that they do not go far enough.[38] Of particular concern to these critics is the absence of rights beyond the Fifth Freedom. They also retain the concept of national carriers, which in many cases is never defined as majority foreign owned carriers. The agreements can also best be described as "positive list" – no international traffic is permitted, unless specified otherwise.

Approaches to liberalizing international air transport have not been restricted to bilateral agreements. A number of regional agreements have recently been adopted. These are listed in Table 9, along with an indication of the extent to which they provide Fifth Freedoms. A notable aspect of the information in the table is the number of agreements among developing countries.

An interesting complement to the existing network of bilateral and plurilateral approaches is the adoption by the economies of the Asia Pacific Economic Co-operation (APEC) of eight principles on air transport liberalization.[39] Seven members of APEC went further and adopted a regional open skies agreement based on these principles (Findlay, 2003).[40]

The external relations agenda for air transport which was put forward by the EC Commission in March 2005 would go beyond existing Open Skies arrangements to create a "common airspace" with the EU's neighbouring countries in the Mediterranean and along its eastern borders, operating under common security and safety rules. As a second major element of its agenda, the Commission has signalled an intention to negotiate major new agreements to create an "open air space" with the United States and to establish liberalized trade in air transport services with Russia and China. In addition, existing bilateral agreements between Member States and non-EU countries would be brought into conformity with European law (see EC Commission, 2005b and 2005c).

38 For example, the International Chamber of Commerce in its statement "The need for greater liberalisation of air transport", 7 December, 2005. (http://www.iccwbo.org/home/statements_rules/statements/2000/need_for_greater_liberalization.asp).

39 An overview of the approach taken by APEC to air transport liberalization can be found at: www.icao.int/icao/en/atb/ecp/CaseStudies/ApecConsensus_En.pdf.

40 Details of the agreement can be found at: http://www.maliat.govt.nz.

Table 8
Open skies agreements completed, 2002

1992	Netherlands - United States	1998	Turkmenistan - United Arab Emirates
1995	Austria - United States	1998	United Arab Emirates - Uganda
1995	Belgium - United States	1998	Uzbekistan - United States (7C)
1995	Czech Republic - United States (7C, T)	1999	Argentina - United States (7C, FN, SS, T)
1995	Denmark - United States	1999	Bahrain - United States (7C)
1995	Finland – United States	1999	Chile - Costa Rica (R)
1995	Iceland - United States (7C)	1999	Dominican Republic - United States (7C)
1995	Luxembourg - United States (7C)	1999	Ireland - New Zealand (7, 8, R)
1995	Norway – United States	1999	New Zealand - Peru (7C, FE S)
1995	Sweden – United States	1999	New Zealand - Switzerland (O, R)
1995	Switzerland - United States	1999	Pakistan - United States (7C)
1996	Germany - United States (7C, FN)	1999	Portugal - United States (7C, T)
1996	Jordan - United States	1999	Qatar - United States (7C)
1997	Aruba - United States (7C)	1999	Tanzania, United Rep. of - United States (7C, T)
1997	Brunei Darussalam - Singapore (S)	1999	United Arab Emirates - United States (7C)
1997	Brunei Darussalam - United States (7C, S)	2000	Australia - New Zealand (7C, 8, FF, O)
1997	Chile - United States (7C, S)	2000	Benin - United States (7C)
1997	Costa Rica - United States	2000	Burkina Faso - United States (7C)
1997	El Salvador - United States (7C)	2000	Cook Islands - New Zealand (O)
1997	Guatemala - Panama	2000	Gambia - United States (7C, T)
1997	Guatemala - United States (7C)	2000	Ghana - United States (7C, T)
1997	Honduras - United States (7C)	2000	Malta - United States (7C, T)
1997	Kenya - Netherlands	2000	Morocco - United States (7C, T)
1997	Malaysia - New Zealand (O, FF)	2000	Namibia - United States (T)
1997	Malaysia - United States (7C, T)	2000	New Zealand - Samoa (O, S, T)
1997	Netherlands Antilles - United States (7C)	2000	Nigeria - United States (7C, T)
1997	New Zealand - Singapore (7C, FF O, S)	2000	Rwanda - United States (7C, FN, T)
1997	New Zealand - United States (7C, FN, S)	2000	Senegal - United States (7C, FN, T)
1997	Nicaragua - United States (7CC)	2000	Slovakia - United States (7C, T)
1997	Panama – United States (7C)	2000	South Africa - Zimbabwe
1997	Romania - United States (T)	2000	Turkey - United States (T)
1997	Singapore - United States (7SC, S)	2001	Cook Islands - Samoa
1997	Chinese Taipei - United States	2001	France - United States (7C, FN)
1998	Brunei Darussalam - New Zealand (7, 8, FF, O,S)	2001	Oman - United States (7C, T)
1998	Chile - New Zealand (7C, FF O, R, S)	2001	Poland - United States (7C, FN, T)
1998	Chile – Panama	2001	Samoa - Tonga
1998	Denmark - New Zealand (FF)	2001	Sri Lanka - United States M
1998	Ethiopia – United Arab Emirates	2002	Cape Verde – United States (7C, FN)
1998	Italy – United States	2002	Chile – Peru (T, S)
1998	New Zealand – Norway (FF)	2002	Jamaica – United States (T)
1998	New Zealand – Sweden	2002	New Zealand – Tonga (7, FF, O)
1998	Peru – United States (7C, S, T)	2002	Singapore – United Arab Emirates (7)
1998	Republic of Korea – United States	2002	Uganda – United States (7C, FN)

Note: 7 denotes "Seventh Freedom" rights for all services; 7C, 7CC and 7SC denote "Seventh Freedom" rights for all-cargo, charter all-cargo and scheduled all-cargo services; 8 denotes "Eighth Freedom" rights for all services; FF denotes a free pricing scheme; FN denotes a double disapproval tariff scheme without tariff filing requirements: O denotes a liberal ownership provision; R denotes an existence of provisions less liberal than comparable ones in other open skies agreements; S denotes suspension due to entry into force of the "Korea" Agreement (and its Protocol in some cases); SS denotes suspension by one of the parties; and T denotes the existence of a transition annex or similar clause.
Source: ICAO.

Table 9
Regional agreements with fifth freedom rights

Andean Pact 1991 (5 States)	Caribbean Community (CARICOM) 1996 (14 States)	Fortaleza Agreement 1997 (6 States)	Banjul Accord 1997 (6 States)	CLMV Agreement 1998 (4 States)	COMESA 1999 (21 States)	ACAC 1999 (16 States)	MALIAT 2001 (7 States)
Fifth: Yes	Fifth: To be exchanged on a reciprocal and liberal basis between members.	Carriage of Fifth Freedom traffic permitted only with consent of States concerned.	Fifth: Yes, unrestricted where no 3rd and 4th Freedom operations; limited to 20% of capacity with 3rd/4th; reciprocal for non-African carriers.	Fifth: No limitation on traffic.	Fifth: Unrestricted where there are no 3rd and 4th freedom operations. Initially, there are 30-40% capacity limitations on 3rd and 4th Freedoms. Eventually there will be no restrictions.	Fifth: No restrictions by 2005.	Fifth: Yes

Source: WTO based on ICAO data.

Aside from the architecture of the bilateral agreements, another question is the nature of discrimination generated by these agreements. The issues here are similar to those raised by the spread of regional trading agreements – whether or not a multilateral, or discriminatory bilateral and regional agreements are best suited for trade in air transport services (WTO, 2004). As in the case of merchandise trade agreements, very little can be concluded a priori about the welfare implications of discriminatory agreements. The new generation of agreements are more liberal, but we cannot say whether or not a more open air transport system would exist if the multilateral approach had been pursued.

(b) The WTO General Agreement on Trade in Services

The bilateral approach to regulation in air transport is not unique among the modes of transport. International road transport is also dominantly organized in the form of 50/50 bilateral cargo sharing agreements. Negotiators of the GATS have not excluded road transport from the scope of the GATS. Rather, WTO Members have simply used the flexibilities offered by the GATS to maintain these agreements as exceptions to the most favoured nation principle.[41] In the case of aviation however, Members chose a different route. They decided to exclude from the purview of GATS the core of commercial air transport – the "hard rights" or traffic rights and the services directly related to the exercise of traffic rights.

Members nevertheless decided that the GATS shall apply to measures affecting three services relevant to air transport – namely: (a) aircraft repair and maintenance services; (b) the selling and marketing of air transport services; and (c) computer reservation system (CRS) services. Between 25 and 45 original Members of the WTO – depending on the service and the modes of delivery concerned – have undertaken commitments for these services, while relatively numerous MFN exemptions have been listed, in particular in the area of computer reservation systems (16) and of the selling and marketing of air transport services (17).[42] Accessions of new Members to the WTO since 1995 have only marginally changed this picture.

In addition, even in the services covered by the scope of the GATS, Members have agreed on a "grandfathering" provision whereby any specific commitment or obligation assumed under the GATS shall not reduce or affect a Member's obligations under bilateral or multilateral agreements that are in effect on the date of entry into force of the WTO Agreement. Furthermore, they have agreed on a provision regarding the exhaustion of pre-existing dispute settlement provisions, such that the dispute settlement procedures of the WTO may be invoked only where obligations or specific commitments have been assumed by the concerned Members, and

41 Coupled with an absence of commitments on cross-border supply of road transport since such a commitment would have been granted to all WTO members.

42 Further details on the commitments undertaken by Members in these areas can be found in WTO (2001).

where dispute settlement procedures in bilateral and other multilateral agreements or arrangements have been exhausted. These two provisions have no equivalent in any other services sector. They have not been tested, since so far no dispute settlement cases on air transport services have arisen. Neither have they been the subject of any discussion among members since the entry into force of the Agreement.

The question of the coverage of air transport services by the GATS has been the subject of many controversial discussions and diverging views. The parameters of this discussion are the following:

- Paragraph 1 of the Annex on Air Transport Services (which has the same legal value as the GATS agreement itself), stipulates that the Annex "applies to measures affecting trade in air transport services, whether scheduled or non-scheduled, and ancillary services". While "measures affecting trade in services" have been widely defined by subsequent dispute settlement cases, "trade in air transport services" is not defined and nor are "ancillary services";
- Paragraph 2 of the Annex stipulates that the Agreement, including its dispute settlement procedures, shall not apply to measures affecting: (a) traffic rights, however granted; or (b) services directly related to the exercise of traffic rights. While traffic rights are extensively and precisely defined by the Annex,[43] "services directly related to the exercise of traffic rights" have not been defined at all.

The divergence of views among Members on approaches to the coverage of air transport services by the GATS arises from this absence of definitions. The problem is further complicated by the absence of a clear distinction between the general exclusion (traffic rights and services directly related to the exercise of traffic rights) and the exception to that exclusion (the three covered services), as well as by the lack of any link between the classification of the Annex and the classification generally used for all other services.

These inconsistencies are reflected in the schedules of Members' commitments. An analysis of the commitments undertaken by Members shows that some of these go beyond the three services listed in the Annex. Some of the scheduled services appear in the air transport part of the non-compulsory classification used by most Members in most sectors – the Central Product Classification of the United Nations (CPC) and its abbreviated version in GATS document MTN/GNS/120. Wet leasing is one such example. Other commitments in the schedules cover services not listed in the CPC under air transport sevices, such as ground handling (services auxiliary to all modes of transport), freight forwarding (ibidem), storage and warehousing (ibidem), financial leasing (financial services), dry leasing (business services), franchising (distribution services) and catering (hotels and restaurants services). In other instances, Members have excluded from their commitments the air transport part of a given service, such as aerial advertisement from advertisement, flight training school from adult education, or catering from hotels and restaurants. Finally, some Members have felt it necessary to list MFN exemptions on some of these services, such as ground handling. So far, no dispute has arisen regarding these commitments.

The text of the Annex was heavily negotiated, particularly regarding its coverage. An agreement could only be achieved at the time on this question through the inclusion of a review clause contained in paragraph 5 of the Annex. This review clause stipulates that "[T]he Council for Trade in Services shall review periodically, and at least every five years, developments in the air transport sector and the operation of this Annex with a view to considering the possible further application of the Agreement in this sector."

The first of these reviews was held between September 2000 and November 2003, essentially during four dedicated meetings of the regular session of the Council for Trade in Services. These extensive debates[44] have

[43] "Traffic rights" mean the right for scheduled and non-scheduled services to operate and/or to carry passengers, cargo and mail for remuneration or hire from, to, within, or over the territory of a Member, including points to be served, routes to be operated, types of traffic to be carried, capacity to be provided, tariffs to be charged and their conditions, and criteria for designation of airlines, including such criteria as number, ownership, and control.

[44] The complete reports of these four dedicated meetings can be found in documents S/C/M/49 dated 1 December 2000, S/C/M/50 dated 5 March 2001, S/C/M/57 dated 13 February 2002 and S/C/M/62 dated 17 October 2002 and the complete documentation provided by the WTO secretariat for those meetings in documents S/C/W/163 and its 6 addenda (dated respectively 3 August 2000, 25 October 2000, 10 November 2000, 13 August 2001, 15 August 2001, 13 August 2001 and 16 August 2001), as well as in documents S/C/W/200 dated 3 October 2001 and S/C/W/200 Add 1 dated 28 February 2002.

led to no consensus with regard to any possible clarification of the existing scope of the Annex, nor with regard to any possible extension of the scope of the GATS to the air transport sector.

On the one hand, several Members contended that since the Annex only excluded the "services directly related to the exercise of traffic rights", services not directly related to the exercise of traffic rights were already included in the scope of the GATS. This was termed the "grey area" concept, whereby a range of services would neither fall into any of the three explicitly covered services (aircraft repair and maintenance services, the selling and marketing of air transport services, computer reservation systems services) nor be included in traffic rights or services directly related to the exercise of traffic rights.

In the absence of a definition of what constitutes a "service directly related to the exercise of traffic rights" those Members suggested a functional test: was retaining traffic rights necessary to undertake the activity concerned? From this test, they concluded that services such as catering, leasing, ground handling, airport management services, and freight forwarding services for air transport were not related to the exercise of traffic rights and therefore already covered by the GATS. These Members therefore called for commitments in such areas as ground handling services and airport management services in the context of the Doha negotiations.

Furthermore, some of them argued in favour of the extension of the coverage of GATS to "hard rights" activities such as all cargo transport services (referring notably to the substantive work of the OECD in that regard), charter services, and domestic air transport services (seen as a mode 3 establishment issue rather than in terms of traffic rights). They also suggested building on the work of the International Civil Aviation Organization (ICAO) on overflight and technical landing operational rights, provisions on access to/use of airport and air navigation facilities and services, remittances of earnings, and movement of personnel, in a fashion similar to that by which the WTO TRIPS Agreement built on the work of the World Intellectual Property Organization (WIPO). In order to address the problem of MFN and traffic rights these Members suggested approaches such as transition periods, conditional MFN (as in the WTO Plurilateral Agreement on Government Procurement) and plurilateral agreements.

On the other hand, in the review exercise many other Members invoked the negotiating history and argued that the GATS only applied to the sectors explicitly listed by paragraph 3 of the Annex. In their view, there was no space for a "grey area," since the three covered sectors were an exception to the general exclusion of traffic rights and of services directly related to the exercise of traffic rights ("except as provided in paragraph 3 of the Annex"). In this view, there was therefore no point in clarifying the scope of the Annex .

An even greater number of Members opposed any extension of the scope of the GATS on the grounds that the rationale of its existing scope had not changed and that liberalization was occurring anyway in a bilateral, regional and plurilateral context. It was further argued that because of its universality and links that would be made with other subjects in the negotiations, multilateral liberalization would act as a brake on the ongoing autonomous process of liberalization.[45] Those inclined to this view also considered that the ICAO was the proper forum to discuss these questions. They added that the GATS had not had any discernible effects on liberalization in regard to the three covered services, whereas liberalization was taking place outside the purview of GATS for hard rights. This was one more reason not to extend the scope of GATS.

The only agreed conclusion of this review was "to decide that the formal commencement of the second review [would] take place at the last regular meeting of the Council for Trade in Services of 2005 [and that this should not] prejudge Members' interpretation of paragraph 5 [the review clause] of the Annex."

[45] For a detailed account of the liberalization process see notably document S/C/W/163 add 3 dated 13 August 2001 and the annual publication of ICAO "The World of Civil Aviation".

7. CONCLUSIONS

Air transport is a vital and increasingly important component of the international trading system, both in terms of its direct contribution to international trade and as a facilitator of international trade in goods and services in other sectors. The growth in the industry over the past 30 years has been remarkable, attributable in large measure to technological innovations in terms of aircraft capacity and performance, combined with significant deregulatory and liberalisation initiatives.

The structure of the air transport services industry has changed in interesting ways over the last several decades, some of which pose significant questions for developing countries that rely on air transport for trade. Quite apart from the task of securing adequate and competitively priced air transport services to ensure export development and growth, developing countries may be challenged by the structural evolution of the industry in the future. Monitoring and reacting to these trends should constitute an important component of development planning.

The industry is engaged in a continuing struggle to define the terms of competition. Policy initiatives have markedly changed the industry from what it was 30 years ago. The introduction of competition has resulted in a growth in equity and non-equity alliances across the globe, expanded the range of routes being served, and lowered airfares. Recognition of the desirability of competition has also resulted in the entry of Low Cost Carriers into the industry, with the result that air transport services have been extended to a broader consumer base. All these changes have occurred within a regulatory framework premised on insistence that expansion of the industry must take place in an environmentally responsible manner.

The regulatory process based on bilateral agreements, conceived in 1944, is under pressure as it tries to cope with the pace of change in the industry. The predominant regulatory response to this pressure has been to maintain the bilateral system, but to relax many of the provisions in these agreements. This process has been widely welcomed and the debate will continue as to whether or not the bilateral process is sufficient to meet the needs of the industry. A number of countries have concluded that the answer is no and complemented their network of bilateral agreements with plurilateral agreements. Market access in the air transport sector is unique in its treatment within the WTO. To date, WTO Members have largely excluded the issue from the GATS agreement, but are continuing to seek a better understanding of how multilateral cooperation and rules can best serve the industry.

As in other industries, measures to address private anti-competitive practices are an important adjunct to efforts to liberalize the international air transport sector. Experience indicates that the potential benefits of liberalization/freer entry in airline markets (as in other industries) will be eroded if carriers are permitted to create unwarranted market power through mergers, joint ventures and strategic alliances, or to collude or engage in predatory or other anti-competitive actions. The appropriate response to this concern is the implementation of effective competition laws or similar instruments. The sound application of competition law in this sector does not, however, involve sweeping intervention or blanket prohibition of practices such as mergers or code-sharing, as these can generate significant efficiency gains and benefits for consumers. Rather, the approach is case-by-case, aimed at preventing structural amalgamations and conduct that are harmful to competition, without coming in the way of efficient inter-lining arrangements, necessary re-structuring or pro-competitive pricing. Competition authorities also have a role to play through their advocacy functions in promoting wider policy changes in favour of competition and efficiency in the airline sector.

Despite the industry's resilience to external shocks and its ability continuously to reinvent itself, it still faces a number of policy challenges, including in taking full advantage of benefits that can flow from deregulation and liberalization. In the context of international trade, this means further clarification of the contribution that can be made by international cooperation. The current system of bilateral agreements has become more liberal over time, and has been complemented by a handful of regional agreements. The question remains whether the governance of international air transport services can be more efficiently handled at the multilateral level rather than through a network of more narrowly drawn agreements.

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Appendix Table 1
Share of countries in international air traffic, 2003

Country or group of countries (whose airlines performed more than 115 million total tonne-kilometres)	TOTAL TONNE-KILOMETRES PERFORMED (millions)[1]								PASSENGER-KILOMETRES PERFORMED (million)[1]							
	Total operation				International operations				Total operation				International operations			
	Rank in 2003	Estimate 2003	Actual 1993	Change vs 1993 (%)	Rank in 2003	Estimate 2003	Actual 1993	Change vs 1993 (%)	Rank in 2003	Estimate 2003	Actual 1993	Change vs 1993 (%)	Rank in 2003	Estimate 2003	Actual 1993	Change vs 1993 (%)
United States	1	128356	89617	43.2	1	42506	29327	44.9	1	1016018	773311	31.4	1	259088	219691	17.9
Germany	2	21937	10109	117.0	2	21097	9542	13	3	149672	52941	182.7	3	141313	47808	195.6
United Kingdom	3	20687	17387	19.0	3	19940	16970	3	2	166498	124882	33.3	2	157479	119950	31.3
Japan	4	20479	14668	39.6	4	14066	10031	-11	4	144054	106360	35.4	5	70394	53979	30.4
China [2]	5	16906	4848	248.7	12	5527	1842	2	5	124591	45000	176.9	17	74346	11171	565.5
Hong Kong SAR[3]		10278				10278		-5		46402				46402		
Macao SAR[4]		198				198		-16		1516				1516		
France	6	15667	9795	59.9	7	12450	7508	1	6	115571	59919	92.9	4	82866	37940	118.4
Republic of Korea	7	14036	7246	93.7	5	13293	6717	1	11	63099	34083	85.1	8	55550	28762	93.1
Singapore	8	13062	6826	91.4	6	13062	6826	-8	10	65387	41262	58.5	7	65387	41262	58.5
Netherlands	9	11382	6512	74.8	8	11374	6507	1	9	69236	38544	79.6	6	69156	38495	79.6
Australia	10	9855	6895	42.9	10	6212	4781	-7	7	86675	57343	51.2	10	49244	36015	36.7
Canada	11	8854	5151	71.9	13	5446	3355	-15	8	74418	40426	84.1	11	42889	24936	72.0
Gulf States[5]	12	8068	2023	298.8	9	8052	2017	10	14	50653	14489	249.6	9	50519	14424	250.2
Spain	13	6100	3025	101.7	16	4272	2168	6	12	57594	27105	112.5	13	38723	18551	108.7
Russian Federation	14	6018			23	2513		5	13	53894			20	20478		
Thailand	15	5871	3167	85.4	11	5564	2941	-6	15	44773	22874	95.7	12	41731	20609	102.5
Malaysia	16	5542	2178	154.5	14	5126	1898	4	18	36824	17445	111.1	14	32309	14431	123.9
Brazil	17	5504	4084	34.8	20	2809	2514	-5	16	44045	29555	49.0	21	20234	16866	20.0
Italy	18	5067	4044	25.3	17	3934	3393	2	17	37934	29702	27.7	16	26087	22751	14.7
Luxembourg	19	4397			15	4397		5	98	548			94	548		
Switzerland	20	3657	3007	21.6	18	3641	2977	-2	25	23797	17704	34.4	18	23639	17443	35.5
Scandinavia[6]	21	3485	2365	47.4	19	2824	1757	0	21	29116	20607	41.3	19	22374	14167	57.9
India	22	3410	1661	105.3	27	2011	1032	12	19	31197	14396	116.7	24	17221	7858	119.2
Mexico	23	3337	1746	91.1	31	1743	811	3	20	29305	18216	60.9	27	13555	8016	69.1
South Arica	24	3137			25	2506		8	23	24873			23	18847		
New Zealand	25	2945	1823	61.5	21	2581	1622	5	24	23822	14163	68.2	22	19870	12194	62.9

Appendix Table 1
Share of countries in international air traffic, 2003 (cont'd)

Country or group of countries (whose airlines performed more than 115 million total tonne-kilometres)	TOTAL TONNE-KILOMETRES PERFORMED (millions)[1]								PASSENGER-KILOMETRES PERFORMED (million)[1]							
	Total operation				International operations				Total operation				International operations			
	Rank in 2003	Estimate 2003	Actual 1993	Change vs 1993 (%)	Rank in 2003	Estimate 2003	Actual 1993	Change vs 1993 (%)	Rank in 2003	Estimate 2003	Actual 1993	Change vs 1993 (%)	Rank in 2003	Estimate 2003	Actual 1993	Change vs 1993 (%)
Saudi Arabia	26	2739	2415	13.4	26	2014	1816	-1	26	20801	18572	12.0	26	13693	12646	8.3
Ireland	27	2573	467	451.0	22	2572	463	47	22	27441	4209	552.0	15	27433	4157	559.9
Israel	28	2538	1654	53.4	24	2507	1638	4	32	12495	8747	42.8	29	12157	8581	41.7
Chile	29	2236	1018	119.6	29	1913	844	7	34	12186	4425	175.4	34	9139	2772	229.7
Turkey	30	2065	842	145.2	30	1754	676	-3	28	16396	7519	118.1	28	13317	5669	134.9
Austria	31	1983	669	196.4	28	1971	665	7	29	14558	5629	158.6	25	14440	5595	158.1
Indonesia	32	1861	2416	-23.0	35	1031	1700	-6	27	17979	19846	-9.4	33	9371	12850	-27.1
Philippines	33	1751	1650	6.1	32	1495	1478	0	30	14183	13085	8.4	31	11753	11295	4.1
Portugal	34	1455	897	62.2	33	1312	778	12	31	13562	7917	71.3	30	12141	6833	77.7
Colombia	35	1432	1014	41.2	38	981	746	13	38	8714	5296	64.5	50	4504	2376	89.6
Pakistan	36	1425	1322	7.8	34	1235	1069	8	35	11755	9898	18.8	32	10059	7533	33.5
Argentina	37	1228	1117	9.9	43	787	780	42	33	12485	9231	35.3	37	7762	6072	27.8
Finland	38	1086	662	64.0	37	991	590	7	36	9056	5529	63.8	36	7981	4712	69.4
Qatar[5]	39	1000			36	1000		-	40	8003			35	8003		
Belgium	40	961	1003	-4.2	39	961	1003	8	54	3958	6484	-39.0	53	3958	6484	-39.0
Egypt	41	960	606	58.4	40	908	562	-10	39	8055	5277	52.6	38	7481	4786	56.3
Sri Lanka	42	864	436	98.2	41	864	436	11	43	6910	3624	90.7	39	6910	3624	90.7
Iran (Islamic Rep.of)	43	857	519	65.1	60	393	223	19	37	8798	5045	74.4	55	3681	1868	97.1
Viet Nam	44	819			47	602		7	42	7227			42	5300		
Kuwait	45	795	632	25.8	42	795	632	-8	44	6715	4054	65.6	40	6715	4054	65.6
Greece	46	759	848	-10.5	46	612	755	-19	41	7354	7899	-6.9	41	5881	6964	-15.6
Bangladesh	47	704	278	153.2	44	697	270	3	51	4662	2556	82.4	49	4583	2470	85.5
Mauritius	48	667	334	99.7	45	661	333	0	46	5212	2677	94.7	44	5144	2658	93.5
Poland	49	608	357	70.3	49	589	351	4	45	5434	3335	62.9	43	5213	3272	59.3
Jordan	50	602	581	3.6	47	602	580	4	52	4498	4004	12.3	51	4498	3993	12.6
Kenya	51	525	191	174.9	50	509	178	14	53	4224	1459	189.5	52	4050	1325	205.7
Morocco	52	505	449	12.5	53	485	437	-20	50	4776	4395	8.7	48	4584	4264	7.5
Jamaica	53	503	155	224.5	51	503	154	-15	47	5005	1488	236.4	45	5005	1474	239.6
El Salvador	54	487	203	139.9	52	487	203	58	49	4833	1738	178.1	47	4833	1738	178.1
Czech Republic	55	485	196	147.4	54	483	196	28	48	4938	1900	159.9	46	4923	1897	159.5

Ethiopia	56	484	259	86.9	55	474	244	10	58	3573	1717	108.1	58	3460	1571	120.2
Brunei Darussalam	57	472	211	123.7	56	472	211	-5	57	3588	1623	121.1	57	3588	1623	121.1
Uzbekistan	58	424			58	401		1	56	3889			56	3646		
Cyprus	59	408	230	77.4	57	408	230	15	55	3935	2175	80.9	54	3935	2179	80.6
Fiji	60	400	126	217.5	59	397	125	9	62	3221	983	227.7	61	3178	964	229.7
Iceland	61	378	219	72.6	61	378	212	-8	63	2998	1968	52.3	62	2998	1905	57.4
Peru	62	344	214	60.7	67	224	143	8	66	2443	1926	26.8	76	1345	1205	11.6
Hungary	63	333	147	126.5	62	333	147	7	60	3397	184	1746.2	59	3397	1484	128.9
Algeria	64	327	296	10.5	65	258	207	3	59	3415	2901	17.7	63	2672	1991	34.2
Trinidad and Tobago	65	276	364	-24.2	63	275	362	-6	64	2671	3232	-17.4	64	2662	3205	-16.9
Tunisia	66	261	173	50.9	64	261	172	-2	65	2459	1877	31.0	65	2459	1875	31.1
Lebanon	67	253	260	-2.7	66	253	260	4	73	1905	1459	30.6	69	1905	1459	30.6
Cuba	68	232	138	68.1	68	219	118	4	71	2029	1321	53.6	68	1939	1069	81.4
Ukraine	69	231			70	211		47	67	2352			67	2115		
Yemen	70	225	124	81.5	69	217	113	26	72	1956	1217	60.7	70	1876	1099	70.7
Kazakhstan	71	222			76	76		-40	69	2149			75	1404		
Malta	72	209	117	78.6	71	71	117	-68	68	2174	1250	73.9	66	2174	1250	73.9
Bolivia	73	186	120	55.0	77	77	96	-27	74	1740	1092	59.3	77	1307	843	55.0
Venezuela	73	186	784	-76.3	92	92	589	-38	70	2043	6880	-70.3	86	834	4676	-82.2
Surinam	74	183			72	72		-29	79	1470			74	1469		
Syrian Arab Republic	75	171			73	73		-56	75	1727			71	1710		
Romania	76	161	161	0.0	74	74	148	-51	76	1706	1810	-5.7	73	1644	1657	-0.8
Panama	77	156			74	74		-77	61	3371			60	3371		
Serbia and Montenegro	77	156			78	78		-10	80	1199			79	1061		
Turkmenistan	78	150			86	102		-7	78	1538			81	1005		
Namibia	79	139			79	136		43	85	930			84	904		
Azerbaijan	80	135			84	111		6	90	751			95	497		
Costa Rica	81	122	189	-35.4	80	120	188	14	77	1674	1432	16.9	72	1654	1425	16.1
Nepal	82	118			82	116		-7	81	1105			78	1084		
Uruguay	82	118			81	118		84	83	1029			80	1029		

[1] 2003 data are estimates.
[2] For standard purposes the data for China excludes the traffic for Hong Kong and Macao Special Administrative Regions (Hong Kong SAR and Macao SAR), and that of the Taiwan province of China.
[3] Traffic for the Hong Kong Special Administrative Region (SAR).
[4] Traffic for the Macao Special Administrative Region (SAR).
[5] Four states in 2002 - Bahrain, Oman, Qatar and United Arab Emirates. At the end of 2002, Qatar withdrew from Gulf Air, hence in 2003 the Gulf States are composed of Bahrain, Oman and United Arab Emirates.
[6] Three states – Denmark, Norway and Sweden.
Source: ICAO.

Appendix Table 2
Ranking of airlines on the basis of passenger traffic, 2003

Ranking: passenger traffic		Ranking: passenger number	Airline	Fleet Size[1]	Country	Passenger Traffic (RPK)[2]		Seat Capacity (ASK)[3]	Load Factor		Passenger Number	
2003	2002	2003				million	change (%)	change (%)	change (%)	change (%)	million	change (%)
1	1	2	American Airlines	714	United States	193222	-1.4	-4.2	72.8	2.1	88.8	-5.7
2	2	3	United Airlines	484	United States	168083	-4.6	-8.2	76.5	2.9	66.2	-3.5
3	3	1	Delta Air Lines	473	United States	158766	-3.3	-5.2	73.4	1.4	104.5	-2.4
4	4	6	Northwest Airlines	432	United States	110247	-4.9	-5.2	77.3	0.2	51.9	-1.5
5	6	12	British Airways	229	United Kingdom	103092	3.0	1.5	73.0	1.0	36.1	-5.0
6	7	9	Air France	245	France	101644	1.7	2.4	75.6	-0.5	43.7	1.9
7	8	11	Continental Airlines	356	United States	95259	-0.3	-2.2	75.5	1.4	39.9	-2.8
8	5	5	Japan Airlines	-	Japan	93847	-10.4	-5.7	64.3	-3.4	58.2	-4.8
9	9	8	Lufthansa Airlines	224	Germany	90708	2.4	3.5	73.1	-0.8	45.4	3.3
10	12	4	Southwest Airlines	399	United States	77342	5.6	3.7	66.9	0.8	65.7	4.1
11	10	13	Qantas Airways	116	Australia	77225	2.8	-11.4	77.6	-0.7	28.9	6.5
12	11	29	Singapore Airlines	86	Singapore	64685	-12.8	-10.4	73.3	-1.2	13.3	-13.4
13	13	21	Air Canada	195	Canada	60962	12.2	-8.4	73.8	-1.5	20.0	-14.5
14	14	10	US Airways	280	United States	60814	-5.7	-3.6	73.2	2.2	41.3	-12.5
15	15	23	KLM	100	Netherlands	57784	-2.7	-0.9	80.2	0.7	19.0	-2.3
16	16	7	All Nippon Airways	177	Japan	55807	-5.6	1.0	63.6	-3.2	48.1	-5.6
17	18	25	Thai Airways	83	Thailand	44396	-4.7	-6.0	69.6	-4.1	17.0	-6.9
18	17	43	Cathay Pacific	87	China	42774	-12.8	1.3	72.2	-5.6	10.1	-18.4
19	20	14	Iberia Airlines	149	Spain	42100	4.0	32.2	75.0	1.9	25.6	3.8
20	24	42	Emirates	63	United Arab Emitates	40110	26.7	0.7	73.4	-3.2	10.4	22.8
21	19	17	Korean Air	123	Korea, Rep of	39981	-4.2	2.6	68.1	-3.5	21.7	-1.9
22	21	26	Malaysia Airlines	103	Malaysia	37659	0.0	3.3	67.6	-1.8	15.4	-5.8
23	23	20	America West Airlines	142	United States	34283	7.1	-2.3	76.4	2.8	20.1	3.1
24	22	24	Air China	129	China	33477	-1.8	4.2	66.0	0.3	18.1	-0.5
25	25	16	Alitalia	151	Italy	31626	5.3	6.6	71.6	0.8	22.5	1.2
26	27	-	Virgin Atlantic	29	United Kingdom	26931	-0.3	6.3	75.6	-5.0	3.9	1.3
27	29	38	Varig	95	Brazil	26546	1.7	-2.3	71.4	2.3	11.0	13.8
28	26	19	China Southern Airlines	112	China	26387	-8.8	-7.6	64.6	-0.8	20.5	-4.8
29	30	37	Swiss	81	Switzerland	25059	6.1	4.4	72.5	1.2	11.2	-9.0
30	28	-	China Airlines	58	Taipei, Chinese	23734	-11.5	-4.2	69.5	-5.7	7.1	-13.1
31	35	27	Alaska Airlines	108	United States	23432	10.4	7.5	70.0	1.9	15.0	6.3

32	36	28	Saudi Arabian Airlines	90	Saudi Arabia	23372	12.3	22.7	62.3	-5.7	14.5	-2.4
33	37	35	ATA	68	United States	23118	15.9	20.0	68.0	-2.4	11.2	11.7
34	33	45	Air New Zealand	39	New Zealand	22691	5.6	2.7	74.4	2.1	9.6	5.7
35	34	-	South African Airways	68	South Africa	22262	4.6	7.4	67.1	-1.8	6.6	3.0
36	31	22	SAS	129	Sweden	21901	-5.6	-2.2	65.7	-2.4	19.3	-11.9
37	32	-	My Travel Airways	30	United Kingdom	21432	-2.1	-0.4	90.1	-1.6	7.9	6.6
38	39	-	Britannia Airways	33	United Kingdom	18739	1.7	2.4	90.3	-0.6	8.0	-0.2
39	65	49	Jet Blue Airways	59	United States	18547	68.5	65.4	84.5	1.6	9.0	56.7
40	40	30	China Eastern Airlines	136	China	18269	0.3	7.8	60.6	-4.5	12.2	6.1
41	42	-	Aeroflot	92	Russia	18203	3.2	1.7	69.4	1.0	5.8	6.4
42	38	-	EVA Air	42	Taiwan	18113	-7.0	-0.6	72.5	-5.0	4.3	-10.1
43	41	50	Austrian Airlines	-	Austria	17965	-0.1	0.1	72.4	-0.2	8.5	-4.1
44	68	18	Easy Jet	84	United Kingdom	17735	92.6	95.2	84.4	-1.1	21.1	85.7
45	44	32	Asiana Airlines	61	South Korea	16798	-3.1	2.2	68.0	-3.7	11.8	-4.5
46	65	15	Ryanair	66	Ireland	16755	54.6	61.0	74.5	-3.1	23.1	47.0
47	47	-	LTU International Airways	24	Germany	16700	3.7	4.4	83.4	-2.7	5.6	-1.8
48	43	-	Condor Flugdienst	36	Germany	16261	-6.6	-6.4	84.4	-0.1	4.8	-14.3
49	45	41	THY Turkish Airlines	52	Turkey	16112	-2.9	-0.1	67.0	-1.9	10.5	1.1
50	46	-	First Choice Airways	33	United Kingdom	15878	-2.6	-2.2	90.0	-0.3	6.3	-2.8

[1] Includes aircraft for passenger, cargo, and combination

[2] RPK = Revenue Passenger Km

[3] ASK = Available Seat Km

Source: ICAO.

Appendix Table 3
Ranking of airlines in terms of cargo traffic, 2002

Ranking 2003	Ranking 2002	Airline	Country	Cargo Traffic (RTK)		Employees number
				million	change (%)	
1	1	American Airlines	United States	2909	-0.1	78900
2	2	United Airlines	United States	2758	-17.0	63000
3	3	Delta Air Lines	United States	2048	-6.1	70000
4	4	Northwest Airlines	United States	3189	-1.7	39100
5	6	British Airways	United Kingdom	4461	6.0	51939
6	7	Air France	France	5432	-0.2	71654
7	8	Continental Airlines	United States	1341	1.1	37680
8	5	Japan Airlines	Japan	4749	-0.9	21197
9	9	Lufthansa Airlines	Germany	7089	-1.0	34559
10	12	Southwest Airlines	United States	206	10.3	32487
11	10	Qantas Airways	Australia	1530	-4.3	34872
12	11	Singapore Airlines	Singapore	6691	-2.1	14010
13	13	Air Canada	Canada	-	-	29198
14	14	US Airways	United States	-	-	31700
15	15	KLM	Netherlands	4392	4.6	34529
16	16	All Nippon Airways	Japan	1442	8.5	12277
17	18	Thai Airways	Thailand	1780	0.5	25531
18	17	Cathay Pacific	China	5299	2.3	14673
19	20	Iberia Airlines	Spain	868	2.1	26202
20	24	Emirates	United Arab Emirates	2819	32.5	15173
21	19	Korean Air	Korea, Rep of	7066	13.2	15352
22	21	Malaysia Airlines	Malaysia	2187	5.5	18000
23	23	America West Airlines	United States	-	-	12755
24	22	Air China	China	2206	4.2	23000
25	25	Alitalia	Italy	1374	-0.3	20653
26	27	Virgin Atlantic	United Kingdom	1018	13.9	7519
27	29	Varig	Brazil	1057	-10.1	-
28	26	China Southern Airlines	China	1205	16.9	17569
29	30	Swiss	Switzerland	1305	21.0	7300
30	28	China Airlines	Taipei, Chinese	-	-	9124
31	35	Alaska Airlines	United States	77	7.2	10040
32	36	Saudi Arabian Airlines	Saudi Arabia	85	-90.1	-
33	37	ATA	United States	-	-	7918
34	33	Air New Zealand	New Zealand	824	8.3	10165
35	34	South African Airways	South Africa	879	15.4	-
36	31	SAS	Sweden	-	-	9147
37	32	My Travel Airways	United Kingdom	33	-12.8	1522
38	39	Britannia Airways	United Kingdom	-	-100.0	3175
39	65	Jet Blue Airways	United Kingdom	-	-	4704
40	40	China Eastern Airlines	China	1305	27.5	16435
41	42	Aeroflot	Russia	614	9.1	14714
42	38	EVA Air	Taipei, Chinese	4913	19.1	4469
43	41	Austrian Airlines	Austria	465	2.7	7137
44	68	Easy Jet	United Kingdom	-	-	3226
45	44	Asiana Airlines	South Korea	2805	-0.1	6411
46	65	Ryanair	Ireland	-	-	2288
47	47	LTU International Airways	Germany	174	58.3	2100
48	43	Condor Flugdienst	Germany	-	-	-
49	45	THY Turkish Airlines	Turkey	382	-2.6	10239
50	46	First Choice Airways	United Kingdom	11	-17.2	2034

Source: ICAO.

Appendix Table 4
Forecast of world traffic by regional flow, 1985-2023

RPKs in billions	1985	1990	1995	2000	2001	2002	2003	2013	2023	2004-2023 %/year
Africa-Africa	13.5	14.7	14.8	19.4	19.9	21.2	22.5	42.6	63.4	5.3
Africa-Europe	43.0	47.7	57.2	99.4	96.2	97.2	99.1	182.4	269.3	5.1
Africa-Middle East	5.2	7.4	6.5	9.8	10.6	13.2	13.9	28.0	41.5	5.6
Africa-North America	1.2	1.3	2.6	4.4	4.6	4.3	4.4	11.6	17.2	7.1
Central America-Central America	12.8	14.3	18.3	24.0	23.0	23.4	24.8	53.4	95.3	7.0
Central America-Europe	17.9	27.6	44.2	66.4	73.0	69.7	72.5	117.3	177.1	4.6
Central America-North America	43.3	63.7	71.1	93.9	93.5	95.8	100.1	150.5	232.1	4.3
Central America-South America	3.3	3.5	4.3	7.3	7.2	7.1	7.1	15.2	25.6	6.6
China-China	8.4	18.3	56.6	73.6	84.6	97.2	95.3	236.9	452.1	8.1
China-Europe	9.6	16.9	26.6	40.1	40.2	42.6	34.5	94.5	143.1	7.4
China-North America	7.8	13.4	21.6	33.2	36.2	33.2	24.9	56.2	87.8	6.5
China-Northeast Asia	6.8	10.9	16.0	19.4	18.4	24.5	20.1	44.3	73.1	6.7
China-Oceania	3.0	5.8	9.2	12.1	12.4	13.2	10.6	20.4	29.4	5.2
China-Southeast Asia	8.1	14.5	23.0	29.3	31.7	36.9	27.7	58.3	90.3	6.1
CIS Region-CIS Region	175.8	224.2	63.4	41.7	46.7	51.9	57.3	89.1	137.4	4.5
CIS Region-International	15.9	24.1	33.9	43.3	43.5	42.7	45.7	99.8	156.6	6.4
Europe-Europe	170.1	258.3	306.8	440.1	449.3	453.8	474.7	733.6	1061.6	4.1
Europe-Middle East	43.4	41.5	44.9	65.0	59.8	58.6	58.9	116.9	171.9	5.5
Europe-North America	158.6	230.7	278.9	420.0	377.5	349.2	347.5	619.1	903.0	4.9
Europe-Northeast Asia	17.0	29.3	46.6	63.6	55.8	53.3	48.3	114.2	175.3	6.7
Europe-South America	12.3	22.3	32.9	53.2	52.1	49.2	49.5	106.3	170.6	6.4
Europe-Southeast Asia	26.6	46.4	65.9	95.8	95.9	96.4	95.0	170.9	253.2	5.0
Europe-Southwest Asia	11.9	17.5	20.7	26.2	27.5	27.6	29.5	57.7	94.9	6.0
Middle East-Middle East	17.7	19.5	20.7	27.8	27.1	27.5	29.3	49.3	73.0	4.7
Middle East-North America	5.0	6.6	10.3	16.1	12.0	10.4	9.6	25.8	39.1	7.3
Middle East-Southeast Asia	15.1	11.0	20.6	24.0	22.9	24.0	26.4	47.5	70.8	5.1
Middle East-Southwest Asia	14.5	16.6	23.2	29.4	29.9	31.1	33.8	60.1	97.3	5.4
North America-North America	470.6	589.1	670.5	866.9	808.0	791.0	798.9	1214.4	1797.0	4.1
North America-Northeast Asia	46.9	95.2	121.5	140.2	127.5	121.2	105.4	233.0	364.5	6.4
North America-Oceania	11.0	19.0	24.1	30.0	27.6	26.5	25.9	39.8	59.8	4.3
North America-South America	14.5	19.6	35.9	47.2	44.8	42.7	37.6	89.2	147.5	7.1
North America-Southeast Asia	8.0	15.3	25.9	32.1	29.3	30.5	26.8	55.3	84.9	5.9

Appendix Table 4
Forecast of world traffic by regional flow, 1985-2023 (cont'd)

RPKs in billions	1985	1990	1995	2000	2001	2002	2003	2013	2023	2004-2023 %/year
Northeast Asia-Northeast Asia	32.3	50.0	67.4	79.0	80.2	85.0	86.1	152.6	244.7	5.4
Northeast Asia-Oceania	6.1	12.9	31.8	24.1	22.5	24.5	22.8	42.1	62.9	5.2
Northeast Asia-Southeast Asia	16.0	32.5	44.3	48.5	47.8	54.4	45.7	94.0	150.3	6.1
Oceania-Oceania	18.6	26.2	42.7	49.2	50.7	50.2	55.5	68.5	93.1	2.6
Oceania-Southeast Asia	12.2	24.3	33.1	46.2	47.6	46.6	42.0	74.2	109.1	4.9
South America-South America	29.5	33.8	39.7	53.5	50.8	52.7	47.9	125.2	223.0	8.0
Southeast Asia-Southeast Asia	17.7	29.9	53.8	53.7	57.0	60.6	59.4	115.5	189.3	6.0
Southeast Asia-Southwest Asia	5.7	5.8	8.1	10.9	11.6	12.6	12.5	24.6	42.1	6.2
Southwest Asia-Southwest Asia	10.5	11.6	15.2	16.0	16.6	17.4	17.7	45.2	87.8	8.3
Rest of the World	6.0	8.2	12.4	18.4	20.1	21.1	21.8	44.7	67.9	5.9
World total	**1573.2**	**2181.5**	**2567.2**	**3394.4**	**3293.8**	**3292.1**	**3268.9**	**5820.3**	**8925.6**	**5.2**

Source: Boeing.

C OFFSHORING SERVICES: RECENT DEVELOPMENTS AND PROSPECTS

1. OFFSHORING: MORE FEARS AND HOPES THAN FACTS?

Despite the recovery in the world economy in 2003 and 2004, unemployment remained high in many industrial countries. Even in those countries which reported a strong recovery, such as the United States and the United Kingdom, employment levels recovered only moderately, leading many observers to wonder about a "jobless recovery". Although employment growth typically lags behind in each cyclical output recovery, sluggishness in services sector employment seemed to be a new development. In previous downturns, the services sector continued to generate new jobs. The information communications technology (ICT) sector – one of the most dynamic sources of new employment in the 1990s – not only slowed down in terms of job growth, but actually experienced a decline in the payroll after the ICT crash in 2000-01. Many dot.com companies and telecom firms closed down or had to downsize as investment outlays in IT hardware and software decreased in OECD countries.[1]

In those bleak times in 2002 and early 2003, when the recovery was still rather fragile, a number of reports emerged highlighting the potential for substantial cost savings to firms which could source some of their in-house supplies – in particular information technology (IT) services – from low-cost locations. These reports, released mainly by business consulting firms and industry associations, had discovered a new "mega-trend": the offshoring of services. The authors of these reports argued that thanks to the increased digitization of information and increased availability of broad bandwidth communication at low prices, a large spectrum of IT jobs could from now on be provided at far lower costs from low-income countries to firms and consumers in high income countries. These opportunities ranged from low-skilled jobs, such as data entry typists and phone operators in call centers, to high skilled jobs, such as software developers. Forrester Research (2002) describes nine services occupation categories subject to potential offshoring, which combined represent 44 per cent of total US employment in 2002 according to Kirkegaard (2004a). Van Welsum and Vickery (2005) reported that in 2003, the occupations potentially affected by offshoring represented 19.2 per cent of total employment in the EU, 18.6 per cent in Canada and 18.1 per cent in the United States (2002).

In the 1990s, a large number of multinational firms had already partially shifted the work of certain back office supply jobs (such as payroll, invoicing and accounting) to countries where they could be provided at lower cost. However, with the arrival of broad bandwidth lines at low costs and the increased digitization of information in all sectors (in particular services), the attraction of a significant cost reduction in the production of goods and/or services was becoming irresistible for any firm in a competitive environment.[2]

Within a very short time, reports from management consulting firms were picked up by the media. Newspapers and TV stations reported a new threat to employment in developed countries through the relocation of services jobs to developing and East European countries. Most of the reports focused on jobs in the United States and the United Kingdom that were threatened with relocation to India. This new development was often likened to the offshoring of manufacturing jobs to Mexico and China in the recent past. The rise in the number of newspaper reports (on offshoring services) has been well documented by Amiti and Wei (2004) for the 1991-2004 period. A spectacular rise occurred in such reports during the course of 2003 and through the first quarter of 2004. There were 2,634 reports in US newspapers on services outsourcing activities in the first five months of 2004. Most of the reports caught media attention because of their projections of the (cumulative) number of jobs that would be lost in the United States due to the relocation of jobs to low cost locations over the next five or ten years.

For developing countries, offshoring seems to be unequivocally beneficial for employment, exports and economic growth. In particular, developing countries with a large English speaking population, a good telecoms infrastructure and a large pool of IT professionals, such as India and the Philippines, are expected

[1] EITO (2004) reports that global ICT markets (including hardware and software) slowed sharply in 2001-2003. IT markets in the US decreased in 2001 and 2002 and those of Europe and Japan in 2002 and 2003 (see Appendix Table 1).

[2] This does not imply that all digitizable services can be moved abroad. Some services activities using digitized information rely on intimate knowledge of the services provider and need face-to-face contact.

to reap large employment and income gains from these new possibilities. It is not only the number of jobs but also the quality of jobs which are particularly attractive to these countries. These new jobs are relatively well paid, they are in industries which are not dependent on natural resources and they can be considered environmentally friendly. Prospects for the Indian economy and trade have been portrayed by some observers to be largely dependent on the dynamic expansion of the services sector (see Mattoo et al., 2004). Projections abound which indicated the potential for significant export growth. In 1999, the Indian National IT Task Force set a software export target of $50 billion by 2008.[3] The NASSCOM-McKinsey (2002) report expected exports of software, call center and transaction processing services to reach $57 billion in 2008, a sixfold increase from the FY 2001-02 level. Employment in the Indian IT industry, direct and indirect, could reach 4 million people in 2008. The NASSCOM-KPMG (2004) study anticipated annual export growth in offshored IT services of 30 to 40 per cent in "the next few years."

What about the developed countries? Notwithstanding the public concern alluded to above, most studies conclude that the repercussions of service offshoring in high income countries are mixed, but positive overall. Productivity and profits are expected to rise, and the "loss" of offshored jobs should be compensated by increased employment and perhaps higher wages in the medium-term, provided labour markets are suitably flexible. While the potential for substantial cost reductions attracts the attention of management boards, the prospects of job losses and increased international competition in the services sector alarms both the trade unions and the broader public. Given widespread concern in respect of wage and employment prospects in services industries which were only moderately exposed to foreign competition in the past, governments and legislators are being asked to act to protect domestic jobs. In the United States, these concerns have provoked a flurry of proposed legislation in 34 states, all intended to restrict offshoring services activities (see UNCTAD, 2004b; Klinger and Sykes, 2004). In most cases the proposed bills intend to prohibit work on state contracts to be performed overseas or by individuals not authorised to work in the United States.[4]

The most curious aspect of this heated debate is that all the expectations and fears of offshoring and the backlash against it in the high income countries are based on very partial, selective information, mostly from private sources[5] or anecdotal evidence.[6] It has proved difficult up to now to glean hard evidence from official balance of payments data or employment records. Recently, a number of studies and new statistical information have pointed to the "modest" size of the services offshoring trend if viewed from a macro-economic perspective. The annual growth rates cited alone might look impressive, but as a percentage of total inflows and outflows in the relative labour markets, or as a percentage of total services trade, the numbers are far less impressive.

In the following Section an attempt is made to clarify the discussion by first defining what in this essay is meant by "offshoring" and "outsourcing." The Section will then go on to consider measurement problems related to this activity.

2. THE DEFINITION OF OFFSHORING AND OUTSOURCING

There is no commonly accepted definition of "offshoring" in the public debate nor in the economic literature. However, the term "offshoring" is widely used as a particular subcategory of "outsourcing". The latter has been defined as "the act of transferring some of a company's recurring interval activities and decision rights to outside providers, as set in a contract".[7] The typical consequence of such a decision is a decline of employment in the plant/firm which is doing the "outsourcing" and a rise in employment in the plant/firm from which

3 See Indian Council on International Economic Relations (ICRIER), "Report on Trade in Software Services", December 1999.

4 Most of the proposed state contract bans are legally suspect and courts are likely to find such measures inconsistent with federal foreign affairs power and the US Constitution's foreign commerce clause, according to Klinger and Sykes (2004).

5 Data on India's software exports are collected by NASSCOM, a private industry association, on behalf of the Reserve Bank of India.

6 For a summary of anecdotal evidence of offshoring services activities in India, see Morgan (2003).

7 Greaver II (1999).

the supplies are sourced thereafter. The vagueness of the term is often related to the fact that it is not made clear if the change in sourcing of supplies refers to the plant level, the firm level or to the national level. The term "recurring interval activities" might include a given level of in-house supplies in a stagnant business environment, but the meaning is less clear in an expanding environment in which additional supplies from the outside do not necessarily result in an absolute reduction of employment but tend to limit its expansion. It is also useful to distinguish between a replacement of the supplies which takes place between plants of the same firm or from a non-affiliated firm (control-ownership), and whether the new sourcing is from plants in the home country or abroad (location). In certain cases, the sourcing decision goes hand-in-hand with new investment abroad, which leads some observers to focus the outsourcing debate on outright plant closures, with output being replaced by new greenfield investment abroad. But this latter definition seems to be too narrow to capture the scope of outsourcing discussed here.

Chart 1 might be helpful in clarifying the terminology used later in this essay. Four types of "outsourcing" are reported, using location and control/ownership as distinguishing criteria:

1. **Captive onshore outsourcing** implies a shift in intra-firm supplies to an affiliated firm in the home economy.
2. If the shift in sourcing of supplies benefits a non-affiliated firm in the home economy, one can describe it as **non-captive onshore outsourcing**. The term "onshore" could be replaced in both cases by "local" or "domestic".
3. **Captive offshoring** describes a situation in which future supplies are sourced from an affiliated firm abroad.
4. The fourth variant of outsourcing may be labeled **non-captive offshoring** and refers to the case when the new supplier is a non-affiliated firm and located abroad.[8]

From an international perspective, the latter two categories of outsourcing, namely captive and non-captive offshoring, are of particular interest.

Chart 1
Types of outsourcing

		Located in home economy	Located abroad
Shifting intra-firm inputs/supplies to	Non-affiliated firm	local/domestic/ onshore outsourcing	offshore outsourcing = offshoring
	Affiliated firm	captive onshore outsourcing	captive offshore outsourcing = captive offshoring

Source: adapted from OECD (2005a).

A major problem with the definitions above is that they do not concord easily with officially collected economic data. Outsourcing decisions are made at the micro level of plants or firms, while the official data are generally collected at the sectoral and national level. In the case of "offshoring", current statistical concepts do not allow a link to be made between import statistics and a management decision to substitute a product/ service produced in-house by an imported product. Moreover, in contrast to merchandise trade, services trade flows recorded in balance of payments (BOP) statistics are generally not broken down by region and country,

[8] OECD (2005a) uses a somewhat different terminology. This report considers "offshoring" as a subcategory of "outsourcing". "Captive onshore outsourcing" is referred to as "internal domestic supply" by the OECD and "captive offshoring" is labeled as "internal offshoring".

which hampers analysis of the geographic aspects of services offshoring.[9] A further difficulty in services trade statistics is due to the importance of the large internal services transactions of multinational firms. Many of these internal across-border transactions might not be reported.

Another obstacle arises if one attempts to look at the sectoral breakdown of offshoring. The sectoral affiliation of a firm might not match the product or service which is offshored. An automobile company might offshore its accounting services and a bank might offshore its IT services. Employment and the net value-added produced in the home country in the automobile (banking) sector might fall as a consequence of offshoring without a corresponding increase in the imports of automobiles (financial services). These difficulties in the sectoral allocation of offshored activities also affect the estimate on the offshore potential of an economy. Obviously, services activities can also be offshored by non-services sectors.

3. THE ECONOMICS OF OUTSOURCING

(a) Outsourcing is not a new phenomenon

Developments in the car industry over the past century illustrate the processes and driving forces behind outsourcing. It took 700 parts to make a T-Ford in the early 20th century. With this relatively limited number of parts, it was possible to combine the benefits of large-scale mass production with the benefits of a high degree of specialization within a single plant. The gains from this kind of specialization have been acknowledged as early as 1736 in Adam Smith's description of the pin factory, and demonstrated at a large scale with perfected technology by the car industry. Workers were highly specialized and typically performed one single task along an automated assembly line, while the plant was vertically integrated and produced the car starting from raw materials.

Over time, competitors to Ford emerged, and consumers became richer and demanded more comfort, higher speed and better designs from their cars. A multitude of models were developed, each fitted with comfortable seats, air-conditioning, radios and other entertainment, along with numerous devices to improve safety, comfort, fuel efficiency, and to reduce noise and emissions of pollutants. As cars became more complex, it was no longer possible to combine mass production and specialization within one single plant. The number of tasks outgrew the number of operations that could be efficiently and effectively organized and coordinated within one plant. Furthermore, skills in mechanical engineering were no longer sufficient to produce and sell a car. Skills in electronics, design, marketing and many other fields were required. This multitude of tasks and skills required organizational/managerial innovations in order to accommodate increased complexity while maintaining cost effectiveness. Outsourcing has been central to the more or less continuous restructuring of the industry. The car manufacturers have identified the strategically important tasks and competencies and focused attention and in-house production on these. Non-core tasks and competencies are purchased from outside suppliers.

Which activities are considered strategic or core has changed over time. But the trend has been that an increasing number of parts and services are considered non-core and are produced by external suppliers. Over time, a network of several layers of suppliers located in a large number of countries has emerged. The contractual relationship between a car manufacturer and a supplier depends on the strategic importance of the component in question. Some suppliers may have entered a long-term contract entailing joint product development with the car manufacturer and have typically located close to the final assembly plant. Other suppliers may be located further afield and provide standard components on short-term contracts. The input-output tables for the US economy in 2002 show that 70 per cent of the cost of a car came from parts, components and services purchased from external suppliers. A quarter of total purchases of intermediate inputs were on services.[10] How much of this is imported cannot be

[9] Some traders, for example the EU, Japan and the US provide a regional/country breakdown of their balance of payments data but on a rather aggregated product/services level.

[10] Source: US Department of Commerce, Bureau of Economic Analysis (BEA) (2004), http://www.bea.doc.gov/bea/dn2/i-o_annual.htm. Accessed 25.11.2004.

derived from the tables.[11] What is clear, however, is that without the development towards increased specialization and outsourcing, today's cars would either be closer to the T-Ford technology or they would be beyond the budget of ordinary people, even in high-income countries.

Services industries are undergoing similar developments as the car industry in the past, and similar gains should be expected. There are, however, worries in developed countries, particularly in the United States, that offshoring will export jobs to low-cost countries leaving behind unemployment and downward pressure on wages. And in poor countries there are high hopes and expectations that offshoring will be the future engine of growth and job creation. As discussed below, offshoring has hitherto been on a modest scale, but projections from a number of sources suggest that the potential is immense. It is therefore useful to take a close look at the limits to offshoring at the firm, industry and international level.

At the firm level, there are technical, strategic and managerial limits to offshoring. Technical limits relate to the extent to which services are separable from the core activities of the firm in question. Strategic limits relate to the need of companies to control strategic assets, while managerial limits relate to managerial capability and the costs of dealing with foreign suppliers. Market forces apply to offshoring in much the same way in every sector. If demand for IT skills and English-speaking workers increase sharply in services-exporting countries, wages will start to rise and the price gap between local and imported services will narrow. As shown by Bhagwati et al. (2004) the supply of skilled workers in India is scarce, and is likely to remain so in the foreseeable future.[12] In other words, the situation is not one of an almost unlimited supply of adequately skilled workers. A rise in demand is therefore likely to drive up wages.

At the international level, the familiar forces of comparative advantage and intra-industry trade drive offshoring in the same way as these two forces drive trade in general. Comparative advantage and intra-industry trade are complementary. Trade between countries that are significantly different when it comes to relative factor endowments is driven by comparative advantage. Trade between similar countries is motivated by the desire for a broader variety of goods and services ("love of variety"). Offshoring enables countries to exploit comparative advantage and obtain variety through trade at the same time. Offshoring of IT services and business processing, for example, can be characterized as vertical trade within the same industry. The offshored services are usually less skill-intensive and less capital-intensive than those retained in the home country, and trade is mainly driven by comparative advantage. The final product, be it manufactured goods such as cars or computers, or services such as financial services, is often subject to horizontal intra-industry trade.

Even though the bulk of offshored services located in developing countries are in the low-skilled end of the outsourcing industry, all IT occupations require higher skills than the average Indian worker has, and offshored activities are relatively skill-intensive in the Indian context. Furthermore, there are pockets of relatively high-skilled services being offshored to state-of-the-art firms in, for example, India or South Africa.

Finally, one needs to keep in mind that a sharp increase in imports relative to exports would lead to deterioration of the current account of the balance of payments in the importing country and set in motion adjustments in the real exchange rate.

(b) Make-or-buy; onshore or offshore?

This Section takes a closer look at the limits to outsourcing at the firm level. Which services activities will a firm conduct in-house and which will be purchased from independent outside suppliers? What are the parameters

[11] Intermediate use of motor vehicles, bodies and trailers and parts from "own sector" was, according to the input-output tables, about $132 billion in 2002. Imports of car parts (HS 1996 categories 8706, 8707, 8708) the same year were about $31 billion, according to Comtrade. This is only a rough indicator of the extent of international production networks, since the US and Comtrade use different classifications. Imports of category parts and accessories for motor vehicles (HS 96 8708) came from 95 countries of which Canada, Japan and Mexico were the largest sources of inputs.

[12] According to Bhagwati et al. (2004) only 6 per cent of the Indian population between 18 and 24 years of age is enrolled in colleges and universities. And of these only a tiny fraction has the minimal English skills that would make them function well in occupations such as call answering. Furthermore, it is argued that with the exception of a few elite institutions, the higher education system in India is in "a dire state and starved of resources." Nevertheless, in a country with a population of 1.1 billion, of which a large proportion is below the age of 25, the absolute number of skilled people is still large.

that determine the make-or-buy decision? These are fundamental questions for analysing the potential for offshoring in the absence of good and comprehensive data. The major determinants of the make-or-buy decisions are the following:

- technical and institutional separability;
- to what extent the task is standardized;[13]
- transaction and managerial costs within the firm relative to outside suppliers;
- production costs; and
- the size of the market.

Separability is obviously a precondition for outsourcing. Recent innovations, particularly in IT, have made an increasing number of service tasks separable in time and space. Services that basically collect, manipulate or organize information can be codified, digitized and separated from other tasks within the firm, and then become candidates for outsourcing. A number of entirely new information-based services and occupations have also emerged with the diffusion of IT. Examples are software developers and IT consultants and help-desk services, but also search services, and new types of media and content have opened opportunities for new independent service suppliers.

Standardization and automation were important driving forces in the development of extensive networks of more or less independent suppliers in the car industry. Once information-based services have been codified, digitized and separated, they can also be standardized and in some cases automated. Some can even be reduced to a set of instructions or tasks that workers can follow routinely. Examples of information-based services that can be codified, standardized and outsourced are accounting, billing, payroll, booking and many more. These are typically non-core tasks, both in manufacturing and services companies, and are increasingly outsourced to specialized external suppliers. In addition, as computer software has become standardized, many IT services have also become non-core and can be outsourced.[14]

Managerial costs can be considerable within large companies and probably increase more than proportionally with the complexity of the task and the number of tasks being conducted, as already noted for the car industry. Furthermore, many of these costs are independent of the production volume (they are fixed) and constitute a higher share of total cost the smaller the scale of production. With outsourcing, such fixed managerial costs are limited to searching for a supplier and negotiating a contract, and these costs can be considerably lower than setting up in-house production. This is the most important reason why outsourcing is attractive. There are also variable managerial costs such as monitoring and coordinating production. These costs are usually lower with in-house production than with outsourcing, and make outsourcing less attractive. The make-or-buy decision is thus based on finding the balance between fixed and variable costs that results in the lowest total costs. The more standardized an activity, the lower the managerial cost of outsourcing. This is illustrated by Chart 2, which shows the relationship between unit cost (including fixed and variable managerial costs and production costs) and standardization.[15] A task is more standardized as we move to the right on the horizontal axis. At low levels of standardization, when the task in question is specific to the firm, it is likely to be produced in-house. The least standardized tasks are typically the strategic or core tasks and these are likely to remain in-house. The same goes for new tasks that are not (yet) standardized and high-skilled tasks that cannot easily be codified, while the standardized tasks are the first to be outsourced.

The relevance of market size for the make-or-buy decision was recognized at least as early as the 1950s. If firms must reach a minimum scale in order to break even, the number of firms that can operate profitably

[13] In the literature "asset specificity" is the term used to capture the extent to which an input is customized for the downstream consumer.

[14] See Carr (2004) for a discussion.

[15] Unit production costs differ with location but not with organizational form and not with the degree of standardization. Fixed managerial costs vary both with location and organizational form. The left-hand side starting point of the cost curves is fixed managerial costs plus unit cost of production. Variable managerial costs vary both with organizational form and location and decline more than proportionally with the degree of standardization.

is limited by the size of the market. Likewise, within a firm a minimum scale is needed in order to employ specialists in all tasks and keep them fully occupied. But as firms grow, a larger administration is needed in order to coordinate activities and govern relations between divisions and individuals. At one point the cost of additional administration exceeds the benefits of additional tasks or components being produced in-house. Outsourcing is thus a way of avoiding expanding unit costs, but the existence of a network of outside suppliers requires a sufficiently large market.

Market size is important for one more reason that has to do with the risks related to outsourcing. The outsourcing firm must be sure that the supplier delivers the agreed quantity and quality of inputs at the agreed time, whether it is a service or a component. If not, the production process can be brought to a halt and in an environment with just-in-time production systems this can be extremely costly. Furthermore, if quality is not as agreed, the value of the outsourcing firm's brand name can deteriorate. If the market is large and there are a large number of alternative firms to search among, the chance of finding a good match is better and the chance of finding an alternative should a supplier fail is also better.[16]

Turning to the other side of the outsourcing agreement, there are also uncertainties facing the outside supplier. Producing the agreed quality and quantity may require investment in new skills, new equipment and product development. Workers in call centres in India, for example, have to learn how to speak English the American way in order to enter into outsourcing contracts with American customers and they may have to install software that is compatible with the customers' and so on. If these investments are of little value outside the outsourcing contract, the sub-contractor may be left with costly but useless assets should the outsourcing firm breach or terminate the contract. Also, for this reason the types of tasks and components that are first outsourced are those that are standardized. This is the least risky for both parties. As discussed elsewhere in this essay, standardization facilitates international trade, and as observed here, it also facilitates outsourcing.

So far, we have focused on managerial costs and not touched upon the production costs of the activity in question. If the outside supplier is located in the same country as the outsourcing firm, one should expect that production costs are the same, since the factors of production are purchased in the same market. If the activity in question can be offshored to a low-cost location, there are additional gains in terms of lower production costs, but there are also additional managerial costs. The latter depend on whether offshoring is through foreign direct investment (captive offshoring) or through entering a contract with an independent foreign supplier. In the case of captive offshoring, the costs of acquiring local knowledge about laws and regulations, the availability of non-tradable local inputs and so on have to be incurred in addition to the cost of setting up or acquiring the foreign firm. The additional managerial costs of non-captive offshoring consist only of searching for a partner and negotiating a contract. Captive offshoring thus involves a stronger commitment of the firms' resources than offshoring to independent suppliers.

There are also additional variable managerial costs related to offshoring. These are due to differences between the two countries involved in terms of language, laws, government regulations, currency, and usually also due to distance, since even digitized service provision requires some face-to-face communication between the contracting parties. The emphasis of many service-exporting countries on liberalization of service delivery through the movement of natural persons (mode 4 in the GATS) clearly indicates that face-to-face communication is still important. The additional costs related to differences between countries should be about the same for both types of offshoring, while it still holds that monitoring and coordination costs are lower within the firm (captive offshoring) than with outside suppliers (non-captive offshoring).

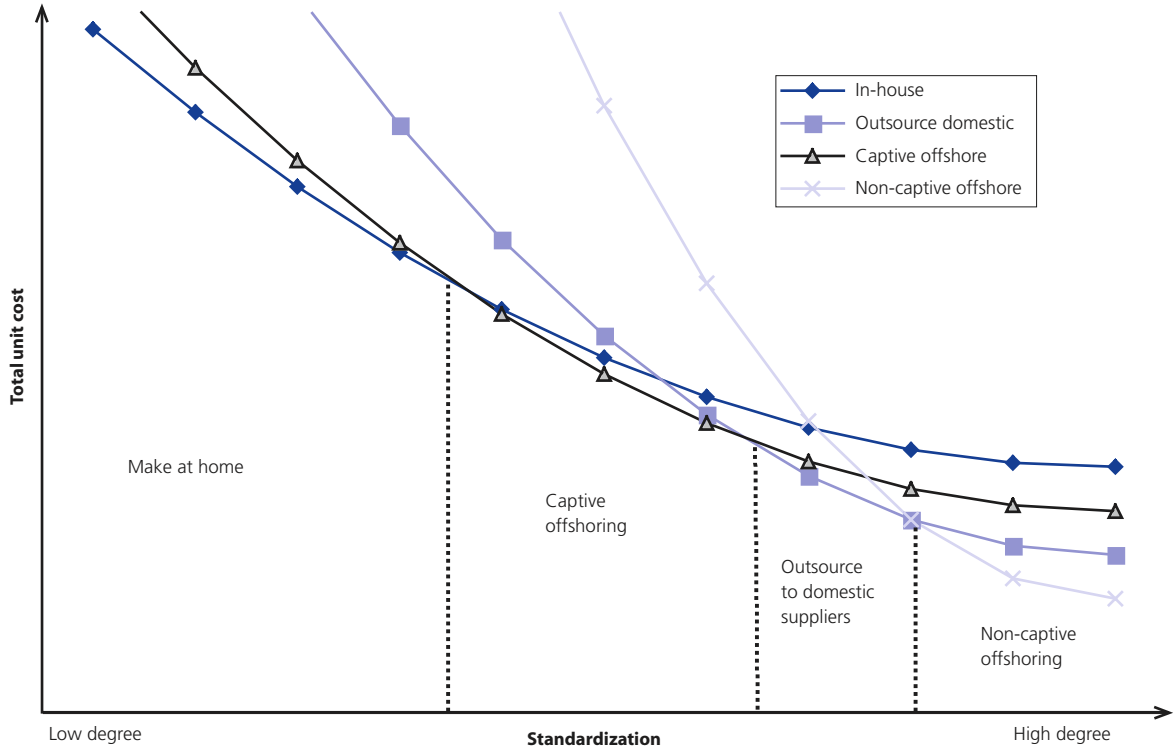
Fixed managerial costs differ between the four types of outsourcing as follows:
Captive offshoring > local in-house production > non-captive offshoring > local outsourcing.

Unit production costs are lowest with offshoring, and in Chart 2 this compensates for higher fixed managerial costs and makes captive offshoring cheaper than domestic in-house production at high levels

[16] See Grossman and Helpman (2002) for a discussion of the relation between market size and search costs.

of standardization.[17] Finally it is recalled that monitoring and coordination costs are lower with in-house production (at home or abroad) and lower with domestic outsourcing than non-captive offshoring. Unit costs as a function of the degree of standardization for all four types of outsourcing are depicted in Chart 2.

Chart 2
Costs, standardization and types of outsourcing



The Chart shows that an activity needs to reach a certain level of standardization before it is profitable to outsource it. When that threshold is reached it is still the best option to keep production within the firm, but locate production to a low-cost country. With further standardization it becomes profitable to outsource the activity to an independent supplier, but to a local one. Only at relatively high levels of standardization will it pay off to offshore to an independent producer, given the cost function depicted in this chart. Moving from left to right on the standardization axis can be interpreted as moving from the strategic core of the firm towards non-core, standard activities. It is important to bear in mind that while developing software is the core business of a software firm, it is not a core business of, say a bank, and the latter will outsource maintenance and adaptation of software to outside suppliers while a software firm will not. A high degree of standardization is closely related to mature technology. Chart 2 can thus be interpreted to mean that high-technology firms undertaking mainly high-technology activities are likely to retain most activities in-house, although they do engage in captive offshoring to some extent. Low-technology firms undertaking mainly low-technology activities, in contrast, are likely to outsource.

The shape and position of the curves in Chart 2 depend on the characteristics of the firm in question. It is well known that even firms in the same country and the same industry differ widely in terms of productivity and costs. A high-productivity firm is able to produce more from a given amount of inputs than a low-productivity firm. A highly productive firm can afford to pay higher fixed costs than a less productive firm, and is therefore more likely to both outsource and offshore. Its reward for doing so is to further improve its cost competitiveness. The firms with the lowest productivity, in contrast, are unable to offshore and may not even be able to compete with those who do, and could be driven out of business (Antras and Helpman, 2004). This is a creative destruction process where the least productive firms will be driven out of business while larger and more productive firms prevail and expand, improving average productivity in the offshoring industry as a whole.

[17] Chart 2 shows a stylized example using parameters that reproduce the results from Antras and Helpman (2004).

The position of the curves in Chart 2 also depend on relative wages in the two countries involved, communication and travel costs between the two locations, and differences in the general business climate in the two locations. The larger the wage gap between home and foreign locations, the more firms will choose the offshoring option. By the same token, the lower the trade costs between the two locations, the larger the number of firms that will choose one of the offshoring types. Transport costs decrease with the weight-to-value ratio of the product, which is one of the reasons why the electronics sector has lent itself easily to offshoring. For digitized services, the weight-to-value ratio is zero, and trade costs consist of costs of telecommunications, payment systems and travel, including the time and money required to obtain a visa.[18] When these costs go down, offshoring is likely to increase.

The risks of outsourcing are lower the better the institutional and infrastructural quality in the location of the contracting partner. A high-quality legal framework reduces the costs of enforcing a contract. The less standardized the service being outsourced, the more important is the legal framework. Similarity in legal frameworks at home and abroad reduces the costs of establishing and enforcing contracts with independent foreign suppliers. The weaker the legal framework and the larger the differences between the partner countries, the higher the risk of offshoring and the fewer the firms that will engage in offshoring. The United States and the United Kingdom are the leading outsourcing countries. India's and Ireland's success in attracting offshoring business has been partly attributed to their English-speaking workforce. Outsourcing from the other leading industrial countries is much less extensive. Furthermore, their sourcing of services tends to be from countries which are closer to home geographically and/or culturally. A large share of German outsourcing contracts goes to Central Europe, while a large share of Spain's outsourcing contracts go to Latin America.[19]

Low wages and poor quality of institutions and infrastructure typically go together. Therefore, offshoring businesses are more likely to go to middle-income countries than to least-developed countries. Among the low-income and least-developed countries, large countries are more likely to attract outsourcing businesses. Finally, it should be noted that institutional and infrastructural quality at the national level are not always the most relevant variable to look at. In some cases, notably in India, software parks and other special zones have excellent infrastructure and effective one-stop-shops for sorting out the legal formalities of establishing and running a business, even if the average quality in the country as a whole leaves much to be desired.

To summarize this Section, the driving forces for outsourcing and offshoring services are first and foremost technology development, notably ICT, and economic growth. Growth leads to and feeds on a higher degree of specialization. Developments in IT have made it possible to standardize, digitize and outsource a number of services, of which some are offshored. The location of offshored services depends on:

- labour costs;
- trade costs;
- the quality of institutions – particularly the legal framework;
- the tax and investment regime;
- the quality of infrastructure – particularly telecommunications;
- skills – particularly language and computer skills.

Improvement in the regulatory environment, such as trade liberalization for imported inputs, lifting of foreign investment restrictions, favourable taxation and low-interest export credits have complemented the dynamic export performance of the two largest IT traders, namely Ireland and India (see Box 1). To conclude, offshoring is likely to be concentrated on non-core standardized services. Large and highly productive firms are the most likely to engage in offshoring. Host countries of offshoring activities are likely to be relatively low-cost, with good telecommunications infrastructure, and a reasonably good record on the rule of law. Being close to the offshoring partner in terms of physical distance and/or language and culture also helps.

[18] These costs have fallen sharply between the mid-nineties and 2003. See Appendix Table 3.

[19] See Farrell (2004) and *Financial Times IT Review* 01.12.2004.

Box 1: Public policies and the development of India's software exports

In 1986, the Indian government promulgated a policy giving "software exports, software development and training" a prominent position in its economic policy objectives. In order to address various obstacles to the expansion of software exports, the government introduced the "Software Technology Park" scheme and established an Autonomous Society, the "Software Technology Park of India" (STPI) in 1991. This Society is in charge of managing data communication infrastructure facilities and other services such as technology assessments and professional training of software exporters. By July 2004, 40 software technology parks have been set up under the aegis of STPI. Twenty more STPI centres are planned in the next eight years. In March 2004, all STPI centers combined have attracted 4,644 units, of which 3,544 are already exporting software. Although STPI centers can be found in 16 Indian States, those of Karnataka, Tamilnadu, Maharastra and Andra Pradesh accounted for three-quarters of India's software exports in 2002-03.

What are the main benefits for firms established in STPI centers?

- STPI provides state-of-the-art High Speed Data Communication (HSDC) facilities and 35 international gateways;
- duty-free imports;
- exemption from payment of local duties;
- exemption from corporate income tax up to March 2010;
- single window for government clearance;
- foreign ownership up to 100 per cent allowed for firms established in STPI centers.

These various forms of public support (trade facilitation, infrastructure, a favourable tariff and tax regime, and liberal FDI regulations) have created clusters of software exporters. The increasing importance of STPI centres in India's software exports is best illustrated by the rise in the share of STPI units in India's total software exports. In 1992-93, STPI units accounted for 8 per cent of India's software exports and ten years later, when India's exports had greatly expanded, this share has risen to 81 per cent.

Source: Based on STPI website information, in particular from its Annual Report 2003-04 (http://www.stpi.softnet/areport3.html).

4. THE SCOPE OF OFFSHORING SERVICES TODAY

Gauging the size of the offshored services activities is not a small task. The various official statistical sources available are in general not adequate to record a phenomenon which in the field of services is rather new. Statistical classifications of industries or activities need quite some time to adjust to structural changes in an economy. It is therefore not surprising that most of the information on services offshoring is based on private surveys and anecdotal evidence. While these surveys are useful in catching early emerging developments, their findings are not always easy to integrate into a broader picture by relating them to the entire domestic or even the global economy. It could be that the surveys report on a new branch of business, which records spectacular annual growth rates over a couple of years, while the size of the activities of that branch remain small at a more aggregate level. This Section focuses on the offshoring of IT services, the activity which has attracted the most attention over the last few years. The discussion below is also concentrated regionally, as it highlights in particular the offshoring of IT services between India and the United States, the two countries which are at the centre of the IT offshoring phenomenon.

Two approaches to measuring services offshoring are attempted below. First, estimates (including of private consulting firms) are presented. These are estimates of the size of IT markets and the development of outsourcing and offshoring in the IT sector for recent years. This information is subsequently compared, where possible, with official BOP data on cross-border transactions in computer and information services (and other professional services), which include offshored IT (and business process) services .

(a) Surveys on the size of services offshoring in recent years

- The OECD (2005a) reports the size of the global market for outsourced IT and business process (BP) services to be close to $260 billion in 2001. The value of offshored IT and business service activities are put at $32 billion, representing 12.3 per cent of the global IT market. Domestic outsourcing is given at $227 billion. Two-thirds of all offshoring is estimated to be captive offshoring, in other words referring to intra-firm trade. This estimate of the total IT and business process services market does not include IT services provided from affiliated firms in the home market (or "internal domestic supply" in the OECD terminology);

- McKinsey (2003) reports that US companies offshored IT and business process (BP) services worth $26 billion to 12 major markets in 2001. The share of US companies in global offshoring activities is estimated at 70 per cent and this implies a global value for all offshored IT and BP services in the order of at least $35 billion in 2001. The 12 markets exclude major EU markets and therefore the above estimate somewhat underestimates the global offshoring of US companies worldwide;

- The European Information Technology Observatory (EITO) (2004) reports a global market for IT services and software of €591 billion in 2003 (measured in 2002 exchange rates). Converted into current 2003 dollars this estimate is equivalent to an amount of about $710 billion in 2003. This estimate excludes BP services. Adjusted for exchange rate and market growth between 2001 and 2002, the EITO estimate exceeds that of OECD (2005a) by a large margin, despite its narrower sectoral coverage. EITO (2004) also indicates that the growth of IT markets had been significantly faster than GDP growth in the 1995-2000 period, but became less dynamic than GDP growth in the 2000-2004 period;

- Gartner (2004b) reports that global software and IT expenditure amounted to $663 billion in 2003. BP services are again excluded. Software expenditure alone reached $93.8 billion and that of IT services $568.9 billion. Gartner (2004a) claims that "outsourcing will account for 53 per cent of the total worldwide IT services market in 2004". This would be equivalent to $322 billion in 2004 and about $285 billion in 2003. No data are given for the share of offshored IT services in the total of outsourced activities and software expenditure is not taken into account.

The two most recent studies above suggest IT and software expenditure worldwide in the order of $650 to $710 billion in 2003. Total outsourced IT services (excluding software) are about $285 billion (based on Gartner (2004b). Offshored IT and BP services are estimated to have been in the order of $40 to $45 billion in 2003.[20] For the same year, world exports of business services are estimated at close to $500 billion. These values can be compared to world GDP and world commercial services exports, valued respectively at $36,000 billion and $1,800 billion in 2003.

(b) IT services trade as measured by Balance of Payments (BOP) statistics

The second approach to measuring the size and evolution of services offshoring is based on (national) balance of payments (BOP) data. Although not all services imports result from offshoring activities services, all offshored services should be included. Thus, cross-border services trade provides an upper limit for any estimated value of offshored services. BOP data record transactions between economic entities resident in two different economies. Among the limitations of BOP data in measuring services offshoring, three stand out. First, detailed sectoral reporting of services trade is not always available at the national level. Second, the

[20] The McKinsey (2003) estimate of $35 billion for offshored IT services in 2001 is grossed up by 25 per cent, the same rate as the increase in global trade of computer and information and other business services between 2001 and 2003.

detailed sectoral definition available might be inadequate to capture IT and BP services and third, the volume of recorded cross-border services trade among affiliated firms might be sharply affected without any change in captive offshoring.[21]

Missing BOP data can be a serious challenge in estimating accurately world exports (imports) of IT services. BOP data on services trade provided in the IMF Balance of Payments statistics cover 130 economies which represent more than 95 per cent of world services trade in the years 2000-2003. However, from these 130 economies, only 80 report trade in computer and information services. A distortion might also be introduced by the fact that international trade in IT services is likely to be better registered on the export side rather than on the import side. This is largely due to the fact that a statistical agency can obtain information more easily from a few large exporters than from a large number of importers of varying size.

Another major obstacle to capturing offshored services in imports is the fact that the standard classification of IT services in BOP statistics is either too small or too large to measure IT and business process services (BPS). Official BOP statistics combine computer and information services at the most detailed level. This category does not, in principal, catch business process services but includes information services (mainly services of news agencies). World exports of "computer and information services" were estimated at $75 billion in 2003. These and other data discussed above are reported in Table 1. Business process services such as accounting, auditing, bookkeeping, research and development, call centers, transcription services etc. are included in the category "other professional services". The share of business process services in this category is most likely less than one-half, but might account for the largest part of this category in a small number of countries. World exports (and imports) of the BOP category "other professional services" are estimated to amount to at least $420 billion in 2003.

Classification problems arise not only because of methodology but also quite often because there is a problem of availability. Many countries do not provide BOP data according to the detailed standard category breakdown. Numerous countries do not report any imports of computer and information services or other professional services at the detailed level, but subsume these two categories into others at a more aggregated level. In some cases, the reported data of computer and information services might also include services which should be grouped elsewhere. Indian BOP data report "software" exports which could be mistaken for "computer and information services," but this category also includes IT-enabled services which should be more adequately classified under "other professional services." These differences in classification approaches by various national providers of BOP statistics tend to distort the research findings. One consequence of this could be that the share of India in world exports of IT services is considerably overstated if India includes categories which other countries exclude, and even more so if some major services traders do not supply any detailed information on their trade in computer and information services.

Table 1
Global IT markets, trade and offshored IT services
(Billion dollars)

A. Surveys

Source	Reference year	IT Market size	Outsourced IT services	Offshored IT services (incl. BPS)
OECD (2005a)	2001	...	260	32
McKinsey (2003) (WTO)	2001	...	...	35
McKinsey (2003) (WTO)	2003	...	...	45
EITO (2004)(WTO)	2003	710	...	...
Gartner (2004b)	2003	663	322	...

B. Balance of Payments Statistics

Source			Business services	Computer and information services
WTO and IMF BOP	2003	world exports	494	75
	2003	world imports	458	47

[21] OECD (2005a) discusses the measurement problems of IT services trade in BOP statistics on pages 92 through 95. See also van Welsum (2003).

Few national BOP statistics allow us to divide cross-border transactions between affiliated and non-affiliated firms. In US BOP statistics, this distinction is made and affiliated services imports could be considered as a proxy for captive offshoring of companies resident in the United States. Many surveys confirm that at present, most offshoring takes the form of captive offshoring. This view is supported by data on US IT services imports. In 2003, affiliated trade accounted for 63 per cent of US computer and information services imports, and for 77 per cent of US imports of other business, professional and technical services, a proxy for business process services. However, this conflicts with the information given above on Indian software exports. According to NASSCOM India's software exports of 2003-04 are provided largely by Indian-owned companies. Is India's case different from others?

Unfortunately, there are a number of limitations to the use of affiliated trade as a proxy for the size or the expansion of captive offshoring. Although international trade among affiliated firms includes (captive) offshoring activities, not all trade among affiliated firms is due to offshoring. Some of the imported supplies from affiliated firm(s) abroad might have never been produced in-house in the home country, and therefore cannot be attributed to offshoring activities.

With respect to the evolution of affiliated trade, one has to take into account that a large part of the rise in affiliated trade in recent years is associated with a high level of mergers and acquisitions. The merger of two firms leads to an increase in affiliated trade even without any change in production and employment patterns, as the unaffiliated trade between the two firms will be considered as affiliated trade after the merger. The same reasoning applies in the case of an acquisition. The US Department of Commerce (BEA) notes that "... in 1998-2001 newly acquired affiliates accounted for most of the growth in sales of services through US affiliates".[22] Therefore, the BOP (and MNC sales through affiliates) data tend to overstate the growth of captive offshoring activities. Affiliated trade can therefore be a poor proxy for the level and/or the rate of expansion in captive offshoring in a given industry.

But trade with affiliates can also pose several sectoral classification problems. As previously noted, a prominent feature of offshoring services is that companies with their main business activity outside the IT sector want to replace their in-house IT service supplies with purchases from specialized IT firms abroad. A US insurance company, for example, offshores some of its IT services to an affiliated firm in India. US balance of payments data would record this flow as imports (debits) in IT services from a foreign affiliate only if the affiliate's primary industry classification is in IT services. If the foreign affiliate is also classified (as the parent company) as an insurance company, the transaction would be classified as an insurance service flow and not as a supply of IT service.

(c) Major traders in global IT services trade, 2000-2003

Using BOP data to arrive at an estimate for global trade in IT services, defined as computer and information services (CIS), is therefore not a straightforward exercise. The IMF BOP statistics provide balance of payments data for most countries but as seen above, the detailed breakdown for IT services is not always available. Therefore, the missing data had to be added from national sources (e.g. India and the United States) or crudely estimated (e.g. Denmark and Switzerland and many developing countries).

World exports of computer and information services are estimated to be in the order of $75 billion in 2003. Exports of other professional services (OPS) amounted to $420 billion. In 2003, the share of these two services categories in world commercial services exports are about 4 and 24 per cent respectively. The cumulative export growth of the two categories combined over the 2000-2003 period was 31 per cent, and thus faster than that of total commercial services (21 per cent) and merchandise exports (16 per cent).

The two major exporters of computer and information services in 2003 are, according to BOP data, Ireland and India, which are also generally considered to be the main destinations for offshoring IT services (see Table 2). Both countries reported net exports of computer and information services in excess of $10 billion and

[22] Borga and Mann (2004).

their export growth is faster than global exports over the 2000-2003 period. The United States, the United Kingdom and Germany followed the two leaders at a distance. The United Kingdom and Germany exported less than half of Ireland's exports. Israel ranked as the sixth largest exporter, again in line with other surveys which report this country as a major destination for services offshoring. Despite their reputation as the major global offshorers of IT services, the United States and the United Kingdom are both major net exporters of computer and information services. However, their import growth of CIS has exceeded their export growth since 2000.

Table 2
The major traders in computer and business services, 2000 and 2003
(Million dollars)

A Computer and information services (CIS)

		Exports		Imports		Balance	
		2000	2003	2000	2003	2000	2003
1	Ireland	7490	14372	277	386	7212	13987
2	India	7059	11282	553	465	6506	10817
3	United States	6722	7619	4435	5198	2287	2421
4	United Kingdom	4321	6987	1270	2915	3051	4073
5	Germany	3798	6565	4970	7245	-1172	-680
6	Israel	4119	3657	n.a.	n.a.	n.a.	n.a.
7	Spain	2043	2916	1227	1662	816	1253
8	Canada	2428	2282	899	1027	1530	1256
9	Netherlands	1166	2054	1187	1543	-21	511
10	Sweden	1191	1993	1067	1179	124	814
11	France	803	1255	742	1235	61	20
Memo items:							
	World	51736	75106	38590	46703	13146	28403
	EU (15)	23683	40700	14316	20651	9367	20049

B Business services (computer and information services and other business services (OBS))

		Exports		Imports		Balance	
		2000	2003	2000	2003	2000	2003
(6)	Ireland	9398	21115	14091	22641	-4693	-1526
(8)	India	10409	15734	6771	11475	3638	4259
(1)	United States	47404	52469	27922	33477	19482	18992
(2)	United Kingdom	37780	51785	17915	23033	19865	28752
(3)	Germany	28001	38322	37128	47141	-9127	-8819
(11)	Israel	6903	6780	n.a.	n.a.	n.a.	n.a.
(7)	Spain	10113	16427	11429	16935	-1316	-508
(9)	Canada	12830	13549	10525	11436	2305	2113
(5)	Netherlands	16693	24099	17873	26132	-1180	-2033
(10)	Sweden	7673	13141	8669	11827	-996	1315
(4)	France	20126	25340	16232	25721	3894	-380
Memo items:							
	World	376119	494167	365170	457828	10949	36339
	EU (15)	178616	267993	180341	251981	-1724	16012

Note: Figures in brackets indicate export rank in 2003.
Source: IMF, Balance of Payments Statistics, CD ROM December 2004, national statistics and WTO estimates.

In 2003, according to current BOP data, the largest importer of computer and information services was Germany. German imports of CIS exceeded even those of the United States, which ranked second in 2003. Other major importers of CIS are the United Kingdom, Japan and Spain. The three largest net importers of computer services are Japan, Brazil and Germany.

An outstanding feature of the BOP data provided in Table 2 is the fact that Ireland and India are very modest importers of CIS and that their imports do not show a steady increase similar to the global trend.

A disturbing aspect of the official BOP data is the large discrepancy between exports and imports at the global level. World CIS exports exceed imports by a wide margin (nearly $30 billion) throughout the 2000-2003 period. Even within the EU(15), a wide discrepancy can be observed between intra-trade measured on the export side and intra-trade recorded on the import side (about $6 billion in 2002).

Combining CIS and other business services (OBS) into business services has the advantage that the misclassifications between the two categories are no longer a problem, but the coverage of the sector becomes very large. Nevertheless, it is worth noting that at this more aggregated level the ranking and net-exporting positions of the various economies change dramatically from those observed for CIS only (see Table 2, Part B). Now the top exporters in 2003 (for CIS and OBS) are the United States and the United Kingdom, well ahead of Germany, France and the Netherlands. The United States and the United Kingdom are also large net exporters while Germany and Japan are large net importers of CIS and OBS. Ireland remains a large exporter, but its imports exceeded exports in 2003, while India retains a net exporter position. India's ranking in aggregated CIS and OBS export category, however, decreases from number 2 to number 11.

The estimated size of global offshore activities depends crucially on the accuracy of the data provided by the major offshorers and the countries providing the offshored services. As mentioned above, national BOP data report Ireland to be the largest exporter of IT services worldwide followed by India. There exists a considerable discrepancy in reported global exports and imports of IT services, which could be due to over-reporting on the export side or to under-reporting on the import side, or to a combination of the two.

Looking more closely at the major exporters, the recorded exports of Ireland are astonishingly large if one takes into account the limited level of employment in this sector in Ireland. Ireland is reporting exports of IT services two times larger than the United States, while it employed "only" 24,000 IT specialists in 2003. A special feature of Irish IT services exports is the inclusion of software licences. Previously, these licences were included with merchandise exports of computer hardware, for which Ireland is a major distribution centre in Western Europe. Most of the Irish CIS exports go to the EU (15), but no further country detail by EU Member is given. Therefore, it is currently impossible to link with certainty the $6 billion intra EU trade surplus to an over-reporting of Ireland's CIS exports. According to the IMF BOP Manual, software licence fees should be classified under the category "royalties and licence fees," in which Ireland reports a large deficit (of $10 billion) in 2003.

Another major source of the difference between world exports and imports of CIS could be due to over-reporting of India's CIS exports. First, there is the question of allocating BPS with CIS. Indian sources indicate that some non-CIS services, such as IT-enabled services, are included in its "software" exports. For example, the Reserve Bank of India's (RBI) Annual Report 2004 shows that Indian "software" exports worth $12.2 billion in Fiscal Year (FY) 2003-04 include IT-enabled business services, such as call centers, valued at $3.6 billion.

Second, a large, although decreasing share of India's "software exports" are reported to be delivered "onsite".[23] It could well be that these onsite service deliveries might be classified as local sales of foreign affiliates in partner countries (GATS mode 3) and thus are not included in BOP data. Third, the "onsite" delivery of CIS by Indians employed abroad should be considered as Indian exports only as long as these employees have not become local residents. There is a rule that employees staying abroad for more than one year should be considered residents of the host country. Thereafter, the earnings of these employees are no longer counted in the BOP statistics but might appear (in subsequent periods) in the form of worker remittances. In Box 2, an attempt is made to reconcile the reported discrepancies in the bilateral services trade statistics between India and the United States.

[23] NASSCOM (2005) reports that nearly 41 per cent of India's IT offshore revenues stem from onsite delivery in FY 2003-04.

Box 2: Closing the gap between Indian and US statistics on bilateral CIS trade

One part of the excess of exports over imports of CIS at the world level can be attributed to the discrepancy between Indian exports of IT services to the United States reported by the Reserve Bank of India and US Department of Commerce data on US imports of IT services from India. At the detailed sectoral level of CIS trade, some estimates are needed to reconcile the detailed bilateral data from Indian and US sources. Our adjusted data for 2003 indicate that India records IT exports (including IT-enabled services) to the US of about $6.8 billion, while the US data suggest CIS imports from India close to $0.9 billion.

How does one get these numbers? India's "software" exports to the world amounted to $11.282 billion in calendar year 2003. NASSCOM, which collects this information and provides it to the Indian Central Bank, indicates that 69 per cent of these exports went to North America in fiscal year 2002-03. On the assumption that 60 per cent of India's "software" exports had been destined for the US market, this would be equivalent to $6.77 billion in calendar year 2003.

Turning to the adjustment on the side of US imports, US unaffiliated imports of IT services from India amounted to $330 million in 2003. Including the (estimated) imports from affiliated firms the number reaches $900 million, provided that the share of unaffiliated trade in US bilateral trade with India is the same as in US global IT imports (namely 36.5 per cent). US services imports (including affiliated trade) from India, without transport, travel and royalties and license fees, amounted to $1,139 million in 2003. This represents an upper limit for total US CIS imports from India. This suggests that the $900 million figure remains consistent with the broader US data.

But the $0.9 billion remains far off the Indian CIS export data in 2003. Even if one takes into account that India's "software" exports include many business services other than IT services, a reconciliation with official US BOP numbers is not possible even at a more aggregate level. A reconciliation between Indian and US data in respect to India's software exports is only possible if one takes into account the earnings of Indian IT specialists which are beneficiaries of US H-1B visas and are considered by the US Department of Commerce as local residents. Unfortunately, it was not possible to obtain information on the number of Indian IT specialists and beneficiaries of H-1B visas who had already worked in the United States for more than one year. Given the annual approval of beneficiaries (provided in Appendix Table 9), it is possible that their number could have been close to 80,000 in 2003. If one multiplies this employee number with the average annual earnings (about $60,000) one obtains total earnings of $4.8 billion, a sum which could largely close the gap found in the statistics above.

While the general perception among the US public appears to be that the United States is importing more services from India than it is exporting, US balance of payments statistics report a surplus in favour of the United States. The most detailed sectoral breakdown of US data by country (which covers both affiliated and non-affiliated trade) refers to the category "Other private services," which is defined as total private services less travel, transport and royalties and license fees. At this level, US services exports to India stood at $2.1 billion, while imports amounted to $1.1 billion in 2003. Throughout the 2000-03 period, the United States consistently reported a bilateral trade surplus. It may be concluded that the US BOP data provide a more positive picture for US services trade than might be gleaned from the discussion of US job losses attributed to offshoring services to India.[24]

(d) Survey data versus BOP data

In 2003, BOP data on global "computer and information services" exports amounted to $75 billion, exceeding survey-based estimates of globally offshored IT and business process services of about $45 billion by a

[24] See also van Welsum (2004).

considerable margin. However, it cannot be deduced from these numbers that offshored IT services account for more than one-half of global IT services exports, as not all imports reflect offshored services and CIS does not – at least theoretically – include IT-enabled services. McKinsey (2003) does not provide a breakdown of IT services and business process services and therefore no "guesstimate" can be made of the share of offshored IT services in total world exports of CIS. On the other hand, the offshored IT and business process services ($45 billion) can be compared to world exports of CIS combined with other professional services ($494 billion), or with total world services exports. The $45 billion of offshored IT services (broadly defined) accounted for less than 10 per cent of world exports of business services and for 2.5 per cent of world exports of commercial services in 2003.

BOP data have several advantages over the survey data provided by business consultants. First, they reveal the relative size of IT services in total services trade and also allow the calculation of net exports. Second, in some cases, BOP data supplied by partners provides a check on reported bilateral trade flow data via mirror partner statistics.

There is strong anecdotal evidence of IT jobs and call center jobs being offshored to India, Ireland (and elsewhere), but until very recently the estimated value of these offshored services has been rather modest if related to total international services trade. Both the United Kingdom and the United States are still the world's largest net exporters of business services. While for the United States imports of CIS and OBS combined have grown faster than exports between 2000 and 2003, the opposite can be observed for the United Kingdom (see Table 2). India, which according to the BOP data ranks as number two among CIS exporters, is still a net exporter of business services (CIS and OBS), but the growth of exports in this larger services group lagged behind the expansion of imports in the 2000-03 period. The Indian BOP data would tend to support the view that India is "losing" jobs in OBS trade and is "gaining" in CIS trade, on the crude assumption that the sectoral trade balance can be taken as an indicator of a "job balance." India's business services trade surplus rose by only $0.6 billion between 2000 and 2003 which does not point to a massive net transfer of jobs. Ireland, the top exporter of IT services, actually records a trade deficit if CIS are combined with OBS in 2003 (see part B of Table 2).

(e) Trade and employment in IT services

The emergence of offshoring services activities has raised expectations and concerns in respect of employment. Various reports have highlighted the current and potential repercussions on employment linked to an increase in offshoring services activities. The projections of two consulting firms on the repercussions of offshoring have attracted a good deal of attention. John C. McCarthy, vice president of Forrester (2002), projected the total number of accumulated job losses in the US economy due to offshoring to be in the order of 3.5 million by 2015 and Gartner projected "that up to 25 per cent of the traditional IT jobs in many developed countries will be situated in emerging markets by 2010".[25] Press articles provided anecdotal evidence of job losses in IT occupations in developed countries due to offshoring, while new IT jobs were reported to have been created in developing countries, particularly in India. Most observers agree that the offshoring of IT jobs is not a recent development, but has only gained momentum in the last few years.

In the following Section the focus will be, first, on employment and wage developments of the IT sector in the United States, which is generally considered to be in the forefront of the "new" trend in offshoring services activities. Thereafter, recent employment trends in Ireland and India are discussed.[26] In reviewing the recent employment and wage data in order to grasp the impact of offshoring, one has to take into account that the level of national employment (and wages) is subject to both cyclical variations and structural changes (such as offshoring). Therefore, one has to ask if the decline in employment in the IT industry or in IT occupations observed in many high income countries in 2002 was due to a fall in demand for IT services in general, to increased offshoring, or perhaps to other factors.

[25] Gartner (2004b).

[26] Information on migration of ITS specialists can be found at OECD (2005a) *OECD Information Technology Outlook 2004*, Chapter 6, ICT skills and employment, Paris: OECD. Available online http://www.oecd.org/document/22/0,2340,en_2649_33757_34238742_1_1_1_1,00.html. Accessed 02/03/05.

In the United States, the majority of computer occupations are found outside the computer services industry and it is therefore necessary to look at what happened to the employment level by occupation. Between 1997 and 2000, the annual average number of computer and mathematical occupations rose sharply in absolute and relative terms. The average annual growth in the employment of computer system analysts was 13.3 per cent, almost ten times larger than for all occupations. In 2001, the number of employed computer analysts increased on average slightly while that of all occupations stagnated. In 2002, the number of computer occupations contracted sharply. Thereafter, employment in computer and mathematical occupations recovered between December 2002 and December 2003 at a rate slightly less than the overall recovery in occupational employment. However, in the course of 2004, employment growth in computer occupations was up by 5.5 per cent and again exceeded markedly growth in all occupations (1.2 per cent) (see Appendix Table 5).

Wages of computer systems analysts have recorded stronger increases than those for all occupations on average between September 1997 and July 2003. However, if one breaks out the period from 2002 to 2003 wages of this group remained slightly behind those of all occupations (see Appendix Table 6). At the time of writing, there is no more recent information available on occupational wages, but wage developments in the IT services industry might be taken as a proxy for the wages paid to computer systems analysts in all sectors. In 2004, the weekly wages in the computer systems design and related services sector decreased slightly, while those for all non-farm employment increased by 2.2 per cent.

What can be learned from this information on US employment and wages? Employment in US computer occupations had been more affected by the downturn than all occupations in 2002 and 2003. However, in 2004 employment growth in these occupations again exceeded overall employment growth, as it had done in the years before 2000. In the course of 2004, the computer (and mathematical) workforce increased by 174,000, accounting in total for 3.357 million people, or 2.4 per cent of the total US occupational workforce at the end of 2004. This represented a new peak level in computer occupations in both absolute and relative terms, although a precise comparison with previous peak employment is not possible due to a break in the time series.[27]

According to US data, wages did not react as quickly to the economic downturn as did employment levels. Until 2002, there was no sign of a particular weakness in the wages of computer analysts. Only in 2003, and perhaps in 2004, did wages increase less than for all occupations. Despite this recent weakness relative to other wages, it should be recalled that at an average hourly wage of $33.25, computer and system analysts earned nearly twice as much as all other occupations in 2003. The strength in the rebound in employment in 2004, and the resilience of wages of computer occupations, do not support the view that offshoring services of high-skilled IT specialists had a marked impact on overall US employment in these occupations up to the end of 2004.

Statistics on layoffs also indicate an improved employment situation in 2004. The US Department of Labor reported that the annual number of separations caused by layoffs in software and computer services (industries not occupations) decreased steadily from 36,016 in 2001 to 16,230 in 2003 and declined further in the first three quarters of 2004.[28] Typically, only a very small fraction of the mass layoffs in these industries are linked to offshoring. According to the US Department of Labor, the share of separations due to overseas relocation among all separations caused by layoffs (across all non-farm industries) ranged between 1 per cent and 1.3 per cent annually from 2000 to 2003. Unfortunately, this information is no longer reported from January 2004 onwards.

US employment and wages in computer occupations in recent years should perhaps not be compared with the exceptional situation at the end of the 1990s when the United States faced a severe shortage of IT specialists, accentuated by the dot.com boom, fears of the IT millennium or 2YKbug, and a major upgrade in standard business software (Windows 2000). This particular situation led the US administration to relax its immigration policy through the American Competitive and Workforce Improvement Act of 1998, in order to attract foreign IT specialists. In FY 2001, 191,000 foreigners obtained an H-1B visa in order to work in the United States in

27 US Department of Labor, *The employment situation: December 2004* and http://www.bls.gov.

28 US Department of Labor News, November 18, 2004, *Extended Mass Layoffs in the Third Quarter of 2004,* Table 6.

computer-related occupations. In the following years, and under the double shock of the burst of the dot. com boom and the tragedy of 9/11, the number of approved petitions for H-1B visas was more than halved, reaching 75,000 in FY 2002 and 85,000 in FY 2003. The decline of H-1B beneficiaries clearly reflects reduced demand for IT occupations. On the other hand, even in FY 2003 there was still a need to recruit foreigners to fill specific vacant IT jobs in the United States (see Appendix Table 9). The absolute decline in the number of approved H-1B IT specialists between FY 2001 and FY 2002/FY 2003 (more than 100,000) indicates that it is likely that foreign IT specialists accounted for most of the decline in US computer occupations between November 2000 and November 2003 (160,000).[29]

It is interesting to note that at $60,000 in FY2002 and FY2003, the median annual earnings of H-1B beneficiaries in computer-related occupations closely match the average wages paid domestically in this occupation (see Appendix Table 9 and annualized hourly wages given in Appendix Table 6). Onshore outsourcing by US firms of IT services to domestic providers of IT services employing H-1B beneficiaries is therefore unlikely to be driven by wage cost considerations. It seems more likely that persistent skill shortages in the US economy play the most prominent role in approvals of H-1B visas.

Ireland is often said to be among the main beneficiaries of offshoring IT activities and reports the world's largest IT services exports in recent years. IT services employment in Ireland depends largely on exports of IT services. Although Ireland remained an attractive location for offshoring IT services, it nevertheless recorded a dramatic decline in the employment of its IT industry after 2001. According to Ireland's Industrial Development Agency (IDA), the country's employment in IT services declined by nearly one-quarter between 2001 and 2003, falling to a level of 24,000 people in 2003. The Irish experience illustrates the dramatic fall in the global demand for IT services between 2001 and 2003, which more than offset any Irish gains in employment from offshoring. A less known feature of Irish IT employment is that the majority of its employees had been foreigners throughout the 2000-2003 period (see Appendix Table 7). In any case, Ireland's employment levels are too modest to have a significant impact on employment in major IT markets.

Compared with Ireland, India's software industry is in quite a different league, as it employs at least 20 times more IT specialists than Ireland (see Appendix Table 8). Contrary to the United States and Ireland, employment in India's software industry (excluding IT-enabled services (ITES)) expanded steadily by more than one-third between FY 2001-02 and FY 2003-04, adding 150,000 people to the payroll in the sector. According to NASSCOM (2005) India's software industry employed 568,000 people in FY 2003-04. About 5 per cent of them worked in the domestic sector. Employment in "business services" (or ITES) which comprise customer care, finance and payment services, more than doubled between FY 2001-2002 and FY 2003-04, reaching 245,000 people. Employment in the (narrowly defined) software sector, which uses high-skilled IT specialists, still accounted for more than two-thirds of India's total software industry (incl. ITES) in FY 2003. However, its expansion was less dynamic than that of business services, which employs primarily low-skilled workers.

A large number of Indian IT specialists work abroad to deliver services "onsite". This poses the question whether they should be included in India's or in the host country's employment data. If an Indian IT specialist works for Indian firms temporarily abroad, one should consider him as part of India's IT sector employment. However, if the Indian IT specialist works for a longer period abroad, one should count him at some point in the host country's employment figures. It could be that India's IT specialists working abroad for longer than 3 months are still considered to be Indian residents and therefore included in India's employment data, although according to international statistical standards they should be considered as residents in the receiving country. In recent years, this could easily add up globally to more than 200,000 people, roughly one-third of India's recorded IT specialists (narrowly defined). It seems that employment statistics provided by NASSCOM covers Indian IT specialists working abroad but employed by an Indian software house as part of Indian software employment in captive user organizations. Employment in this sector reported the smallest increase between FY 2001-02 and FY 2003-04, but still remained the largest employer among all the four sectors identified (see Appendix Table 8). This interpretation could fit with reports that in the past most software exports were delivered "onsite," while in recent years direct exports (supplied from India) have become more prominent.

[29] Kierkegaard (2004a) draws a similar conclusion in respect of the decline in approved H-1B visas.

IT employment in the United States and India account for only a small share of total employment in either country. In the United States, the 3.4 million employees in computer occupations accounted for 2.3 per cent of total occupations at the end of 2004. Employment in the computer systems design and related services industry amounted to 1.16 million people, or 0.9 per cent of total non-farm employment (based on establishment data). In India, the 813,000 employees in the "software" sector (broadly defined) represent about a quarter of one per cent of India's active labor force (estimated at 320 million) in FY 2003-04. It is worth recalling the actual size of IT employment in the current offshoring debate in order to appreciate more fully the potential impact of outsourcing on each of these economies.

US employment growth in IT occupations was marginal in 2003, but strengthened significantly in the course of 2004, while India's employment in (the narrowly defined) software industry expanded by about one-third over the last two fiscal years. Obviously, India's share in the supply of global IT services has increased over the last years. India's software exports expanded much faster than world markets. But not all the gains in India's market share in the global supply of IT services should be attributed to offshored IT services. Although the expansion in India's software industry is largely driven by its IT services exports, not all of them are replacing IT services previously provided in-house in firms of the importing country.

5. IMPLICATIONS OF OUTSOURCING AND OFFSHORING

(a) Implications for the outsourcing/offshoring country

Since services account for between two-thirds and three-quarters of total employment in developed economies, productivity gains in this sector are essential to economic growth and improvements in welfare. Furthermore, since services constitute a large and growing share of GDP in developed as well as emerging economies, world trade growth would probably slow down relative to world income growth in the long run if services were not traded. World trade has been an important engine of world growth and development during the post-World War II period and trade in services, including offshoring, will sustain this process. In short, offshoring contributes to a continuation of the post-World War II trend of increased international integration, where trade as a share of GDP has increased and led to growth through specialization, technology diffusion and shifting comparative advantage. It is not new, but represents a deepening of existing trends.

As explained in Section 3, innovation can take the form of development of new goods, services or processes. New goods and services are typically specific to the innovating firm and are produced in-house. However, as the product, service or process matures, it becomes standardized and a possible candidate for outsourcing. The process at the firm level is one of adding new innovations at the technology frontier, spinning off mature goods and services while maintaining a focused and productive organization. The finance sector springs to mind as the most prominent service sector subject to this dynamic. However, services such as entertainment, media, software development, engineering, architecture, design and even education and health, have started to standardize and outsource routine tasks. In the health sector, this could enable highly skilled health personnel to focus on providing and improving treatment rather than spending a lot of time on routine tasks. Both in manufacturing and services, what is typically retained within the organization are those tasks that are of strategic importance and hence the tasks that contribute directly to distinguishing the final product from that of competitors.[30]

At the national level the process is one of changing comparative advantage with the accumulation of physical and human capital, and shifting the areas of specialization to higher-technology activities. IT has opened the services sector to this dynamic, and vertical disintegration in service sectors is increasingly common. An indication of the extent to which a sector is vertically integrated is the ratio of value added to gross output, i.e. the share of the sales value that has been produced in-house. The most important in-house production factor is labour. Typically, vertically integrated industries have a high share of compensation to employees in their total cost structure. This is very clearly illustrated in Table 3, which shows cost shares in five different industries in the US. The shares are calculated from the input-output table from 2002.

[30] IT services provided within manufacturing firms are also subject to outsourcing.

Table 3
Cost structure in selected United States' industries, 2002

Cost component	Motor vehicles	IT services	Other business services	Administrative support services	Computer systems design
Total material inputs	53.6	10.3	5.7	8.2	3.2
Wholesale and retail trade	6.2	1.1	0.8	2.4	0.4
Transport and storage services	2.3	1.7	1.4	1.7	0.4
Publishing industries (includes software)	0.0	0.4	0.4	0.1	0.0
Broadcasting and telecommunications	0.4	6.0	2.8	2.2	1.5
Information and data processing services	0.2	2.3	0.8	1.1	0.7
Financial and legal services	1.8	8.9	7.8	6.9	2.8
Miscellaneous professional, scientific and technical services	2.8	7.5	10.4	5.3	1.7
Computer systems design and related services	0.1	1.7	0.7	0.4	0.6
Management of companies and enterprises	1.2	0.6	0.5	1.7	0.2
Administrative and support services	0.2	6.6	5.7	5.9	3.1
Other services	3.8	6.9	4.8	3.6	2.8
Compensation of employees	18.6	33.7	38.6	46.3	63.3
Taxes on production and imports, less subsidies	0.5	0.9	0.7	1.3	1.4
Gross operating surplus	8.3	11.4	19.0	12.8	17.7
Memo:					
Total value added share	27.4	45.9	58.3	60.4	82.4

Source: US Department of Commerce, Bureau of Economic Analysis (2004).

Compensation of employees, taxes and operating surplus represent the value that is created within companies, while material inputs and the different categories of services inputs are purchased from other companies. The most mature industry of the five, motor vehicles, has by far the lowest wage cost share, and by far the highest share of inputs sourced from other firms. At the opposite end of the spectrum is computer systems design, where more than 60 per cent of total costs are wage costs and as much as 82 per cent of total sales value is generated within the companies. It is further worth noticing that the share of services in intermediate input is quite low, while the share of material inputs is very high in the motor vehicle industry, suggesting a shift in the industry's core activities from manufacturing to services such as R&D, design and marketing. The large sectors producing intermediate services for other sectors are other business services and administrative support services. Both have a high share of in-house value added.

In the following, some experiments are done on the basis of the cost structure depicted in Table 3 in order to assess the possible impact of outsourcing and offshoring. Two types of changes are analysed. First, companies that purchase services from outside firms could shift sourcing from local suppliers to foreign suppliers. Second, local service suppliers could outsource some of the activities that are at present performed in-house to outside suppliers locally and abroad. The discussion assumes offshoring to non-affiliate firms, while the modifications that need to be made with captive offshoring are discussed towards the end of the Section.

Scenario 1: 10 per cent of intermediate purchases of IT services from all US industries are shifted to India and the cost saving is 40 per cent.[31]

According to the US input-output table for 2002, intermediate purchases of IT services in the US economy were close to $90 billion. If 10 per cent were offshored to India, costs would be reduced from $90 to $85.4 billion (5.1 per cent) and the reduction in total cost in the economy would be hardly discernible. This includes only the direct effects of offshoring. Indirect effects would be transmitted in the economy through backward and forward linkages, but these are not taken into account here.

[31] See Farrell (2004) for an estimate of net costs savings of outsourcing of services to India.

Scenario 2: 5 per cent of US purchases of business services and administrative support services are shifted to India. The net unit cost of the offshored service is 40 per cent lower than local supply. As a reaction to increased competition from Indian suppliers, the local services companies outsource 10 per cent of their in-house activities to outside firms, half to India and half to local suppliers. It is assumed that outsourcing to local firms reduces unit costs by 10 per cent.[32] Again only direct effects are estimated.

Purchase of business services (i.e. "Miscellaneous professional, scientific and technical services") and administrative support services amounted to $824 and $412 billion respectively in 2002. If 5 per cent of this was offshored to India at 40 per cent lower costs, this would save the economy 25 billion dollars, or slightly more than 0.1 per cent of total costs in the US economy.[33]

If the two intermediate services sectors respond to increased competition by offshoring 10 per cent of their activities to outside suppliers, of which half went to India and half to local suppliers, an additional $28 billion would be saved. The total cost savings of the two steps would be close to 0.3 per cent of total industry output value in the United States (or 0.5 per cent of GDP). The total impact on the economy of reduced costs in the two services sectors depends on how the savings are spent. The cost savings could be passed on to customers through lower prices, or they could be captured by the firms through higher profits or by workers through higher wages. The more competitive the market, the larger the share of cost savings will be passed on to customers through lower prices.

- Lower price of the service. If the tax rate and profit margin are kept constant, the price of business services and administrative support services would decline by the same percentage as the cost - 2.5 per cent in this case. As already noted, the price level in the total economy would decline by about 0.3 per cent. The business services sector also supplies investment products to other sectors. A 2.5 per cent price reduction could increase real investment in these investment products, possibly by around 2.5 per cent, adding about $750 million or 0.05 per cent to total investment;

- higher profit margin. If firms avoid passing cost savings on to customers, and maintain their output prices, the profit margin would increase from 24 to 27 per cent in business services and from 15 to 18 per cent in administrative support services. This could lead to a higher investment rate in the sector and better services in the longer run, which could in turn have a similar effect as a lower price, as discussed under the previous bullet point. There is, however, no one-to-one relationship between profit margin and investment, and all or part of the additional profits could simply add to shareholders' consumption expenditure;

- higher wages. If the cost savings from outsourcing was captured by the remaining workers in the outsourcing companies, some of the gains would be spent, and some would be saved, contributing to higher investment. It would probably also lead to pressure for higher wages in other sectors which draw on the same pool of skills – and subsequent pressure to outsource to save costs also in these sectors.

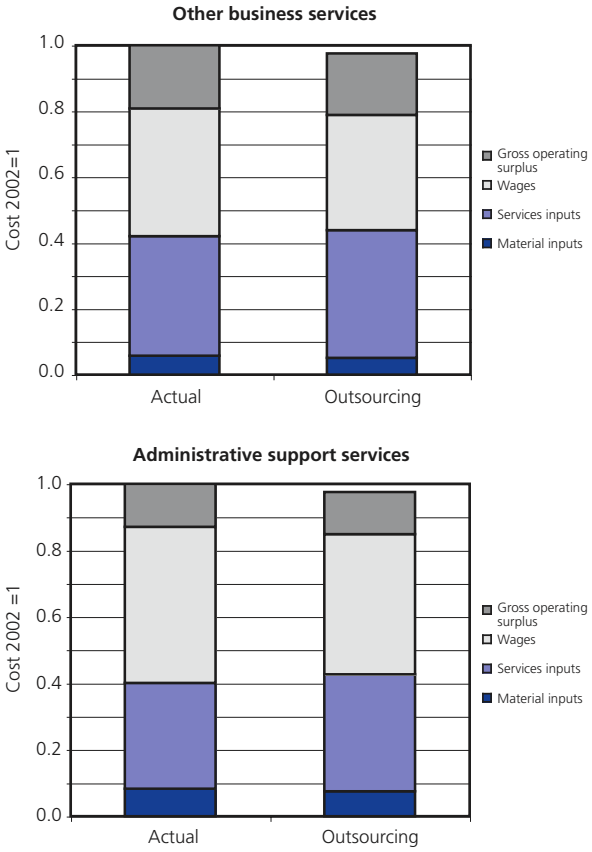
In reality, the gains from outsourcing are a mix of these three elements, but lower costs contribute to higher income and more investment, whichever way the gains from outsourcing and offshoring are spent. The difference is the relative importance of these effects and probably the time it takes for the gains to work their way through the economy. The change in cost structure if gains are used for price reductions is depicted in Chart 3.

[32] This percentage is chosen somewhat arbitrarily and serves as an example, since little is known about exactly how much is saved at a sectoral level from outsourcing to domestic suppliers.

[33] Total costs are equal to total output value.

It is known that the total employment level and the aggregate trade balance of an economy are determined by domestic macro-economic policy, while trade policy and technical changes at home and abroad affect the composition of trade and employment. Offshoring services to non-affiliated firms abroad has the same effect as trade in intermediate inputs in general: it improves productivity in the offshoring firm through lower costs of each individual offshored input, as illustrated by Chart 3, and through a broader variety of inputs. Further, it has the usual effect of reducing the relative income of the production factor that is used intensively in the import-competing activity. In most conceivable cases this improves welfare for the world as a whole and for the United States. However, since the United States is a large economy, its trade volumes and cost structures affect world market prices. If the United States exports relatively information-intensive goods and services and the relative price of these decline in world markets as a result of additional US supply, there is a negative terms of trade effect. However, the scale of offshoring at present, and likely developments during the next couple of decades, are nowhere near the scale that would cause a deterioration of terms of trade which outweighed the productivity gains (see Bhagwati et al. 2004).

Chart 3
Cost structure before and after outsourcing
Scenario 2



Although offshoring is unlikely to have a negative impact on total welfare in the United States and other developed countries, there are likely to be distributional effects. In Section 3 it was shown how differences in factor prices, notably wages, affect the offshoring decision. But the causality does in fact run both ways. Labour demand and wages in the activities being offshored tend to go down, while lower costs of imported inputs tend to raise productivity and reduce costs, allowing for higher rewards to domestic workers. Which effect is the strongest is an empirical question and depends on the human and physical capital intensity of the outsourcing sector, both on average and in the activities being outsourced (Kohler, 2004), and on the mobility of capital in the case of captive offshoring (Eckel, 2003).

Empirical evidence so far suggests that the productivity effect by and large has dominated, although the effects of offshoring cannot be distinguished clearly from the effects of the dot.com bubble and the bursting of the bubble. From September 2000 to September 2004, average weekly earnings of production workers in computer systems design and related services (NAICS code 5415) increased by 10.8 per cent, as compared to an increase of 9.5 per cent for average weekly earnings in the total US private sector. However, computer systems design services (NAICS code 541512) experienced an increase in weekly earnings of only 1.8 per cent during the same period, lagging behind the overall economy. A recent study (Baily and Lawrence, 2005) finds that about 100,000 computer programmer jobs were lost due to offshoring to India during the period 2000-2003. These were jobs in basic programming. However, in the same period more skill-intensive jobs were being created for software engineers and computer and network system analysts. This is precisely what one would expect with changing comparative advantage and technological changes that make services tradable.

Captive offshoring introduces an additional dimension into the analysis since it affects the relative endowments of capital and labour both in the outsourcing and recipient country. In general an outflow of capital results in a shift in employment from capital-intensive to labour-intensive sectors in the capital-exporting country.[34] The

[34] This is a prediction of the so-called Rybczynski theorem.

opposite is true in the capital-importing country. This is to some extent counterbalanced by the repatriation of profits. In any case, the capital flows will probably have to be larger than observed for captive offshoring of services to have a discernible effect on the total composition of employment in the United States.

It is also important to ask what is the alternative to offshoring. It may well be a defensive strategy by the offshoring company in order to maintain market share in the face of increased import competition in the market for its final output. In that case, the alternative to offshoring is not domestic production but a loss of market share and downsizing. This is particularly relevant in industries that perform a mix of high-skilled and low-skilled activities, where the low-skilled activities constitute a relatively large share of total costs.

(b) Impact of outsourcing on the service-exporting country

As noted in 4(b), the bulk of trade in IT-enabled services is in the category of captive offshoring. The discussion on the impact for service-exporting countries therefore draws on insights from the theory of multinational enterprises, FDI and trade. The possible gains from FDI in host countries are the following:

- employment creation (in cases of unemployment and underemployment);
- increase in total investment (in capital-constrained host countries);
- technology spillovers;
- linkages to the local economy.

A possible negative effect can be crowding out of local industries. The IT-enabled services sector in many of the major exporters (India, Ireland and the Philippines) is mainly producing for exports and thus falls under the export-platform FDI category. This type of FDI is unlikely to crowd out local industries, particularly if unemployment and capital constraints exist in the host country.

Many of the IT-enabled services enterprises that export from India and other poor countries would probably not have established there at all if not for the purpose of exporting, since local demand for such services is unlikely to have initiated or sustained them. This is because the existence of specialized services suppliers requires that both the supplier and the customer have IT hardware (computers and telecommunication lines), and computer and telecommunication penetration in India is low. The telephone penetration rate (fixed and mobile lines) was only 5.2 per 100 inhabitants in 2002, while in the Philippines it was about 22. This compares for example to 33 lines per 100 inhabitants in China and 40 in Mexico (ITU, 2004). According to NASSCOM (2005), Indian domestic sales in the software and services industry accounted for $3.4 billion out a total of $15.9 billion sales in 2003/04.

India and the Philippines have substantial unemployment and underemployment problems and they are probably also capital-constrained. Therefore, jobs created and investments made in the IT services exporting sector are likely to be net additions to total employment and investment. A recent study (Baily and Lawrence, 2005) estimates that the number of software-related jobs created in India in order to service the US market is about 135,000, while NASSCOM (2005) suggests that there were 195,000 "active export focused IT professionals" in 2003, while the corresponding figure for the Philippines was 20,000.

Ireland is not capital-constrained and does not have an unemployment problem today, but some 15-20 years ago it was among the European countries with the highest unemployment rate, at almost 17 per cent in 1985 and 1986. The unemployment rate went down to 3.9 per cent in 2001, but picked up slightly after 2001 following the burst of IT bubble (OECD, 2005b). ICT (both software and hardware) has been an important part of Ireland's amazing catch-up with the leading EU economies since it became a member in 1973 (Barry and Curran, 2004; Barry, 2004). ICT services accounted for 7 per cent of total employment in services in 2002. About a tenth of the enterprises were foreign-owned but these accounted for 77 per cent of turnover and 44 per cent of employment (Central Statistics Office, Ireland, 2004).[35] Ireland has been highly successful in

[35] Foreign-owned enterprises play a more important role in ICT manufacturing, where 97 out of 136 enterprises were foreign-owned and accounted for 84 per cent of employment and 97 per cent of turnover (Central Statistics Office, Ireland, 2004).

attracting export platform FDI and foreign-owned firms accounted for 89 per cent of Ireland's services exports in 2002 (Barry, 2004). Furthermore, over time the foreign firms have established linkages to the local economy and their demand for skilled labour has motivated investment in human capital.

The extent to which captive offshoring creates linkages and/or spillovers to the local economy is crucial for its development effect. Linkages are found to be small for export-platform FDI in general. Spillovers are more difficult to measure and entail technology transfers, for example via a skills pool on which domestic and foreign companies can draw. Another impact stems from investments in infrastructure that are made in order to attract or accommodate foreign firms, but also benefit local firms and the community at large. Finally, there could be a demonstration effect, inspiring local entrepreneurs as well as other foreign companies to invest in the same country. In particular, if one or more of the major multinationals offshore to a country, others are more likely to follow suit (Barry, 2004).

Export-led growth in the newly industrialized Asian countries (NICs) in the 1960s was founded on investments in industries that were at the frontier of the countries' technological capacity and for which domestic demand had not yet reached levels that could sustain a scale-effective industry. These exporting industries became recipients of technology transfers from abroad and channels for technology diffusion to local suppliers, creating linkages and thereby serving as engines of growth. Rapid export growth from export processing zones, in contrast, has not generated sustained development unless the exporting industries have over time become integrated into the local economy. Drawing on this experience, it can be concluded that the development effect of hosting offshored services depends on the extent to which these services become integrated with the local economy over time.

Turning to the impact on income distribution in exporting countries, it has been shown that in Mexico, outsourcing of manufacturing activities from the United States has actually led to an increase in demand for skills and an increase in wage inequality – the opposite of what one would expect in trade between a rich and a poorer country (Feenstra and Hanson, 1997). The reason is that while the activities being outsourced are relatively unskilled and labour-intensive in the United States, they are relatively skills-intensive in Mexico due to the differences in industrial structure between the two countries. A similar effect is observed in outsourcing of services to e.g. India, although the evidence is more of an anecdotal nature. Routine information processing is low-skilled labour intensive in the United States and other developed countries, but the skills requirement is well above what the average Indian worker possesses. Besides, multinational companies tend to pay higher wages than local companies, further contributing to wider wage gaps.[36] Therefore, offshoring is likely to increase employment and exports in India, but may not have a similarly favourable effect on income distribution, at least in the first instance.

6. OFFSHORING AND THE GATS: WHAT IS AT STAKE?

This Section discusses how offshoring is related to the GATS Agreement, and what opportunities might exist for extending opportunities for trade involving offshoring under transparent and predictable multilateral arrangements. Since 1995, the GATS has provided a framework for the liberalization of virtually all services sectors. Based on a so-called "positive list approach", it allows governments to undertake specific commitments sector by sector and according to four modes of supply.[37]

[36] See for example Lipsey (2002) for a survey on home and host country effects of FDI.

[37] Cross-border supply (mode 1) is defined to cover services flows from the territory of one Member (A) into the territory of another Member (B); consumption abroad (mode 2) refers to situations where a service is supplied in the territory of Member A to a service consumer of another Member B; commercial presence (mode 3) implies that a service supplier of one Member (A) establishes a commercial presence in the territory of another Member (B) to provide a service; and the presence of natural persons (mode 4) consists of persons of one Member (A) entering the territory of another Member (B) to supply a service.

The most relevant mode of supply for offshoring activities is the so-called "cross-border supply" of services (or "mode 1"), which is defined as "the supply of a service from the territory of one Member into the territory of another Member" (Art. I:2(a)). Examples of cross-border delivery include international transport, the supply of services through telecommunications or mail, as well as services embodied in exported goods.[38] Electronic transactions also fall *inter alia* under mode 1.

In the discussions on electronic commerce, there was a generally shared view among WTO Members that the GATS was technologically neutral, in the sense that "it does not contain any provisions that distinguish between the different technological means through which a service may be supplied."[39] This principle, referred to as "technological neutrality" means, in particular, that mode 1 specific commitments undertaken during the Uruguay Round, when Internet was not widely used by the business community, do cover Internet transactions. The principle of technological neutrality has been endorsed by a recent WTO dispute settlement panel. In the *United States – Gambling* dispute, the Panel considered that the definition of mode 1 in Article I:2(a) "does not contain any indication as to the means that can be used to supply services cross-border. This indicates [...] that the GATS does not limit the various technologically neutral possible means of delivery under mode 1. [...] a market access commitment for mode 1 implies the right for other Members' suppliers to supply a service through all means of delivery, whether by mail, telephone, Internet, etc., unless otherwise specified in a Member's Schedule."[40] One should note, however, that this panel report has been appealed. It is thus too early to consider this statement as formally endorsed by WTO Members.

Should an Internet transaction also be considered as mode 2, defined as the supply of a service "in the territory of one Member to the service consumer of any other Member" (so-called "consumption abroad", Art. I:2(b)). For mode 1, the supplier is situated outside the territory of the Member having undertaken the commitment. In theory, the main distinction between mode 1 and mode 2 is that the service is delivered within the territory of the Member for the former mode and outside the territory in the case of mode 2. However, electronic delivery blurs this distinction, and the physical presence of the consumer is not necessarily a relevant criterion for determining the place of delivery of a service. So far, WTO Members have discussed this issue mainly in relation to financial services and have not reached a clear understanding on how to address it. As the same problem arises in all sectors where services can be supplied electronically, and as these have increased with the development of the Internet, this means that the scope for potential controversial situations has expanded as well. However, in practice, a problem may only arise when, for a given sector, the level of commitment is different for mode 1 and mode 2 (for instance, there is an "Unbound" for mode 1 and a "None" for mode 2). An understanding among Members on whether mode 1 and /or mode 2 are/is relevant for electronic supply might facilitate negotiations. Pending an agreed solution, the best approach may be to ensure a similar level of commitments for both modes 1 and 2.

The degree of market opening consolidated under the GATS is determined by specific commitments undertaken by each Member in its national schedule. GATS specific commitments can be defined as legal guarantees enjoyed by foreign services suppliers, governing conditions of access to a market and conditions of competition *vis-à-vis* domestic suppliers. In GATS terms, the concept of market access entails six quota-type and other specified restrictions. National treatment refers to the obligation to accord to services and service suppliers of other Members treatment no less favourable than the treatment accorded to national services and service suppliers. Members have the possibility to select the sectors and modes of supply for which they are ready to undertake specific commitments. Moreover, these specific commitments can be qualified with various types of limitations, thus allowing a Member to tailor them to its specific national policy objectives. Therefore, specific commitments undertaken under mode 1 – and mode 2 – in relevant sectors (professional services, computer services, financial services, but also health and education, for instance) do guarantee a certain level of transparency

38 See *Guidelines for the Scheduling of Specific Commitments Under the General Agreement on Trade in Services (GATS)*, adopted by the Council for Trade in Services on 23 March 2001, WTO document S/L/92, paragraph 28.

39 *Work Programme on Electronic Commerce – Progress Report to the General Council*, adopted by the Council for Trade in Services on 19 July 1999, WTO document S/L/74, paragraph 4.

40 *United States–Measures Affecting the Cross-Border Supply of Gambling and Betting Services*, Report by the Panel, WTO document WT/DS285, circulated on 10 November 2004 (hereinafter *United States – Gambling*), paragraph 6.281 and 6.285. Note that the Report was appealed on 7 January 2005; the Appellate Body Report is expected at the beginning of April 2005.

and predictability to countries supplying services under these modes, including offshoring-related services. Full market access and national treatment commitments mean that the "importing" Member cannot maintain or implement any of the six market access measures listed in Article XVI and cannot discriminate, *de jure* or de facto, against foreign services and service suppliers. Moreover, the undertaking of specific commitments triggers the application of other GATS disciplines, related in particular to transparency requirements, good regulatory practice, behaviour of monopolies, and also the Annex on Telecommunication Services.

Services trade in most sectors is heavily regulated and the need to regulate is likely to increase as competition develops. The GATS explicitly recognizes "the right of Members to regulate, and introduce new regulations, on the supply of services within their territories in order to meet national policy objectives". Members reaffirmed this principle in the *Negotiating Guidelines* which provide the framework for the current negotiations.[41] Policy objectives include, *inter alia*, the protection of the consumer or the need to ensure the quality of the service and/or the qualifications of the supplier. The GATS does not seek to influence policy objectives, but establishes a framework of rules to ensure that services regulations are administered in a reasonable, objective and impartial manner, and are not more burdensome than necessary. Furthermore, Members are currently developing disciplines to ensure that certain types of non-discriminatory measures (qualification requirements and procedures, technical standards and licensing requirements) are based on objective and transparent criteria, and do not constitute unnecessary barriers to trade in services. Applying these measures to cross-border trade raises a number of questions which should be given closer consideration. For instance, does a measure impact differently on services supplied electronically as opposed to those supplied by suppliers who are present within the territory of the Member (modes 3 and 4)? Does the electronic supply of services call for different types of regulatory approaches? For instance, how are qualification and licensing requirements enforced with respect to suppliers situated outside the territory of the "importing" Member?

Another relevant aspect of the GATS framework is its exception provisions. Article XIV, for instance, contains general exceptions which are obviously pertinent for electronic transactions. This provision allows in certain conditions Members to depart from their GATS obligations, including their specific commitments, to take measures necessary to achieve certain public policy objectives, such as the protection of public morals and the maintenance of public order. In this context, it is also worth noting that Article XIV(c) permits, *inter alia*, Members to take measures necessary to protect the privacy of the personal data of individuals and the confidentiality of individual records and accounts, and to prevent deceptive and fraudulent practices.

The current services negotiations offer an opportunity to improve existing commitments, and undertake new commitments. But how far have modes 1 and 2 been consolidated in Members' schedules in previous negotiations? A WTO Secretariat study[42] reveals that mode 1 has attracted overall far fewer commitments than mode 3, for instance. One explanation may be that Members have considered this mode of supply not to be technically feasible for given sectors (which they sometimes explicitly indicated with an "Unbound*"). Indeed, cross-border supply is irrelevant – and will remain so – for a number of activities which, by their very nature, require physical proximity between the consumer and the supplier (hotel and restaurant services, hairdressing services, for instance). However, one should note that the assumptions concerning the "technical feasibility" of trading services cross-border may have changed since the end of the Uruguay Round as a result of technological developments. Uncertainties about how to enforce regulatory measures with respect to suppliers situated abroad may be another explanation which prompted governments to retain the right to prohibit all suppliers for reasons of "regulatory prudence". But the main characteristic of mode 1 commitments is that they are mostly consolidated as "None" (i.e. no limitation) or "Unbound"; limitations are less common than for mode 3, for instance; fewer types are used (they include mainly nationality, residency and commercial presence requirements) and they are found mainly in financial, telecoms and professional services. Another interesting characteristic is that the level of bindings for individual modes, including mode 1, does not differ significantly between developed and developing countries. However, such general patterns would need to be interpreted with care since, for a given mode, there may be big variations from one sector to another.

41 *Guidelines and Procedures for the Negotiations on Trade in Services*, adopted by the Special Session of the Council for Trade in Services on 28 March 2001, WTO document S/L/93.

42 WTO (2001).

Specific commitments undertaken with respect to mode 2 are significantly more liberal than those for the other three modes of supply. Most of the time, limitations scheduled for mode 1 have not been repeated under mode 2. This may be a potential source of difficulty given the discussions surrounding the status of electronic transactions.

It is important to recall that the absence of specific commitments in a given sector does not mean the absence of trading opportunities. In fact, actual access conditions for services supplied electronically, in particular information technology services and business process outsourcing, tend to be rather liberal. Of course, scheduling commitments in relevant sub-sectors would add transparency and predictability for business operators.

It is also useful to recall that some general GATS disciplines do apply to services trade even in the absence of specific commitments. The most important of such disciplines is no doubt the obligation not to discriminate among services or services suppliers based on their nationality (MFN obligation). Other generally applicable disciplines include transparency requirements (obligation to publish all measures of general application and to establish enquiry points mandated to respond to other Members' information requests), establishment of administrative reviews and appeals procedures and disciplines on the operations of monopolies and exclusive suppliers.

While modes 1 and 2 are no doubt most relevant for the development of offshoring activities, the fact that two-thirds of all offshoring is "captive" offshoring (see Section 4 (c)) suggests that lifting foreign investment restrictions may contribute to developing offshoring activities in "exporting" countries. Mode 3 commitments by the countries "exporting" offshoring activities may further contribute to the development of offshoring centers, in particular in developing countries.

Is the GATS equipped to promote further liberalization of offshoring-related services? Some commentators consider that the current framework is "far from ideal".[43] In addition to the uncertain status of electronic delivery as in relation to mode 1 and mode 2 discussed above, the main criticism concerns the current classification system, which would inadequately reflect "new" services, as well as the "positive list approach" which, coupled with the request-offer process used in the negotiations, would slow down liberalization efforts. Proposals to correct these perceived deficiencies range from the use of model schedules for cross-border trade of IT and BPO services (such schedules were used in the negotiations on telecommunications and maritime transport, for instance), to undertaking a horizontal commitment to liberalize cross-border trade in a wide range of services (such horizontal commitments would mean, in fact, adopting a negative list approach for modes 1 and 2).

Turning to classification first. The GATS does not require Members to follow any specific classification system to describe committed sectors and sub-sectors. So far, most Members have based their schedules on the so-called "Services Sectoral Classification List", which was established by the Secretariat of the GATT in 1991.[44] This list is based on the 1991 UN Provisional Central Product Classification[45] (CPC Prov.) and lists 12 services sectors, disaggregated in about 160 sub-sectors, indicating for each of them the corresponding CPC number. The Services Sectoral Classification List is generally acknowledged to be outdated in a number of sectors. As a result, it is unclear where individual IT and BPO activities are covered. It should be noted, nevertheless, that problems related to classification are not limited to IT and BPO services; they affect other equally important sectors, such as energy, telecommunication, environmental services, etc. In the Committee on Specific Commitments, Members have started to review the classification of various sectors – including computer and related services – but there has been no tangible result so far. By early 2005, no Member had proposed to give consideration to the classification of BPO services.

Secondly, when defining the framework for the new round of services negotiations, Members explicitly stated that the negotiations should preserve the existing structure and principles of the GATS (including the

43 Mattoo and Wunsch-Vincent (2004).

44 WTO document MTN.GNS/W/120, dated 10 July 1991.

45 *Services Sectoral Classification List*, Note by the Secretariat, WTO document MTN.GNS/W/120, (hereinafter 'W/120').

positive list approach), and they established the request-offer approach as the main method of negotiation.[46] Proponents of this approach – among them most developing countries – were motivated by the expectation these principles would give them more flexibility in deciding which sectors to liberalize. Adopting a negative list approach for commitments under modes 1 and 2 would contravene such expectations. Moreover, such an initiative would inevitably trigger similar proposals for other modes, in particular mode 3. A model schedule does have merits, but an equally strong case could be made for other sectors (such as energy services).

As a result of technological developments, cross-border trade in services has gained significant economic importance and the development of offshoring-related activities certainly contributed to this renewed interest. As a result, mode 1 already figures prominently in the ongoing negotiations.[47] However, this focus may not necessarily be sufficient in itself to warrant drastically different solutions, and to run the risk of fragmenting the agreement in order to create a special regime for offshoring-related services. Equally strong arguments could be made for strengthening liberalization in other sectors and other modes of supply. The current structure of the GATS allows specific commitments to be undertaken and should be able to further the liberalization of cross-border trade. Weaknesses of the GATS systems which may impair the liberalization of offshoring-related services (obsolete classification, liberalization targeted at only a few activities without taking into account the commercial reality, for instance) raise more horizontal questions because they affect nearly all services sectors. They should be addressed as such.

7. CONCLUSIONS

In reviewing the international trade and the employment data of major countries prominently engaged in the offshoring of IT services, one is tempted to conclude that most of the expressed expectations and fears related to the size and dynamics of offshoring of IT services are exaggerated. At present, the impact of offshoring services jobs is far stronger in the popular perception than on actual production, employment and trade patterns. The number of jobs affected today by offshoring IT services is small if related to the overall employment levels in the developed countries most affected. It is also small in the countries which have started exporting IT services if related to their total employment. According to BOP data, the leading beneficiaries of the IT service offshoring are Ireland and India. Ireland reports "only" about 24,000 people were employed in its software industry in 2003, a level markedly lower than in 2001. Ireland's exports of computer and information services are reported to amount to $14.4 billion, the largest in the world. Indian software industry employment (narrowly defined) amounted to 568,000 people in fiscal year 2003-04, representing an increase of 37 per cent since fiscal year 2001-2002. Again, according to NASSCOM(2005), 95 per cent of India's software industry employment is export-oriented and only 5 per cent works for the domestic market. A large part of India's IT specialists still work abroad and many of them are included in the host country's employment data. Indian employment and trade data indicate that the most dynamic component of services offshoring is not within the high-skill-intensive IT sector, but in the generally low-skilled business services sector. Employment in the latter sector doubled in India within the last two years. Nevertheless, even the broadly defined IT sector accounts for less than 0.25 per cent of the employed Indian labor force.

In Ireland and India, the rise of the IT sector was strongly supported by the respective governments, which created a favorable business environment. Government support was not limited to infrastructure and educational training, but included trade facilitation, a favorable tax regime and FDI-friendly regulations. However, government support alone cannot be credited for the success of the IT and IT-enabled services industry in these two countries. Realizing the potential of new technological innovations such as low-priced bandwidth communication lines and the digitization of many information-based services also needed companies with the managerial skills to take advantage of both low-cost labour and new market opportunities.

[46] *Guidelines and Procedures for the Negotiations on Trade in Services,* adopted by the Special Session of the Council for Trade on Services on 28 March 2001, WTO document S/L/93.

[47] See, for instance, the Communication from Chile, India and Mexico, *Joint Statement on Liberalization of Mode 1 under GATS negotiations,* WTO document JOB(04)/87, 28 June 2004.

Past experience has shown that opportunities provided by technological change contribute markedly to economy-wide productivity gains, which are the source of all lasting income gains. All major technological changes require adjustment of production capacities and the employment structure. In the (net) offshoring economies, flexibility in periods of adjustment reduces the losses which some firms and employees inevitably will experience at the beginning. The adoption of new technologies and management methods is usually stretched over a significant trial and error period and the normal turnover rates (or churn rates) in the labour markets accommodate structural changes to a large extent. Some of the projections made by Forrester (and other companies) in respect to the expansion of offshoring might be chilled in a harsher environment for the IT sector in the coming years.

In ten years' time, "the new wave of globalization" brought by the offshoring of services will be compared with previous revolutions such as e-commerce. The projections of the expansion of e-commerce in the mid-90s was not as significant as predicted, but this new technology has found its niche in the retail distribution (accounting for less than 2 per cent of US retail sales in 2004.[48] Likewise, offshoring of IT and IT-enabled services will increase significantly in size in the coming years without upsetting national employment levels in the countries which offshore, given the normal turnover rates in labour markets. Neither will it dramatically change the overall employment situation in the countries providing the offshored services, given their large labour force growth in the years ahead.

Finally, as far as the GATS is concerned, offshoring is one of many services sectors that could be subject to multilateral market access commitments under GATS auspices, aimed at increasing predictable and transparent trading opportunities. It was noted, however, that improvements in GATS, particularly in relation to such matters as the definitional distinction between mode 1 and mode 2 and the need for clarity with regard to scheduling nomenclature, would make it easier for WTO Members to contemplate new commitments with less uncertainty as to their implications.

[48] US Department of Commerce, News, Quarterly E.Commerce Sales, 3rd quarter 2004, 19 November 2004.

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APPENDIX TABLES

Appendix Table 1
International ICT markets by region, 2001-2003
(€ million at constant 2002 exchange rates and percentage)

	Value	Annual percentage change		
	2003	2001	2002	2003
Information Communication Technology (ICT)				
Europe (incl. Eastern Europe)	631012	3.2	0.1	1.2
United States	670897	-1.3	-2.7	0.0
Japan	254502	7.0	3.3	-0.8
Rest of World	514381	6.7	5.0	4.7
Total	**2070792**	**2.8**	**0.7**	**1.4**
Information Technology (IT)				
Europe (incl. Eastern Europe)	298395	1.6	-3.0	-0.8
United States	392417	-4.5	-6.3	0.4
Japan	114613	3.8	-0.8	-0.5
Rest of World	128050	2.8	1.7	1.4
Total	**933476**	**-0.7**	**-3.6**	**0.0**
Telecommunications				
Europe (incl. Eastern Europe)	332616	4.8	3.2	3.0
United States	278480	3.9	2.8	-0.6
Japan	139889	10.0	6.8	-1.1
Rest of World	386331	8.2	6.3	5.9
Total	**1137316**	**6.3**	**4.5**	**2.5**

Source: EITO (2004).

Appendix Table 2
The major traders in other business services, 2000-2003
(Million dollars)

	Exports				Imports			
	2000	2001	2002	2003	2000	2001	2002	2003
Ireland	1908	4386	5208	6743	13814	16597	19384	22255
India	3350	3889	4358	4452	6218	6771	7673	11010
United States	40682	38078	40567	44850	23487	21630	24959	28279
United Kingdom	33459	35404	40612	44797	16645	17782	19045	20118
Germany	24203	25832	25318	31757	32158	36234	35877	39896
Israel	2784	2892	2908	3124	3700	3935	3533	3624
Spain	8070	9402	10931	13511	10202	11266	12376	15273
Canada	10402	9856	10233	11266	9626	9576	9505	10409
Netherlands	15527	16562	20074	22045	16686	18537	21038	24589
Sweden	6482	6912	8659	11148	7602	8777	9512	10648
France	19323	21804	20693	24086	15490	10358	19227	24486
Japan	17709	16245	17401	18042	24296	23808	24715	23149
China	7663	8448	10419	17427	6959	7504	7957	10371
Luxembourg	...	...	2069	2387	...	...	1779	2234
Italy	13789	17024	17043	22254	17799	19962	20370	24644
Brazil	4568	4613	4319	4133	3434	4203	3543	4379
Russia	1740	1343	2012	2978	3367	3594	4583	5046
Memo items:								
World	324383	333750	358727	419061	326580	333217	357958	411126
EU (15)	154934	172228	186926	227293	166025	176535	195194	231330

Source: IMF, Balance of Payments Statistics, CD ROM December 2004, national statistics and WTO estimates.

Appendix Table 3
The decline in leased line pricing, 1992-2004
(Indices, 1992=100)

OECD average	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
56/64 kbit/s													
2 km	100	100	123	132	139	120	121	81	77	71	66	58	56
50 km	100	101	103	94	89	76	68	41	44	39	37	32	32
200 km	100	101	108	106	77	71	63	41	42	37	35	33	32
2 Mbit/s													
2 km	100	102	110	111	112	107	101	63	62	60	54	52	48
50 km	100	101	92	87	83	77	64	42	46	42	38	35	32
200 km	100	101	98	91	82	77	65	44	48	41	37	34	31

Source: OECD, OECD Information Technology Outlook 2004.

Appendix Table 4
Increasing role of Software Technology Parks of India in India's IT exports
(Billion dollars and percentage)

Fiscal Year	India	STPI units exports	Share of STPI units
1992-93	0.220	0.017	8
1993-94	0.325	0.037	11
1994-95	0.489	0.078	16
1995-96	0.753	0.217	29
1996-97	1.099	0.501	46
1997-98	1.722	0.921	54
1998-99	2.600	1.497	58
1999-00	3.958	2.679	68
2000-01	6.206	4.389	71
2001-02	7.653	6.190	81
2002-03	9.526	7.682	81

Source: Software Technology Parks of India (STPI) (http://www.stpi.soft.net/areport12.html).

Appendix Table 5
US Total employment by occupation, total and computer occupations, 1997-2004
(Thousands and percentage)

	All occupations	Computer and mathematical occupations	of which: Computer systems analysts and scientists
A. Thousands			
1997	129558	1494	1236
1998	131463	1747	1471
1999	133488	1847	1549
2000	135208	2074	1797
2001	135073	2103	1810
2002	136485	2030	1742
2002-Dec [a]	136599	3163	...
2003-Dec	138556	3183	...
2004-Dec	140278	3357	...
B. Percentage change (annual)			
1998	1.5	16.9	19.0
1999	1.5	5.7	5.3
2000	1.3	12.3	16.0
2001	-0.1	1.4	0.7
2002	1.0	-3.5	-3.8
2003-Dec	1.4	0.6	...
2004-Dec	1.2	5.5	...
1997-2000	1.4	11.6	13.3

[a] Break in series.
Source: US Bureau of Labor Statistics, the Current Population Survey (CPS) (Household data).

Appendix Table 6
Hourly wages of computer systems analysts in the United States, 1997-2004
(Dollars)

Year	All occupations (a)	Computer systems analysts and scientists (b)	Relative wage of computer systems analysts and scientists (b):(a)
1997 (Sept)	15.09	26.79	1.78
1998 (Dec)	15.72	27.89	1.77
1999 (Sept)	15.36	28.49	1.85
2000 (July)	15.80	29.26	1.85
2001 (Jan)	16.23	30.33	1.87
2002 (July)	17.18	32.86	1.91
2003 (July)	17.75	33.25	1.87

Source: US Department of Labor, National Compensation Survey (www.bls.gov/ncs/home.htm).

Appendix Table 7
Employment in Ireland's software industry, 1993-2003
(Thousands and percentage change)

Year	Total	Irish nationals	Foreign nationals
A. Thousands			
1993	8.9	4.5	4.4
1995	11.8	5.8	6.0
1997	18.2	9.2	9.0
1998	21.6	9.3	12.4
1999	24.9	11.1	13.8
2000	30.0	14.0	16.0
2001	31.5	15.0	16.5
2002	27.9	12.6	15.3
2003	23.9	10.7	13.2
B. Percentage change			
1998	19	1	38
1999	15	20	11
2000	21	26	16
2001	5	7	3
2002	-11	-16	-7
2003	-14	-15	-14
1997-2000	64.8	52.2	77.8
2000-2003	-20.2	-23.5	-17.4

Source: IDA, Ireland.

Appendix Table 8
Employment in India's software industry, 2000-2004
(Thousands and percentage)

	Total	Software Export sector	Software Domestic sector	Software Captive user org.	Business Services (ITES)	Total (excl. ITES)
A. Thousands						
1999-00	284	110	17	115	42	242
2000-01	430	162	20	178	70	360
2001-02	522	170	22	224	106	416
2002-03	661	205	25	260	171	490
2003-04	813	260	28	280	245	568
B. Percentage change						
2000-01	51	47	18	55	67	49
2001-02	21	5	10	26	51	16
2002-03	27	21	14	16	61	18
2003-04	23	27	12	8	43	16

Source: NASSCOM, Indian IT Industry Factsheet (available at http://www.nasscom.org/download/IndianITIndustryFactsheet.pdf).

Appendix Table 9
Indian speciality occupation workers in the United States (H-1B), FY 2000-2003
(Petitions approved and median annual earnings)

	H-1B petitions approved			
	All nationalities		Indian nationals	
	Total	computer related (03)	Total	computer related (03)
		(a)	(b)	(c)
FY 2000	257640	148426	124697	103763
FY 2001	331206	191397	161561	136646
FY 2002	197537	75114	64980	47477
FY 2003	217340	83114	79166	...

	Wages and wage sum of H-1B computer specialists of all origins and Indians			
	Earnings (annual) computer related Median value dollars (d)	Estimated earnings computer analysts Million dollars (e)=(a)*(d)	Estimated earnings of Indians Million dollars (b)*(d)	Estimated earnings of Indians IT specialists Million dollars (c)*(d)
FY 2000	55000	8163	6858	5707
FY 2001	58000	11101	9371	7925
FY 2002	60000	4356	3899	2849
FY 2003	60000	4986	4750	...

Note: Fiscal year 2000 refers to the period October 1, 1999 through September 30, 2000.
Sources: US Immigration and Naturalization Services (FY 2000 and 2001) and US Department of Homeland Security (FY 2002 and 2003).

Tariff Profiles Table I
Final MFN bound tariffs

Import markets	Binding coverage (per cent)			Simple average			Duty-free HS subheadings (per cent)			Non *ad valorem* duties (per cent)			Maximum *ad valorem* duty			National peaks (per cent)		
	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr
Albania *	100.0	100.0	100.0	7.0	9.4	6.6	26.1	10.9	28.4	0.0	0.0	0.0	20	20	20	0.0	0.0	10.1
Angola	100.0	100.0	100.0	59.2	52.8	60.1	0.0	0.0	0.0	0.0	0.0	0.0	80	55	80	0.0	0.0	0.0
Antigua and Barbuda	97.9	99.9	97.6	58.7	105.1	51.4	0.0	0.0	0.0	0.0	0.0	0.0	220	220	206	0.2	0.0	0.1
Argentina	100.0	100.0	100.0	31.9	32.6	31.8	0.0	0.1	0.0	0.0	0.0	0.0	35	35	35	0.0	0.0	0.0
Armenia *	100.0	100.0	100.0	8.5	14.7	7.5	34.2	1.2	39.2	0.0	0.0	0.0	15	15	15	0.0	0.0	0.0
Australia	97.0	100.0	96.5	9.9	3.2	11.0	19.8	32.2	17.8	0.4	2.1	0.1	55	29	55	6.1	8.9	6.6
Bahrain	72.6	100.0	68.4	35.8	38.9	35.1	0.0	0.0	0.0	0.0	0.0	0.0	200	200	100	0.4	2.2	0.0
Bangladesh	15.8	100.0	3.0	163.8	188.5	35.7	0.1	0.0	0.8	0.0	0.0	0.0	200	200	200	0.0	0.0	3.1
Barbados	97.9	100.0	97.6	78.1	111.2	73.0	0.0	0.0	0.0	0.0	0.0	0.0	247	223	247	0.4	0.0	0.4
Belize	98.0	100.0	97.7	58.2	101.4	51.5	0.0	0.0	0.0	0.0	0.0	0.0	110	110	110	0.0	0.0	0.0
Benin	39.4	100.0	30.1	28.3	61.8	11.4	1.4	0.0	2.1	0.0	0.0	0.0	100	100	60	2.2	0.0	4.6
Bolivia	100.0	100.0	100.0	40.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	40	40	40	0.0	0.0	0.0
Botswana *	96.5	99.5	96.0	18.8	37.5	15.8	15.0	21.8	13.9	0.0	0.0	0.0	597	597	60	2.6	2.4	2.7
Brazil	100.0	100.0	100.0	31.4	35.5	30.8	0.6	2.2	0.3	0.0	0.0	0.0	55	55	35	0.0	0.0	0.0
Brunei Darussalam	95.3	97.6	95.0	24.3	23.2	24.5	0.0	0.0	0.0	0.3	2.4	0.0	50	50	50	0.0	0.0	0.0
Bulgaria *	100.0	100.0	100.0	24.5	*35.6*	23.0	4.0	4.6	3.9	2.1	15.7	0.0	98	98	40	1.3	0.0	0.0
Burkina Faso	39.2	100.0	29.9	41.9	98.1	13.2	1.4	0.0	2.1	0.0	0.0	0.0	100	100	100	0.0	0.0	4.0
Burundi	21.8	100.0	9.9	68.3	95.1	26.8	3.0	2.5	3.7	0.0	0.0	0.0	100	100	100	0.0	0.0	13.9
Cambodia *	100.0	100.0	100.0	19.0	28.1	17.7	0.8	0.0	1.0	0.0	0.0	0.0	60	60	43	0.1	0.0	0.0
Cameroon	13.3	100.0	0.1	79.9	80.0	57.5	0.0	0.0	0.0	0.0	0.0	0.0	80	80	80	0.0	0.0	0.0
Canada	99.7	100.0	99.7	5.1	*3.5*	5.3	31.1	41.8	29.5	3.8	26.0	0.4	238	238	20	6.1	6.4	6.5
Central African Republic	62.5	100.0	56.8	36.2	30.0	37.9	0.0	0.0	0.0	0.0	0.0	0.0	70	30	70	0.0	0.0	0.0
Chad	13.5	100.0	0.3	79.9	80.0	75.4	0.0	0.0	0.0	0.0	0.0	0.0	80	80	80	0.0	0.0	0.0
Chile	100.0	100.0	100.0	25.1	26.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	98	98	25	0.1	0.6	0.0
China *	100.0	100.0	100.0	10.0	15.8	9.1	5.8	2.8	6.2	0.0	0.0	0.0	65	65	50	1.3	3.1	1.3
Colombia	100.0	100.0	100.0	42.9	91.9	35.4	0.0	0.0	0.0	0.0	0.0	0.0	227	227	104	2.2	0.0	0.0
Congo	16.0	100.0	3.2	27.5	30.0	15.2	0.0	0.0	0.0	0.0	0.0	0.0	30	30	30	0.0	0.0	0.0
Costa Rica	100.0	100.0	100.0	42.8	42.5	42.9	1.9	0.0	2.2	0.0	0.0	0.0	233	233	100	0.1	0.9	0.0
Croatia *	100.0	100.0	100.0	6.0	*9.4*	5.5	25.0	15.1	26.5	2.4	18.3	0.0	55	55	25	1.9	5.2	0.3
Cuba	30.9	100.0	20.4	21.3	37.0	9.5	6.8	4.6	8.4	0.0	0.0	0.0	62	40	62	0.0	0.0	3.2

Tariff Profiles Table I
Final MFN bound tariffs (cont'd)

Import markets	Binding coverage (per cent)			Simple average			Duty-free HS subheadings (per cent)			Non *ad valorem* duties (per cent)			Maximum *ad valorem* duty			National peaks (per cent)		
	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr
Côte d'Ivoire	33.1	100.0	22.9	11.1	14.9	8.6	1.8	0.1	2.9	0.0	0.0	0.0	64	64	25	0.4	0.9	0.0
Democratic Republic of the Congo	100.0	100.0	100.0	96.2	98.2	95.9	0.0	0.0	0.0	0.0	0.0	0.0	100	100	100	0.0	0.0	0.0
Djibouti	100.0	100.0	100.0	40.9	47.3	39.9	0.1	0.3	0.0	0.0	0.0	0.0	450	450	200	0.5	3.3	0.0
Dominica	94.8	100.0	94.0	58.7	112.2	50.0	0.0	0.0	0.0	0.0	0.0	0.0	150	150	100	0.0	0.0	0.0
Dominican Republic	100.0	100.0	100.0	34.9	39.6	34.2	0.0	0.0	0.0	0.0	0.0	0.0	99	99	40	0.0	0.0	0.0
Ecuador	99.8	99.8	99.8	21.7	25.5	21.1	0.0	0.0	0.0	0.0	0.0	0.0	86	86	40	0.2	0.6	0.0
Egypt *	99.1	99.7	99.0	36.6	95.3	27.7	1.9	0.0	2.2	0.2	1.3	0.0	3000	3000	160	0.4	2.2	0.2
El Salvador	100.0	100.0	100.0	36.5	42.1	35.7	2.1	0.0	2.4	0.0	0.0	0.0	164	164	80	0.2	1.2	0.0
European Communities	100.0	100.0	100.0	4.1	*X*	3.9	24.3	26.7	23.9	6.0	40.8	0.7	75	75	26	3.1	5.2	7.1
Fiji	52.3	100.0	45.0	40.1	40.4	40.0	0.0	0.0	0.0	0.6	2.4	0.0	70	70	40	0.0	0.0	0.0
Former Yugoslav Republic of Macedonia *	100.0	100.0	100.0	6.9	11.3	6.2	35.9	34.0	36.2	1.4	10.0	0.1	60	60	25	3.2	9.7	2.3
Gabon	100.0	100.0	100.0	21.4	60.0	15.5	0.0	0.0	0.0	0.0	0.0	0.0	60	60	60	0.0	0.0	1.2
Gambia	13.7	100.0	0.5	102.0	103.5	58.3	0.0	0.0	0.0	0.0	0.0	0.0	110	110	110	0.0	0.0	0.0
Georgia *	100.0	100.0	100.0	7.2	11.7	6.5	21.6	8.3	23.6	0.3	2.5	0.0	30	30	20	0.5	0.0	0.3
Ghana	14.3	100.0	1.2	92.5	97.1	35.9	0.0	0.0	0.0	0.0	0.0	0.0	99	99	99	0.0	0.0	0.0
Grenada	100.0	100.0	100.0	56.8	101.0	50.0	0.3	1.9	0.0	0.0	0.0	0.0	200	200	100	0.6	0.0	0.0
Guatemala	100.0	100.0	100.0	42.2	51.3	40.8	0.0	0.0	0.0	0.0	0.0	0.0	257	257	75	0.6	4.0	0.0
Guinea	38.9	100.0	29.6	20.1	39.7	10.0	1.5	0.0	2.2	0.0	0.0	0.0	75	75	40	0.3	0.0	0.6
Guinea-Bissau	97.7	100.0	97.4	48.6	40.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	50	40	50	0.0	0.0	0.0
Guyana	100.0	100.0	100.0	56.7	100.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	100	100	100	0.0	0.0	0.0
Haiti	89.2	100.0	87.6	*17.6*	*21.7*	*16.9*	5.5	15.2	3.8	10.9	11.1	10.9	70	70	40	0.0	0.3	0.0
Honduras	100.0	100.0	100.0	32.6	32.3	32.6	0.0	0.0	0.0	0.0	0.0	0.0	60	60	55	0.0	0.0	0.0
Hong Kong, China	45.7	100.0	37.5	0.0	0.0	0.0	100.0	100.0	100.0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0
Iceland	95.0	100.0	94.2	13.4	*43.4*	9.6	39.2	18.6	42.6	3.4	24.5	0.0	229	229	175	4.7	1.8	7.8
India	73.8	100.0	69.8	49.8	114.5	34.3	2.9	0.0	3.5	7.2	0.3	8.8	300	300	150	6.5	0.0	0.2
Indonesia	96.6	100.0	96.1	37.1	47.0	35.6	2.0	0.0	2.3	0.1	0.4	0.0	210	210	150	0.5	2.8	0.0
Israel	76.4	98.5	73.0	20.8	73.0	*9.2*	11.8	2.8	13.7	9.9	0.3	11.8	560	560	170	9.0	2.8	4.8
Jamaica	100.0	100.0	100.0	49.8	97.4	42.5	0.6	1.9	0.4	0.0	0.3	0.0	100	100	100	0.0	0.0	0.0
Japan	99.6	100.0	99.5	2.9	*6.9*	2.3	53.6	28.7	57.4	6.2	22.7	3.6	62	62	30	8.5	8.4	10.4
Jordan *	100.0	100.0	100.0	16.3	23.7	15.2	5.6	0.9	6.3	0.2	1.0	0.0	200	200	30	0.5	3.5	0.0

Import markets	Binding coverage (per cent)			Simple average			Duty-free HS subheadings (per cent)			Non *ad valorem* duties (per cent)			Maximum *ad valorem* duty			National peaks (per cent)		
	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr
Kenya	14.6	100.0	1.6	95.7	100.0	54.8	0.0	0.0	0.0	0.0	0.0	0.0	100	100	100	0.0	0.0	0.0
Korea, Republic of *	94.5	99.1	93.8	15.9	52.9	10.1	14.1	2.2	16.1	0.7	4.8	0.1	887	887	54	2.4	6.7	3.7
Kuwait	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100	100	100	0.0	0.0	0.0
Kyrgyz Republic	99.9	100.0	99.9	7.4	12.3	6.7	19.7	1.2	22.5	0.5	2.4	0.2	30	30	20	0.0	0.0	0.0
Lesotho	100.0	100.0	100.0	78.6	200.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	200	200	200	0.0	0.0	0.0
Macao, China	26.8	100.0	15.6	0.0	0.0	0.0	100.0	100.0	100.0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0
Madagascar	29.7	100.0	18.9	27.4	30.0	25.3	0.1	0.0	0.2	0.0	0.0	0.0	30	30	30	0.0	0.0	0.0
Malawi	31.2	100.0	20.7	76.1	121.7	42.4	0.0	0.0	0.0	0.0	0.0	0.0	125	125	125	0.0	0.0	0.0
Malaysia	83.7	99.9	81.2	14.5	*12.2*	14.9	6.2	12.1	5.1	4.5	27.4	0.2	168	168	40	0.6	4.1	0.0
Maldives	97.1	100.0	96.7	36.9	48.0	35.1	0.0	0.0	0.0	0.0	0.0	0.0	300	300	300	2.6	6.9	1.9
Mali	40.6	100.0	31.6	28.8	59.2	14.2	1.3	0.0	2.0	0.0	0.0	0.0	75	75	60	0.0	0.0	9.1
Mauritania	39.3	100.0	30.1	19.6	37.7	10.5	1.4	0.0	2.1	0.0	0.0	0.0	75	75	75	3.8	0.0	0.2
Mauritius	17.9	100.0	5.3	93.8	119.6	19.5	18.2	0.0	70.3	0.0	0.0	0.0	122	122	122	0.0	0.0	29.7
Mexico	100.0	100.0	100.0	34.9	35.1	34.9	0.2	0.3	0.2	1.0	7.5	0.0	72	72	50	0.0	0.0	0.0
Moldova	100.0	99.9	100.0	6.7	12.2	6.0	22.6	3.0	25.6	1.1	8.3	0.0	25	25	20	0.0	0.0	0.1
Mongolia	100.0	100.0	100.0	17.6	18.9	17.3	1.5	0.7	1.6	0.0	0.0	0.0	75	75	30	0.0	0.3	0.0
Morocco	100.0	100.0	100.0	41.3	54.5	39.2	0.0	0.0	0.0	0.0	0.0	0.0	289	289	45	1.4	6.6	0.0
Mozambique	13.6	100.0	0.5	97.5	100.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0	100	100	100	0.0	0.0	5.0
Myanmar	17.3	100.0	4.7	83.6	102.8	22.3	5.4	0.6	21.0	0.5	0.6	0.0	550	550	550	2.7	3.4	1.4
Namibia *	96.5	99.5	96.0	19.1	39.8	15.8	15.1	22.4	13.9	0.0	0.0	0.0	597	597	60	3.1	1.5	2.7
Nepal *	99.4	100.0	99.3	26.0	41.4	23.7	2.7	0.0	3.1	0.0	0.0	0.0	200	200	60	0.5	0.9	0.0
New Zealand	99.9	100.0	99.9	10.3	5.7	11.0	42.5	51.3	41.1	4.1	0.7	4.6	55	35	55	5.4	8.3	5.9
Nicaragua	100.0	100.0	100.0	41.7	43.5	41.5	0.0	0.0	0.0	0.0	0.0	0.0	200	200	100	0.1	0.6	0.0
Niger	96.8	100.0	96.3	44.3	83.1	38.1	0.6	0.0	0.7	0.0	0.0	0.0	200	200	200	3.1	0.0	0.0
Nigeria	19.3	100.0	6.9	118.4	150.0	48.8	0.0	0.0	0.0	0.0	0.0	0.0	150	150	150	0.0	0.0	0.3
Norway	100.0	100.0	100.0	*3.0*	*X*	3.1	42.3	21.4	45.5	12.2	75.2	2.5	26	26	14	11.1	5.0	12.1
Oman *	100.0	100.0	100.0	13.8	28.0	11.6	3.6	0.0	4.1	0.0	0.0	0.0	200	200	20	1.5	7.5	0.0
Pakistan	44.3	92.6	37.0	52.4	97.1	35.3	0.0	0.0	0.0	0.0	0.0	0.0	200	200	100	0.0	0.0	0.0
Panama *	100.0	100.0	100.0	23.5	27.7	22.9	2.0	0.3	2.2	0.0	0.0	0.0	260	260	81	0.3	1.7	0.0
Papua New Guinea *	100.0	100.0	100.0	31.8	43.2	30.1	0.0	0.0	0.0	0.9	6.4	0.1	100	100	100	0.4	0.0	0.3
Paraguay	100.0	100.0	100.0	33.5	33.2	33.6	0.0	0.0	0.0	0.0	0.0	0.0	35	35	35	0.0	0.0	0.0
Peru	100.0	100.0	100.0	30.1	30.8	30.0	0.0	0.0	0.0	0.0	0.0	0.0	68	68	30	0.0	0.0	0.0
Philippines	66.8	99.4	61.8	25.6	34.7	23.4	3.0	0.0	3.8	0.0	0.0	0.0	80	80	50	0.1	0.0	0.0
Qatar *	100.0	100.0	100.0	16.0	25.7	14.5	0.9	0.0	1.1	0.0	0.0	0.0	200	200	200	0.8	5.6	0.0
Romania	100.0	100.0	100.0	40.4	98.4	31.6	0.4	0.1	0.5	0.0	0.0	0.0	333	333	220	4.3	3.4	0.0

Tariff Profiles Table I
Final MFN bound tariffs (cont'd)

Import markets	Binding coverage (per cent)			Simple average			Duty-free HS subheadings (per cent)			Non *ad valorem* duties (per cent)			Maximum *ad valorem* duty			National peaks (per cent)		
	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr
Rwanda	100.0	100.0	100.0	89.5	74.3	91.8	0.8	3.0	0.5	0.0	0.0	0.0	100	80	100	0.0	0.0	0.0
Saint Kitts and Nevis	97.9	100.0	97.6	75.9	108.7	70.8	0.0	0.0	0.0	0.0	0.0	0.0	250	250	170	0.1	0.0	0.0
Saint Lucia	99.6	100.0	99.5	61.9	114.6	53.9	0.0	0.0	0.0	0.0	0.0	0.0	250	250	206	0.2	0.0	0.5
Saint Vincent and the Grenadines	99.7	100.0	99.7	62.5	114.6	54.6	0.0	0.0	0.0	0.0	0.0	0.0	250	250	206	0.2	0.0	0.5
Senegal	100.0	100.0	100.0	30.0	29.8	30.0	0.0	0.0	0.0	0.0	0.0	0.0	30	30	30	0.0	0.0	0.0
Sierra Leone	100.0	100.0	100.0	47.4	40.3	48.5	0.0	0.0	0.0	0.0	0.0	0.0	80	80	80	0.0	0.0	0.0
Singapore	69.2	100.0	64.5	6.9	9.5	6.3	22.4	3.1	26.9	0.7	3.8	0.0	10	10	10	0.0	0.0	0.0
Solomon Islands	100.0	100.0	100.0	78.8	70.7	80.0	0.0	0.0	0.0	1.4	3.4	1.1	150	150	120	0.0	0.0	0.0
South Africa *	96.5	99.5	96.0	19.1	39.8	15.8	15.1	22.4	13.9	0.0	0.0	0.0	597	597	60	3.1	1.5	2.7
Sri Lanka	37.8	100.0	28.3	29.8	49.7	19.3	0.5	0.0	0.7	1.7	2.7	1.1	100	60	100	0.1	0.0	1.6
Suriname	26.3	100.0	15.1	18.5	19.9	17.0	3.0	0.0	6.0	0.1	0.0	0.1	40	20	40	0.0	0.0	0.0
Swaziland *	96.5	99.5	96.0	19.1	39.8	15.8	15.1	22.4	13.9	0.0	0.0	0.0	597	597	60	3.1	1.5	2.7
Switzerland	99.8	100.0	99.7	*X*	*X*	*X*	15.1	17.4	14.8	84.9	82.6	85.2	0	0	0	0.0	0.0	0.0
Taipei, Chinese *	100.0	100.0	100.0	6.1	*15.3*	4.8	28.4	24.5	29.0	2.3	11.1	0.9	500	500	90	4.9	3.8	2.4
Tanzania	13.3	99.8	0.1	120.0	120.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	120	120	120	0.0	0.0	0.0
Thailand	74.7	100.0	70.9	*25.7*	*X*	*24.2*	3.0	0.7	3.5	25.4	45.6	21.1	226	226	80	1.2	2.1	0.5
Togo	14.0	100.0	0.9	80.0	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.0	80	80	80	0.0	0.0	0.0
Trinidad and Tobago	100.0	100.0	100.0	55.7	90.2	50.5	1.4	4.9	0.9	0.0	0.0	0.0	156	156	100	0.0	0.0	0.0
Tunisia	57.4	98.8	51.1	57.8	116.0	40.6	0.0	0.0	0.0	0.0	0.0	0.0	200	200	180	1.9	0.0	0.1
Turkey	47.3	100.0	39.3	29.4	60.1	17.5	5.4	0.0	7.5	0.0	0.0	0.0	225	225	102	5.6	4.6	1.7
Uganda	15.8	100.0	3.0	73.3	77.7	50.8	0.0	0.0	0.0	0.0	0.0	0.0	80	80	80	0.0	0.0	0.0
United Arab Emirates *	100.0	100.0	100.0	14.7	25.4	13.1	0.9	0.0	1.1	0.0	0.0	0.0	200	200	15	0.7	5.6	0.0
United States	100.0	100.0	100.0	*3.6*	*X*	3.2	37.2	28.7	38.5	10.8	49.6	4.8	350	350	48	7.1	1.9	8.2
Uruguay	100.0	100.0	100.0	31.7	33.9	31.3	0.0	0.0	0.0	0.0	0.0	0.0	55	55	35	0.0	0.0	0.0
Venezuela	99.9	99.0	100.0	36.8	55.7	33.9	0.0	0.0	0.0	0.0	0.0	0.0	135	135	40	1.9	0.0	0.0
Zambia	16.8	100.0	4.1	106.4	123.3	42.7	0.0	0.0	0.0	0.0	0.0	0.0	125.0	125.0	125.0	0.0	0.0	0.0
Zimbabwe	21.0	100.0	9.0	94.1	143.4	11.0	7.5	1.2	18.3	2.5	2.8	2.0	150.0	150.0	150.0	0.0	0.0	5.3

* Implementation period for some commitments goes beyond the year 2005.
Note: See Technical Notes for details on methodology and description of variables.
Source: WTO-CTS.

Tariff Profiles Table II
MFN applied tariffs
(Percentage)

Import markets	Year	Simple average			Duty-free HS subheadings (per cent)			Non *ad valorem* duties (per cent)			Maximum *ad valorem* duty			National peaks (per cent)		
		All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr
Albania	2001	7.5	9.0	7.2	1.0	0.0	1.1	0.0	0.0	0.0	15	15	15	0.0	0.0	0.0
Algeria +	2003	18.7	23.0	18.1	1.1	0.0	1.2	0.0	0.0	0.0	30	30	30	0.0	0.0	0.0
Angola +	2002	8.8	9.4	8.7	0.0	0.0	0.0	1.3	0.4	1.4	35	35	35	5.7	9.5	5.2
Antigua and Barbuda +	2003	9.6	14.6	8.9	10.1	21.1	8.4	3.4	1.0	3.8	70	45	70	4.8	0.3	2.5
Argentina +	2004	12.7	12.0	12.9	10.7	2.6	11.9	0.0	0.0	0.0	35	22	35	0.0	0.0	0.0
Armenia	2004	2.9	6.6	2.3	70.7	32.8	76.5	0.4	2.8	0.0	10	10	10	27.9	0.0	22.6
Australia	2003	4.2	1.2	4.6	46.8	74.5	42.6	0.3	1.3	0.2	25	5	25	10.4	22.1	11.7
Azerbaijan +	2002	8.8	*12.7*	8.3	1.1	0.1	1.3	4.4	15.5	2.7	35	35	22	0.0	0.0	0.0
Bahamas	2002	30.5	24.3	31.5	5.9	17.1	4.2	0.1	0.1	0.1	210	210	100	0.3	0.4	0.3
Bahrain	2004	5.2	6.8	4.9	4.7	20.1	2.3	0.5	2.3	0.2	125	125	20	0.6	2.6	0.2
Bangladesh +	2004	18.6	20.6	18.3	6.6	10.3	6.0	0.0	0.0	0.0	30	30	30	0.0	0.0	0.0
Barbados	2004	13.5	29.3	11.2	0.0	0.0	0.0	1.0	5.9	0.2	229	229	145	5.2	7.1	6.5
Belarus	2001	*10.0*	*9.0*	*10.1*	0.7	1.2	0.6	11.9	23.2	10.1	25	25	25	0.0	0.0	0.0
Belize +	2003	10.5	17.6	9.5	8.2	10.3	7.9	0.3	1.8	0.0	91	91	70	6.3	1.0	3.9
Benin	2003	12.0	14.3	11.6	1.3	0.0	1.5	0.0	0.0	0.0	20	20	20	0.0	0.0	0.0
Bermuda +	2001	17.4	8.0	18.8	5.1	18.0	3.1	0.6	3.1	0.2	75	34	75	0.2	3.5	0.2
Bhutan +	2004	22.1	41.2	19.2	3.5	0.0	4.0	0.3	0.6	0.2	100	100	100	0.6	0.0	0.1
Bolivia +	2004	9.4	10.0	9.3	4.0	0.0	4.6	0.0	0.0	0.0	10	10	10	0.0	0.0	0.0
Bosnia and Herzegovina +	2001	6.0	4.8	6.2	25.7	35.6	24.2	0.0	0.0	0.0	15	15	15	0.0	5.6	0.0
Botswana	2002	*5.8*	*9.1*	*5.3*	50.7	40.4	52.3	14.4	13.3	14.6	55	55	43	11.2	5.8	10.4
Brazil	2004	12.4	10.3	12.7	2.9	2.6	3.0	0.0	0.0	0.0	55	55	35	0.0	0.4	0.0
Brunei Darussalam +	2003	2.6	0.0	3.0	77.1	94.7	74.4	0.8	4.7	0.2	200	30	200	13.7	0.6	15.7
Bulgaria	2004	10.0	*18.4*	8.8	12.6	15.8	12.2	1.4	10.6	0.0	75	75	27	2.8	2.5	0.1
Burkina Faso	2003	12.0	14.0	11.7	1.2	0.0	1.4	0.0	0.0	0.0	20	20	20	0.0	0.0	0.0
Burundi	2003	23.4	33.0	22.0	0.0	0.0	0.0	0.2	0.6	0.1	40	40	40	0.0	0.0	0.0
Cambodia +	2003	16.4	19.5	15.9	4.3	3.0	4.5	0.2	0.3	0.2	120	50	120	2.6	0.0	2.5
Cameroon	2001	18.0	22.0	17.5	0.6	0.0	0.7	0.1	0.6	0.0	30	30	30	0.0	0.0	0.0
Canada	2003	3.9	*3.0*	4.0	42.2	49.6	41.1	2.9	19.8	0.3	238	238	25	9.6	8.0	10.3
Central African Republic +	2002	18.0	22.0	17.4	0.6	0.0	0.7	0.1	0.6	0.0	30	30	30	0.0	0.0	0.0
Chad +	2002	18.0	22.0	17.4	0.6	0.0	0.7	0.1	0.6	0.0	30	30	30	0.0	0.0	0.0

Tariff Profiles Table II
MFN applied tariffs (cont'd)
(Percentage)

Import markets	Year	Simple average			Duty-free HS subheadings (per cent)			Non *ad valorem* duties (per cent)			Maximum *ad valorem* duty			National peaks (per cent)		
		All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr
Chile	2003	6.0	6.0	5.9	0.7	0.0	0.8	0.0	0.0	0.0	6	6	6	0.0	0.0	0.0
China	2004	10.4	16.2	9.5	4.8	2.6	5.1	0.5	0.4	0.5	65	65	50	1.5	3.0	1.5
Colombia	2004	12.2	16.1	11.6	5.2	0.0	6.0	0.0	0.0	0.0	80	80	35	0.3	1.9	0.2
Congo +	2002	18.0	22.0	17.4	0.6	0.0	0.7	0.1	0.6	0.0	30	30	30	0.0	0.0	0.0
Costa Rica +	2004	5.9	12.2	4.9	48.2	21.4	52.3	0.0	0.0	0.0	150	150	20	1.4	7.2	17.2
Croatia	2003	4.7	*9.3*	4.1	46.3	21.0	50.2	2.5	18.7	0.0	61	61	30	5.9	5.1	7.4
Cuba	2003	10.9	10.9	10.9	5.8	9.0	5.3	0.0	0.0	0.0	30	30	30	0.0	0.0	0.0
Côte d'Ivoire +	2004	12.0	14.3	11.6	1.3	0.0	1.5	0.0	0.0	0.0	20	20	20	0.0	0.0	0.0
Democratic Republic of the Congo +	2003	12.0	13.0	11.9	0.0	0.0	0.0	0.5	0.4	0.6	30	20	30	0.0	0.0	0.0
Djibouti +	2002	31.0	20.5	32.6	1.3	9.8	0.0	2.7	2.3	2.8	40	40	40	0.0	0.0	0.0
Dominica +	2003	9.9	19.6	8.4	22.9	25.3	22.5	0.0	0.0	0.0	165	148	165	6.0	7.8	2.9
Dominican Republic	2002	8.5	13.0	7.8	13.6	16.8	13.1	0.0	0.0	0.0	40	40	25	0.4	2.8	0.1
Ecuador +	2004	11.9	14.7	11.5	2.3	1.4	2.4	0.0	0.0	0.0	35	20	35	0.0	0.0	0.0
Egypt +	2002	19.9	22.5	19.5	0.3	0.0	0.3	6.1	0.9	6.9	600	600	135	0.5	2.5	0.2
El Salvador +	2004	7.3	11.7	6.6	47.6	21.6	51.6	0.0	0.0	0.0	40	40	30	7.5	6.9	14.4
Equatorial Guinea +	2002	18.0	22.0	17.4	0.6	0.0	0.7	0.1	0.6	0.0	30	30	30	0.0	0.0	0.0
Eritrea +	2002	7.9	10.0	7.6	0.0	0.0	0.0	0.3	0.3	0.3	25	25	25	17.1	0.0	16.2
Ethiopia +	2002	18.8	21.7	18.4	3.0	0.0	3.4	0.1	0.3	0.1	40	40	40	0.0	0.0	0.0
European Communities	2005	4.2	*5.9*	4.0	24.3	25.9	24.0	5.9	39.9	0.7	75	75	26	3.1	4.1	7.1
Fiji	2004	7.3	8.4	7.2	10.0	2.6	11.1	2.0	4.5	1.7	27	27	27	13.2	12.0	13.4
Former Yugoslav Republic of Macedonia +	2004	9.2	*12.7*	8.7	24.3	30.8	23.3	1.5	10.1	0.1	60	60	31	7.4	8.2	7.0
Gabon +	2002	18.0	22.0	17.4	0.6	0.0	0.7	0.1	0.6	0.0	30	30	30	0.0	0.0	0.0
Gambia	2003	12.8	14.9	12.5	15.8	8.4	16.9	0.3	0.5	0.2	18	18	18	0.0	0.0	0.0
Georgia	2004	7.5	11.7	6.9	2.7	3.4	2.5	0.3	2.5	0.0	30	30	20	0.5	0.0	0.0
Ghana +	2004	13.1	17.3	12.5	11.4	2.8	12.7	0.3	0.4	0.3	233	20	233	0.0	0.0	0.0
Grenada +	2003	10.4	17.0	9.4	4.1	9.6	3.3	3.7	0.7	4.1	40	40	40	4.9	0.0	3.1
Guatemala	2003	6.2	10.0	5.7	47.9	21.3	51.9	0.0	0.0	0.0	40	40	21	1.9	2.5	8.8
Guinea	1998	6.5	6.6	6.4	0.6	0.0	0.7	0.0	0.0	0.0	7	7	7	0.0	0.0	0.0
Guinea-Bissau +	2004	12.0	14.3	11.6	1.3	0.0	1.5	0.0	0.0	0.0	20	20	20	0.0	0.0	0.0
Guyana	2002	11.0	20.1	9.6	4.0	8.9	3.3	0.0	0.0	0.0	100	100	70	6.4	3.4	3.3

Import markets	Year	Simple average			Duty-free HS subheadings (per cent)			Non *ad valorem* duties (per cent)			Maximum *ad valorem* duty			National peaks (per cent)		
		All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr
Honduras	2003	5.9	9.8	5.3	47.8	20.7	52.0	0.0	0.0	0.0	55	55	15	0.3	1.9	0.0
Hong Kong, China	2004	0.0	0.0	0.0	100.0	100.0	100.0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0
Iceland	2004	2.9	6.5	2.4	71.7	58.3	73.8	2.9	22.0	0.0	76	76	20	15.6	12.9	19.1
India +	2004	29.1	37.4	27.9	1.0	2.5	0.7	0.0	0.3	0.0	182	182	160	1.4	1.3	0.4
Indonesia	2002	6.9	8.2	6.7	19.3	10.4	20.6	0.2	0.7	0.1	170	170	170	0.9	2.9	0.6
Iran, Islamic Republic of +	2004	22.1	32.3	20.5	0.0	0.0	0.0	0.5	0.0	0.6	168	100	168	4.7	4.6	4.0
Israel	1999	*5.6*	*15.9*	*4.0*	40.8	30.3	42.4	18.2	30.0	16.4	250	250	100	3.5	6.9	1.8
Jamaica +	2003	7.2	15.7	5.9	62.8	41.4	66.1	0.7	0.1	0.8	75	75	40	6.9	0.7	20.7
Japan	2004	3.1	*7.3*	2.5	50.4	29.2	53.7	6.2	22.7	3.7	50	50	30	8.3	9.0	9.0
Jordan	2004	13.1	19.6	12.1	36.2	21.4	38.4	0.3	1.4	0.2	180	180	30	0.4	2.6	0.0
Kazakhstan +	1996	9.5	8.8	9.5	32.8	27.3	33.6	0.0	0.0	0.0	100	100	100	4.1	2.4	4.3
Kenya +	2004	16.8	23.6	15.7	19.7	9.1	21.4	0.3	0.1	0.3	100	100	35	0.5	0.4	0.0
Korea, Republic of	2004	11.2	41.6	6.7	13.1	2.2	14.8	0.6	3.9	0.1	887	887	50	2.7	6.5	1.5
Kuwait +	2002	3.6	1.7	3.9	12.5	77.2	2.6	2.1	4.8	1.7	100	100	4	0.2	1.4	0.0
Kyrgyz Republic	2003	5.1	7.0	4.8	42.6	26.5	45.0	0.5	2.5	0.2	30	30	15	0.0	0.0	4.7
Lao People's Democratic Republic +	2001	9.6	18.9	8.2	0.0	0.0	0.0	0.4	1.2	0.2	40	40	40	7.6	0.0	2.6
Lebanon +	2002	5.4	14.7	4.0	37.9	19.4	40.7	0.2	0.1	0.2	75	70	75	7.1	10.3	7.0
Lesotho +	2001	8.0	*8.8*	7.9	51.2	42.5	52.5	4.9	12.3	3.8	60	55	60	9.0	6.2	8.8
Libyan Arab Jamahiriya +	2002	17.0	22.4	16.3	29.7	26.6	30.1	2.2	7.8	1.4	400	300	400	5.2	3.3	9.0
Macao, China	2004	0.0	0.0	0.0	100.0	100.0	100.0	0.0	0.0	0.0	0	0	0	0.0	0.0	0.0
Madagascar	2002	5.2	5.7	5.1	37.5	28.9	38.8	0.1	0.0	0.1	25	20	25	5.4	2.3	5.9
Malawi	2003	13.2	15.1	12.9	8.5	11.0	8.1	0.3	0.3	0.3	25	25	25	0.0	0.0	0.0
Malaysia +	2003	8.4	3.3	9.1	51.3	66.2	49.0	0.9	4.9	0.3	300	114	300	7.1	9.0	7.6
Maldives	2002	20.2	18.3	20.5	0.1	0.4	0.0	0.0	0.1	0.0	200	50	200	0.9	0.0	1.1
Mali +	2004	12.0	14.3	11.6	1.3	0.0	1.5	0.0	0.0	0.0	20	20	20	0.0	0.0	0.0
Mauritania	2001	10.6	12.4	10.3	13.0	11.7	13.3	0.1	0.0	0.1	20	20	20	0.0	0.0	0.0
Mauritius	2002	17.5	19.4	17.3	56.5	41.0	58.8	0.4	0.3	0.4	80	80	80	14.6	6.7	15.0
Mexico	2003	18.0	24.5	17.1	1.2	2.3	1.0	1.1	6.5	0.3	260	260	35	0.8	4.2	0.0
Moldova +	2001	4.9	10.2	4.1	41.3	11.7	45.9	0.9	3.0	0.5	25	25	15	16.0	0.0	11.4
Mongolia	2003	5.0	5.1	4.9	1.0	0.4	1.0	0.1	0.4	0.0	15	15	5	0.0	0.0	0.0
Montserrat +	1999	*X*	*X*	*X*	4.1	9.0	3.3	65.4	41.8	69.0	52	52	40	0.0	0.0	0.0
Morocco	2002	30.2	48.6	27.5	0.0	0.0	0.0	0.3	2.4	0.0	339	339	50	1.0	3.3	0.0
Mozambique +	2003	12.4	16.6	11.7	2.1	0.4	2.4	0.0	0.0	0.0	25	25	25	0.0	0.0	0.0
Myanmar	2002	5.5	8.5	5.0	3.0	6.6	2.5	0.2	0.6	0.1	40	40	40	5.2	3.3	5.5
Namibia	2002	*5.8*	*9.1*	*5.3*	50.7	40.4	52.3	14.4	13.3	14.6	55	55	43	11.2	5.8	10.4

Tariff Profiles Table II
MFN applied tariffs (cont'd)
(Percentage)

Import markets	Year	Simple average			Duty-free HS subheadings (per cent)			Non *ad valorem* duties (per cent)			Maximum *ad valorem* duty			National peaks (per cent)		
		All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr
Nepal	2003	13.7	13.5	13.7	0.9	1.6	0.8	0.4	1.6	0.2	80	80	80	0.6	0.1	0.7
New Zealand +	2004	3.1	1.7	3.4	56.8	65.3	55.5	4.1	3.3	4.2	19	7	19	6.3	15.8	6.9
Nicaragua	2003	4.8	9.5	4.0	48.5	21.9	52.6	0.0	0.0	0.0	170	170	15	18.3	2.5	15.0
Niger +	2004	12.0	14.3	11.6	1.3	0.0	1.5	0.0	0.0	0.0	20	20	20	0.0	0.0	0.0
Nigeria	2002	29.1	50.4	25.8	0.0	0.0	0.0	0.4	0.0	0.5	150	150	100	5.2	0.0	1.2
Norway	2004	1.2	*X*	0.6	86.4	36.2	94.1	8.4	62.5	0.1	555	555	14	5.8	2.2	5.8
Oman	2001	5.7	10.2	5.0	5.0	29.8	1.2	0.0	0.0	0.0	100	100	100	1.1	7.4	0.1
Pakistan +	2004	16.5	18.7	16.2	0.7	4.9	0.0	0.0	0.3	0.0	200	200	200	0.9	2.3	0.6
Panama	2002	8.3	14.8	7.4	30.0	18.2	31.8	0.0	0.0	0.0	1000	1000	1000	1.2	3.8	0.3
Papua New Guinea +	2004	6.0	14.7	4.7	77.3	45.0	82.2	0.8	5.5	0.1	75	70	75	20.6	8.2	17.2
Paraguay	2004	10.8	10.1	10.9	10.0	2.6	11.1	0.0	0.0	0.0	30	30	28	0.0	0.0	0.0
Peru	2004	10.2	13.6	9.7	0.8	2.7	0.5	0.0	0.0	0.0	20	20	20	0.0	0.0	0.0
Philippines	2004	6.3	9.5	5.8	2.1	0.1	2.4	0.0	0.0	0.0	65	65	30	3.1	9.1	1.5
Qatar	2004	5.0	6.3	4.9	5.0	20.1	2.7	1.0	6.7	0.2	100	100	20	0.4	2.6	0.1
Romania +	2001	16.9	24.4	15.8	6.8	9.5	6.4	0.0	0.0	0.0	248	248	90	0.5	3.7	0.0
Russian Federation	2001	*9.9*	*8.9*	*10.1*	0.7	1.2	0.6	11.9	23.2	10.1	20	20	20	0.0	0.0	0.0
Rwanda	2003	17.4	13.5	18.0	5.0	0.0	5.7	0.4	0.0	0.4	30	30	30	0.0	0.0	0.0
Saint Kitts and Nevis	2002	9.3	13.1	8.8	24.0	23.9	24.0	0.4	1.9	0.2	400	400	70	4.4	9.7	3.6
Saint Lucia	2002	8.9	14.8	8.0	40.0	27.9	41.9	0.0	0.0	0.0	95	45	95	7.3	1.3	11.4
Saint Vincent and the Grenadines +	2003	9.8	15.6	8.9	7.6	9.3	7.3	0.6	1.9	0.4	40	40	40	5.0	0.0	2.4
Saudi Arabia +	2004	6.0	6.6	6.0	4.8	19.0	2.7	1.2	8.0	0.2	100	100	20	3.8	6.1	3.5
Senegal +	2004	12.0	14.3	11.6	1.3	0.0	1.5	0.0	0.0	0.0	20	20	20	0.0	0.0	0.0
Serbia and Montenegro +	2002	9.4	15.9	8.4	0.0	0.0	0.0	0.0	0.0	0.0	30	30	30	7.2	0.0	4.2
Seychelles +	2001	28.3	38.4	26.8	0.6	4.4	0.0	1.6	2.7	1.4	225	205	225	4.5	4.7	4.1
Sierra Leone	2004	13.7	16.4	13.3	0.4	0.6	0.4	0.0	0.0	0.0	30	30	30	0.0	0.0	0.0
Singapore	2004	0.0	0.0	0.0	100.0	99.7	100.0	0.0	0.3	0.0	0	0	0	0.0	0.0	0.0
Solomon Islands	1998	22.2	34.0	20.5	0.0	0.0	0.0	1.4	3.6	1.1	70	70	70	7.2	0.0	5.5
South Africa	2002	*5.8*	*9.1*	*5.3*	50.7	40.4	52.3	14.4	13.3	14.6	55	55	43	11.2	5.8	10.4
Sri Lanka +	2004	10.1	22.5	8.3	11.6	4.1	12.8	0.7	5.2	0.0	250	250	28	0.2	1.2	10.4
Sudan +	2002	24.5	34.6	22.9	0.4	1.2	0.3	0.0	0.0	0.0	45	45	45	0.0	0.0	0.0

Import markets	Year	Simple average			Duty-free HS subheadings (per cent)			Non *ad valorem* duties (per cent)			Maximum *ad valorem* duty			National peaks (per cent)		
		All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr	All	Agr	Non-agr
Suriname +	2000	*X*	*X*	*X*	3.9	8.4	3.2	81.7	51.0	86.4	50	50	40	0.0	0.0	0.0
Swaziland	2002	*5.8*	*9.1*	*5.3*	50.7	40.4	52.3	14.4	13.3	14.6	55	55	43	11.2	5.8	10.4
Switzerland	2004	*X*	*X*	*X*	16.4	19.8	15.9	83.6	80.2	84.1	0	0	0	0.0	0.0	0.0
Syrian Arab Republic +	2002	19.6	20.6	19.5	0.8	0.0	0.9	0.5	0.3	0.5	200	150	200	7.4	5.2	7.7
Taipei, Chinese	2003	6.9	16.3	5.5	15.6	23.2	14.4	2.3	11.1	0.9	740	740	98	3.5	3.8	2.5
Tajikistan +	2002	8.3	9.4	8.1	0.9	1.5	0.8	0.6	4.9	0.0	30	20	30	2.3	0.0	2.7
Tanzania	2003	13.6	18.1	12.9	32.1	20.5	33.9	0.0	0.0	0.0	25	25	25	0.0	0.0	0.0
Thailand +	2003	15.4	29.6	13.3	3.4	2.9	3.5	1.6	7.5	0.7	80	65	80	2.5	0.0	0.8
Togo +	2004	12.0	14.3	11.6	1.3	0.0	1.5	0.0	0.0	0.0	20	20	20	0.0	0.0	0.0
Trinidad and Tobago	2004	7.8	15.8	6.6	49.2	38.9	50.8	0.3	2.3	0.0	45	40	45	6.9	0.0	21.1
Tunisia	2004	28.3	66.5	22.4	12.2	4.9	13.3	0.0	0.0	0.0	200	200	43	3.8	3.2	0.0
Turkey +	2003	10.1	42.3	5.3	16.6	13.0	17.2	1.7	8.2	0.7	228	228	83	6.9	8.2	3.3
Turkmenistan +	2002	5.1	13.2	3.9	84.0	63.8	87.1	0.6	3.0	0.3	150	150	100	11.9	11.4	10.4
Uganda +	2004	7.8	12.0	7.2	30.4	4.9	34.3	0.1	0.7	0.0	15	15	15	0.0	0.0	0.0
Ukraine +	2002	*7.1*	*X*	6.9	17.3	10.9	18.2	11.1	65.9	2.7	70	70	50	4.9	1.2	4.5
United States	2004	*3.7*	*X*	3.3	37.3	26.2	39.0	10.7	49.9	4.8	350	350	48	6.7	1.9	8.4
Uruguay +	2004	13.3	12.0	13.5	2.2	2.7	2.2	0.0	0.0	0.0	55	55	23	0.0	0.0	0.0
Uzbekistan +	2001	11.0	10.5	11.1	40.1	55.8	37.7	0.0	0.0	0.0	100	30	100	0.1	0.0	0.1
Vanuatu +	2002	13.8	15.5	13.6	20.1	31.2	18.4	2.2	8.4	1.2	250	55	250	1.0	3.5	0.5
Venezuela	2003	12.7	14.8	12.4	0.6	0.0	0.7	0.0	0.0	0.0	35	20	35	0.0	0.0	0.0
Viet Nam +	2004	16.8	24.5	15.7	30.6	10.3	33.7	0.4	3.3	0.0	150	100	150	0.9	2.6	9.3
Yemen +	2000	12.8	15.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	90	25	90	0.4	0.0	0.4
Zambia +	2003	14.0	18.7	13.2	15.7	1.6	17.8	0.0	0.0	0.0	25	25	25	0.0	0.0	0.0
Zimbabwe	2002	16.6	25.7	15.2	4.1	1.3	4.5	7.4	4.1	7.9	100	100	80	1.1	1.7	1.1

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO-IDB and UN Tariff and Market Access Database for those indicated with "+".

Tariff Profiles Table III
Average MFN applied and bound tariffs for agricultural products by category

Import markets	(12) Fruit and vegetables		(13) Coffee, tea, maté,cocoa and preparations		(14) Sugars and sugar confectionery		(15) Spices, cereal and other food preparations		(16) Grains		(17) Animals and products thereof	
	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound
Albania	11.0	12.0	11.9	14.2	6.3	7.3	11.0	12.5	2.0	5.0	9.0	10.0
Algeria +	28.5	-	26.5	-	25.0	-	28.9	-	8.9	-	28.0	-
Angola +	6.3	49.7	18.5	55.0	5.0	55.0	15.0	55.0	2.0	50.0	10.3	53.5
Antigua and Barbuda +	20.5	116.8	10.5	100.0	20.0	100.0	17.2	100.0	8.0	100.0	21.7	104.1
Argentina +	12.3	34.2	15.3	34.2	19.5	33.9	14.6	33.8	6.9	31.1	10.8	27.6
Armenia	9.9	15.0	9.6	14.2	8.8	14.7	7.6	15.0	0.0	15.0	7.9	14.9
Australia	1.8	4.1	1.0	3.9	1.9	*7.3*	1.2	2.2	0.0	0.8	0.4	1.6
Azerbaijan +	*14.2*	-	14.8	-	13.1	-	14.5	-	10.1	-	*13.7*	-
Bahamas	26.1	-	17.6	-	21.5	-	27.3	-	17.2	-	8.9	-
Bahrain	3.1	35.0	3.1	35.0	3.8	35.0	4.3	35.0	0.6	35.0	3.4	35.0
Bangladesh +	25.3	189.2	29.2	187.5	30.0	190.6	23.9	195.6	6.3	158.1	20.7	192.6
Barbados	38.1	108.0	16.8	100.0	21.6	105.5	20.0	100.1	8.5	100.0	80.5	137.1
Belarus	*12.0*	-	*7.5*	-	*X*	-	*10.1*	-	5.0	-	*X*	-
Belize +	24.5	101.9	9.2	100.0	20.8	100.6	19.0	99.8	10.5	103.1	28.3	104.8
Benin	19.4	60.0	15.6	60.0	11.3	60.0	16.6	59.7	5.9	60.0	19.0	60.0
Bermuda +	4.7	-	8.7	-	13.6	-	5.4	-	0.0	-	5.0	-
Bhutan +	49.3	-	38.3	-	30.0	-	37.0	-	50.0	-	30.0	-
Bolivia +	10.0	40.0	10.0	40.0	10.0	40.0	10.0	40.0	10.0	40.0	9.9	39.8
Bosnia and Herzegovina +	5.5	-	4.0	-	6.4	-	4.7	-	1.8	-	7.9	-
Botswana	*10.3*	30.1	*9.2*	68.9	*4.2*	73.7	*10.6*	41.2	*2.5*	28.8	*16.1*	44.2
Brazil	10.8	34.3	13.3	34.1	16.5	34.4	12.6	40.5	5.9	48.3	8.9	38.2
Brunei Darussalam +	0.0	27.5	*X*	*X*	0.0	27.5	0.0	21.3	0.0	27.5	0.0	26.9
Bulgaria	27.9	*47.7*	23.9	*X*	*21.0*	*X*	22.3	*48.0*	16.4	27.7	*X*	*X*
Burkina Faso	19.4	100.0	15.6	100.0	11.3	100.0	16.2	98.4	5.9	100.0	18.8	100.0
Burundi	39.2	100.0	40.0	97.9	29.7	82.8	36.0	95.5	40.0	100.0	40.0	100.0
Cambodia +	13.7	27.0	27.0	36.6	12.3	27.8	23.6	33.2	11.9	18.6	29.3	33.4
Cameroon	29.8	80.0	29.9	80.0	20.0	80.0	25.4	80.0	15.5	80.0	21.5	80.0
Canada	*2.9*	*3.0*	1.4	*1.8*	*4.0*	*X*	*3.7*	*4.3*	*11.5*	*15.5*	*3.8*	*X*
Central African Republic +	29.8	30.0	29.9	30.0	20.0	30.0	25.4	30.0	15.5	30.0	21.5	30.0
Chad +	29.8	80.0	29.9	80.0	20.0	80.0	25.4	80.0	15.5	80.0	21.5	80.0
Chile	6.0	25.0	6.0	25.0	6.0	43.3	6.0	25.1	6.0	25.4	6.0	25.0
China	16.0	16.1	15.1	14.9	27.4	27.4	20.4	20.4	30.5	27.1	14.9	14.8
Colombia	16.7	72.8	17.9	70.0	16.8	106.8	17.0	96.4	13.0	138.0	24.3	98.9
Congo +	29.8	30.0	29.9	30.0	20.0	30.0	25.4	30.0	15.5	30.0	21.5	30.0
Costa Rica +	13.9	43.1	13.4	46.0	20.5	45.0	10.5	42.1	11.1	34.0	21.3	57.0
Croatia	*11.6*	*11.9*	*7.8*	8.0	*12.7*	*14.9*	*8.8*	*11.0*	6.7	*7.7*	*X*	*X*
Cuba	10.1	39.1	21.0	40.0	20.3	40.0	13.0	38.0	6.0	35.3	9.6	39.5
Côte d'Ivoire +	19.4	15.0	15.6	15.0	11.3	15.0	16.6	14.5	5.9	15.0	19.0	13.4
Democratic Republic of the Congo +	15.6	100.0	16.9	100.0	13.1	100.0	15.1	97.2	7.5	65.0	13.4	100.0
Djibouti +	11.0	40.0	31.4	40.0	21.3	40.0	22.3	39.6	5.0	40.0	17.0	40.0
Dominica +	29.9	112.0	28.1	118.8	19.5	112.5	20.0	112.6	8.0	112.5	15.8	118.5
Dominican Republic	19.5	41.6	18.3	40.0	14.6	46.3	13.2	38.8	5.2	51.3	22.3	41.5
Ecuador +	15.9	24.9	17.9	26.7	14.5	35.4	17.0	26.5	12.2	31.2	17.1	29.7
Egypt +	28.4	40.1	28.2	36.9	20.9	37.5	22.9	31.0	7.8	11.3	32.4	44.6
El Salvador +	12.9	39.3	13.4	51.3	27.1	66.3	10.5	35.8	12.4	36.6	20.5	51.5
Equatorial Guinea +	29.8	-	29.9	-	20.0	-	25.4	-	15.5	-	21.5	-
Eritrea +	19.0	-	15.6	-	4.9	-	8.2	-	2.0	-	8.3	-
Ethiopia +	22.4	-	37.7	-	9.4	-	30.9	-	5.0	-	20.2	-
European Communities	*9.8*	*9.9*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO, CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

Tariff Profiles Table III
Average MFN applied and bound tariffs for agricultural products by category (cont'd)

(18) Oil seeds, fats & oils & their products		(19) Cut flowers, plants, vegetable materials; lacs, etc.		(20) Beverages and spirits		(21) Dairy products		(22) Tobacco		(23) Other agricultural products		Import markets
Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	
6.6	2.8	8.6	9.6	14.7	11.6	10.8	10.0	10.4	15.3	6.0	6.6	Albania
19.5	-	7.9	-	27.0	-	22.4	-	25.0	-	14.4	-	Algeria +
5.0	48.6	5.7	55.0	23.4	55.0	5.0	55.0	23.3	55.0	8.1	55.0	Angola +
16.4	101.5	3.7	100.0	21.2	114.1	5.2	100.0	20.6	101.6	3.3	100.0	Antigua and Barbuda +
9.6	34.6	7.6	31.9	19.3	35.0	17.1	35.0	18.8	35.0	8.8	30.5	Argentina +
5.7	13.6	5.3	15.0	*X*	15.0	10.0	15.0	*0.0*	15.0	1.8	14.6	Armenia
1.5	2.9	0.2	1.2	4.3	9.7	*0.2*	*0.9*	0.0	*14.9*	0.3	2.2	Australia
8.8	-	*11.3*	-	*X*	-	14.9	-	*15.0*	-	11.9	-	Azerbaijan +
20.0	-	25.1	-	23.8	-	16.5	-	61.7	-	33.3	-	Bahamas
4.9	35.0	4.4	35.0	52.6	114.8	5.0	35.0	*X*	56.7	5.0	35.0	Bahrain
16.2	186.5	12.8	200.0	29.6	200.0	29.3	149.8	25.0	200.0	11.7	184.8	Bangladesh +
22.4	136.6	6.8	100.0	*46.1*	102.7	53.9	116.4	*X*	100.0	5.6	100.4	Barbados
8.3	-	*9.3*	-	*X*	-	*X*	-	*12.5*	-	6.4	-	Belarus
15.6	100.1	6.4	100.0	41.7	104.0	5.2	100.0	*X*	106.7	5.1	100.4	Belize +
10.7	81.4	5.9	60.0	19.9	58.4	16.3	38.8	12.2	64.4	6.8	60.3	Benin
5.9	-	15.6	-	*X*	-	3.0	-	*X*	-	14.3	-	Bermuda +
44.1	-	31.8	-	77.4	-	50.0	-	100.0	-	29.6	-	Bhutan +
10.0	40.0	10.0	40.0	10.0	40.0	10.0	40.0	10.0	40.0	10.0	40.0	Bolivia +
2.5	-	0.7	-	14.4	-	9.9	-	15.0	-	1.3	-	Bosnia and Herzegovina +
7.7	45.6	5.1	8.9	*18.9*	123.9	*X*	20.0	*35.3*	50.7	2.3	14.8	Botswana
7.8	34.6	5.9	33.0	17.5	38.2	18.3	48.9	16.8	37.9	7.3	28.9	Brazil
0.0	20.0	0.0	20.0	*X*	20.0	0.0	21.0	*X*	*X*	0.1	20.0	Brunei Darussalam +
10.1	22.9	3.9	11.2	*X*	*X*	38.6	79.8	34.7	*X*	6.2	20.0	Bulgaria
10.5	98.8	5.9	100.0	20.0	97.1	16.3	62.8	12.2	77.8	6.8	100.0	Burkina Faso
23.8	99.4	27.6	91.6	39.0	78.5	40.0	22.5	40.0	100.0	21.8	99.6	Burundi
9.5	22.8	17.4	21.1	42.3	43.7	30.8	36.5	33.6	45.6	15.7	20.9	Cambodia +
19.3	80.0	10.1	80.0	28.8	80.0	25.0	80.0	20.4	80.0	13.2	80.0	Cameroon
3.3	3.6	0.7	0.8	*X*	*X*	*X*	*X*	7.3	7.3	0.8	1.4	Canada
19.3	30.0	10.1	30.0	28.8	30.0	25.0	30.0	20.4	30.0	13.2	30.0	Central African Republic +
19.3	80.0	10.1	80.0	28.8	80.0	25.0	80.0	20.4	80.0	13.2	80.0	Chad +
6.0	29.1	6.0	25.0	6.0	25.0	6.0	29.2	6.0	25.0	6.0	25.0	Chile
13.3	11.6	10.1	9.9	23.3	21.4	13.8	12.2	30.7	33.3	12.3	12.0	China
16.1	132.5	8.7	71.8	18.9	91.6	19.3	136.7	17.2	70.0	9.4	79.4	Colombia
19.3	30.0	10.1	30.0	28.8	30.0	25.0	30.0	20.4	30.0	13.2	30.0	Congo +
6.5	27.6	1.9	37.4	13.7	47.1	49.6	84.8	12.6	41.7	3.1	35.5	Costa Rica +
4.0	3.1	6.6	6.5	*19.5*	*10.3*	*X*	*X*	21.4	24.1	2.8	3.7	Croatia
8.2	36.0	5.7	38.8	25.0	39.5	22.4	40.0	30.0	40.0	4.4	30.5	Cuba
10.7	14.6	5.9	15.0	19.9	14.8	16.3	9.1	12.2	48.4	6.8	14.9	Côte d'Ivoire +
12.2	100.0	6.6	100.0	19.2	100.0	13.5	80.0	15.0	100.0	7.9	100.0	Democratic Republic of the Congo +
21.5	41.4	25.3	40.0	32.7	190.6	18.1	45.2	*33.0*	51.1	27.1	40.0	Djibouti +
23.5	119.7	4.6	102.9	60.3	124.2	5.7	100.0	30.0	116.7	3.5	103.8	Dominica +
5.9	37.5	6.2	35.9	19.1	40.0	18.7	42.4	17.3	36.7	2.8	36.2	Dominican Republic
15.5	28.5	8.2	18.9	19.0	25.6	18.9	42.8	17.2	27.2	8.7	18.5	Ecuador +
10.9	19.7	15.1	19.6	41.8	1427.1	18.8	23.5	*X*	*X*	13.7	20.7	Egypt +
6.0	49.8	1.9	27.2	19.4	50.6	28.7	38.9	10.1	74.0	3.1	35.7	El Salvador +
19.3	-	10.1	-	28.8	-	25.0	-	20.4	-	13.2	-	Equatorial Guinea +
6.0	-	3.4	-	24.2	-	10.0	-	17.3	-	2.6	-	Eritrea +
19.5	-	17.8	-	34.7	-	27.5	-	26.7	-	14.5	-	Ethiopia +
3.3	3.2	2.5	2.4	*X*	*X*	*X*	*X*	*X*	*X*	*1.3*	*1.3*	European Communities

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO, CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

Tariff Profiles Table III
Average MFN applied and bound tariffs for agricultural products by category (cont'd)

Import markets	(12) Fruit and vegetables		(13) Coffee, tea, maté,cocoa and preparations		(14) Sugars and sugar confectionery		(15) Spices, cereal and other food preparations		(16) Grains		(17) Animals and products thereof	
	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound
Fiji	6.4	40.0	10.6	40.0	27.0	40.0	10.1	40.2	5.6	41.5	14.4	40.0
Former Yugoslav Republic of Macedonia +	25.6	23.6	*14.0*	*12.4*	*7.5*	*6.6*	*12.8*	*11.4*	11.0	11.0	*11.3*	*11.3*
Gabon +	29.8	60.0	29.9	60.0	20.0	60.0	25.4	60.0	15.5	60.0	21.5	60.0
Gambia	17.9	110.0	16.3	110.0	14.5	110.0	16.5	110.0	13.5	110.0	14.4	110.0
Georgia	13.7	13.7	12.3	12.3	11.2	11.6	14.0	14.0	11.9	11.9	11.9	11.8
Ghana +	19.9	99.0	20.0	90.8	11.3	99.0	18.6	98.3	16.9	87.9	19.4	97.5
Grenada +	25.8	106.5	16.3	116.7	20.3	100.0	17.2	108.9	8.0	78.1	22.2	97.9
Guatemala	13.0	44.9	13.4	40.0	11.1	70.0	10.5	39.5	10.5	66.4	12.3	76.0
Guinea	7.0	40.0	7.0	40.0	7.0	40.0	7.0	39.4	5.8	40.0	6.0	40.0
Guinea-Bissau +	19.4	40.0	15.6	40.0	11.3	40.0	16.6	40.0	5.9	40.0	19.0	40.0
Guyana	26.0	100.0	16.8	100.0	20.9	100.0	17.9	100.0	9.8	100.0	26.5	100.0
Haiti	...	*33.5*	...	24.2	...	40.0	...	*26.7*	...	36.3	...	*20.4*
Honduras	12.8	32.4	13.7	33.5	11.5	35.0	10.6	33.1	12.2	32.4	14.4	28.8
Hong Kong, China	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iceland	*8.4*	*31.3*	*5.0*	17.2	2.4	88.1	*6.1*	*54.9*	18.9	87.5	*X*	*X*
India +	32.4	105.4	56.3	133.1	48.4	124.7	34.6	126.5	49.4	86.3	33.0	105.0
Indonesia	5.0	47.0	4.9	45.3	9.5	58.3	5.2	39.9	*2.6*	68.4	4.4	44.0
Iran, Islamic Republic of +	40.4	-	31.3	-	32.4	-	35.2	-	19.2	-	38.4	-
Israel	*X*	117.0	*1.3*	9.1	*1.3*	9.7	*10.3*	52.0	5.1	37.2	*28.5*	111.4
Jamaica +	25.0	100.0	15.6	100.0	19.1	100.0	15.1	100.0	6.7	100.0	22.8	100.0
Japan	8.4	8.4	11.7	*11.4*	*X*	*X*	*12.6*	*11.1*	*1.0*	*1.5*	*7.0*	*8.8*
Jordan	26.2	24.3	23.1	20.5	12.7	19.1	19.9	21.1	6.3	7.5	14.9	14.2
Kazakhstan +	12.9	-	3.6	-	6.4	-	8.8	-	0.8	-	14.3	-
Kenya +	31.8	100.0	17.5	100.0	34.5	100.0	23.0	100.0	24.7	100.0	27.4	100.0
Korea, Republic of	53.4	*60.4*	53.9	74.1	19.0	24.6	92.6	130.7	186.3	249.8	22.1	27.3
Kuwait +	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	*0.0*	100.0	0.0	100.0
Kyrgyz Republic	10.2	16.8	7.7	10.6	5.6	9.7	7.9	12.4	4.6	9.7	7.5	10.4
Lao People's Democratic Republic +	33.3	-	25.0	-	12.7	-	11.2	-	5.0	-	25.8	-
Lebanon +	34.4	-	7.7	-	7.2	-	8.1	-	3.1	-	10.9	-
Lesotho +	10.7	200.0	*9.2*	200.0	*4.2*	200.0	*10.0*	200.0	*2.5*	200.0	16.4	200.0
Libyan Arab Jamahiriya +	32.2	-	14.4	-	26.6	-	13.2	-	4.7	-	*29.9*	-
Macao, China	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Madagascar	8.8	30.0	11.1	30.0	5.5	30.0	7.7	30.0	0.3	30.0	4.4	30.0
Malawi	20.4	125.0	21.9	95.2	17.5	125.0	22.0	125.0	5.0	99.1	13.0	125.0
Malaysia +	5.3	*X*	14.2	*18.5*	2.8	*X*	3.9	*9.3*	0.0	10.8	0.5	34.4
Maldives	15.1	30.0	16.7	30.0	13.1	30.0	15.2	31.5	14.1	30.0	21.6	90.6
Mali +	19.4	60.0	15.6	60.0	11.3	60.0	16.6	59.2	5.9	60.0	19.0	60.0
Mauritania	17.9	36.3	15.1	46.7	6.3	50.0	14.6	40.7	7.3	75.0	16.8	42.0
Mauritius	24.3	117.8	30.4	118.7	41.9	122.0	22.2	122.0	4.4	100.8	26.7	119.9
Mexico	21.5	37.6	*42.1*	*40.0*	*X*	*X*	*19.7*	36.9	32.7	*37.0*	42.3	*36.5*
Moldova +	13.0	14.9	8.1	10.6	15.0	13.8	10.1	12.7	6.3	10.9	12.8	*14.5*
Mongolia	5.2	18.4	5.0	19.7	5.0	19.7	5.3	19.5	5.0	17.7	4.8	14.4
Montserrat +	*30.6*	-	*21.3*	-	*28.5*	-	*26.1*	-	*9.4*	-	14.0	-
Morocco	48.6	34.0	43.3	34.0	*35.1*	134.5	47.0	51.2	*18.5*	82.9	126.9	103.9
Mozambique +	24.1	100.0	21.3	100.0	10.1	100.0	19.5	100.0	8.8	100.0	22.6	100.0
Myanmar	13.1	152.0	14.0	151.3	*7.3*	*89.4*	7.9	98.1	0.9	11.5	11.4	127.3
Namibia	*10.3*	30.1	*9.2*	68.9	*4.2*	73.7	*10.6*	41.2	*2.5*	30.8	*16.1*	44.2
Nepal	13.6	42.9	23.8	40.8	16.6	45.0	15.2	42.5	10.0	52.5	10.9	35.9
New Zealand +	1.7	6.6	3.2	8.9	1.7	3.7	4.0	11.0	0.0	0.8	1.8	7.1
Nicaragua	12.6	40.5	12.7	40.0	18.0	55.0	8.8	40.9	16.7	45.6	12.8	51.9

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO, CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

Tariff Profiles Table III
Average MFN applied and bound tariffs for agricultural products by category (cont'd)

(18) Oil seeds, fats & oils & their products		(19) Cut flowers, plants, vegetable materials; lacs, etc.		(20) Beverages and spirits		(21) Dairy products		(22) Tobacco		(23) Other agricultural products		Import markets
Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	
5.6	40.0	3.0	40.0	*X*	*48.8*	10.7	40.3	*X*	*X*	3.3	40.0	Fiji
1.8	1.4	3.5	3.5	*29.7*	*16.2*	*16.1*	*16.1*	34.9	34.9	1.7	1.5	Former Yugoslav Republic of Macedonia +
19.3	60.0	10.1	60.0	28.8	60.0	25.0	60.0	20.4	60.0	13.2	60.0	Gabon +
14.7	110.0	10.5	110.0	17.5	110.0	10.8	110.0	14.4	110.0	11.8	76.8	Gambia
4.2	3.6	11.2	12.0	*X*	*X*	12.1	12.1	24.0	24.0	9.8	10.3	Georgia
14.8	96.7	15.0	99.0	19.8	99.0	20.0	75.4	20.0	99.0	13.4	98.6	Ghana +
17.6	98.1	6.4	101.0	27.5	88.0	6.0	100.0	25.0	100.0	5.2	96.2	Grenada +
5.9	63.6	1.9	40.0	25.3	39.1	13.2	90.6	9.0	90.0	3.1	39.3	Guatemala
6.4	39.5	7.0	40.0	6.8	39.0	4.8	26.8	7.0	59.7	6.5	40.0	Guinea
10.7	40.0	5.9	40.0	19.9	40.0	16.3	40.0	12.2	40.0	6.8	40.0	Guinea-Bissau +
18.0	100.0	6.4	100.0	62.3	100.0	14.3	100.0	68.3	100.0	5.2	100.0	Guyana
...	14.6	...	6.4	...	*25.1*	...	*12.5*	...	31.1	...	10.8	Haiti
6.3	32.5	1.8	33.7	14.4	33.0	12.9	24.3	12.9	43.3	3.1	32.9	Honduras
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Hong Kong, China
8.0	99.2	*X*	*X*	9.4	9.5	*X*	*X*	1.1	17.5	5.2	24.4	Iceland
52.5	168.9	25.9	85.1	78.4	125.8	35.0	65.0	30.0	133.3	24.6	101.0	India +
3.8	39.9	5.8	40.7	67.9	98.1	5.0	74.0	10.7	40.0	4.3	40.2	Indonesia
17.5	-	17.5	-	76.9	-	36.3	-	6.0	-	19.0	-	Iran, Islamic Republic of +
3.5	37.7	4.9	50.4	*X*	132.7	*111.0*	168.1	*X*	125.0	3.0	32.2	Israel
16.1	100.0	2.7	97.1	23.5	100.0	25.1	100.0	20.0	100.0	1.7	87.5	Jamaica +
2.2	*2.0*	1.4	1.4	*13.7*	*15.6*	*28.0*	*X*	4.2	4.7	1.4	1.1	Japan
10.2	17.4	11.8	17.8	76.4	105.8	17.9	16.1	55.3	135.6	5.0	12.9	Jordan
1.9	-	6.7	-	13.4	-	12.8	-	20.6	-	5.6	-	Kazakhstan +
13.3	100.0	8.7	100.0	29.8	100.0	59.4	100.0	26.7	100.0	12.9	100.0	Kenya +
13.7	22.2	27.8	35.1	31.4	37.4	67.5	69.8	32.9	59.9	10.2	14.5	Korea, Republic of
0.0	100.0	2.3	100.0	*X*	100.0	0.0	100.0	73.3	100.0	2.8	100.0	Kuwait +
6.0	11.0	6.0	9.9	*X*	*X*	10.0	11.5	7.8	12.3	2.4	10.8	Kyrgyz Republic
11.8	-	13.7	-	31.7	-	8.3	-	28.9	-	8.9	-	Lao People's Democratic Republic +
7.3	-	9.6	-	26.2	-	21.0	-	3.3	-	3.9	-	Lebanon +
7.6	200.0	4.2	200.0	*19.0*	200.0	0.0	200.0	*29.5*	200.0	2.2	200.0	Lesotho +
10.9	-	16.0	-	*54.2*	-	3.9	-	*X*	-	24.2	-	Libyan Arab Jamahiriya +
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Macao, China
4.7	30.0	1.2	30.0	9.3	30.0	5.9	30.0	8.3	30.0	1.6	30.0	Madagascar
10.1	123.0	5.0	114.1	22.7	125.0	16.0	111.8	22.7	125.0	7.8	122.7	Malawi
1.7	*6.0*	0.0	4.9	*X*	*X*	3.6	*X*	*X*	*X*	0.7	5.5	Malaysia +
14.1	30.0	23.4	30.0	29.2	169.4	10.0	30.0	*50.0*	300.0	21.4	33.1	Maldives
10.7	59.3	5.9	60.0	19.9	58.4	16.3	38.8	12.2	64.4	6.8	60.0	Mali +
7.0	28.5	6.2	33.3	17.7	56.8	17.2	20.8	18.4	69.4	5.0	29.2	Mauritania
2.4	121.5	6.2	122.0	54.5	122.0	8.9	105.0	71.7	122.0	4.3	122.0	Mauritius
20.4	38.0	13.4	28.8	26.0	40.4	*42.2*	*33.8*	53.1	52.5	11.7	27.2	Mexico
10.5	11.1	6.6	11.3	*X*	*X*	15.0	*11.5*	*2.5*	*10.0*	5.9	9.3	Moldova +
5.0	19.5	5.0	20.0	5.0	23.2	5.0	16.4	5.0	32.2	5.0	19.5	Mongolia
23.4	-	*X*	-	*29.2*	-	*7.5*	-	*X*	-	*X*	-	Montserrat +
27.8	81.2	30.2	34.1	50.2	34.0	80.5	77.0	22.5	34.0	20.3	33.0	Morocco
11.0	100.0	4.3	100.0	23.4	100.0	20.2	100.0	17.7	100.0	6.0	100.0	Mozambique +
1.7	23.7	4.5	52.8	24.2	326.5	3.3	40.1	25.0	275.0	3.1	41.9	Myanmar
7.7	47.3	5.1	8.9	*18.9*	123.9	*X*	94.8	*35.3*	50.7	2.3	15.1	Namibia
11.2	34.6	9.9	32.1	*40.0*	67.6	14.3	45.8	*35.8*	166.7	7.5	30.7	Nepal
0.8	2.0	0.1	0.4	*4.2*	12.6	1.5	10.1	*1.4*	8.8	0.4	1.3	New Zealand +
5.6	41.8	1.5	40.0	13.7	41.5	19.4	66.3	7.9	63.3	2.8	40.0	Nicaragua

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO, CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

Tariff Profiles Table III
Average MFN applied and bound tariffs for agricultural products by category (cont'd)

Import markets	(12) Fruit and vegetables		(13) Coffee, tea, maté,cocoa and preparations		(14) Sugars and sugar confectionery		(15) Spices, cereal and other food preparations		(16) Grains		(17) Animals and products thereof	
	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound
Niger +	19.4	84.0	15.6	50.0	11.3	200.0	16.6	79.9	5.9	50.0	19.0	146.3
Nigeria	98.2	150.0	42.5	150.0	33.8	150.0	46.4	150.0	49.4	150.0	34.5	150.0
Norway	*X*	*X*	*0.0*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*
Oman	3.2	21.0	4.2	15.0	4.7	13.4	4.7	14.6	1.3	10.9	24.3	60.6
Pakistan +	19.1	100.3	20.1	108.3	22.3	112.5	19.5	100.0	10.6	112.5	16.7	100.0
Panama	12.5	25.9	12.2	30.6	24.8	40.2	10.8	25.6	28.5	32.6	18.6	33.2
Papua New Guinea +	33.5	64.5	26.0	58.3	22.1	75.0	13.9	45.2	0.0	29.4	*10.0*	*32.4*
Paraguay	10.3	32.1	12.9	34.2	19.7	34.7	12.5	34.6	5.7	32.5	8.9	33.2
Peru	17.8	30.0	17.0	30.0	12.5	34.8	14.1	31.7	10.1	43.1	16.5	30.0
Philippines	10.8	39.1	14.9	41.2	15.2	44.7	8.6	36.6	15.7	36.7	21.0	36.6
Qatar	3.1	14.9	3.1	19.9	3.8	20.0	4.3	17.1	0.6	11.8	*3.1*	50.8
Romania +	22.1	74.5	19.2	67.7	27.2	139.8	19.6	117.3	11.1	109.0	31.2	154.1
Russian Federation	*11.9*	-	*7.5*	-	*X*	-	*10.1*	-	5.0	-	*X*	-
Rwanda	12.1	75.4	20.7	80.0	9.4	69.0	16.7	73.3	7.2	80.0	14.9	80.0
Saint Kitts and Nevis	16.2	115.6	*14.0*	99.0	20.9	107.5	21.8	112.5	7.0	100.5	12.6	98.8
Saint Lucia	25.1	121.5	13.4	102.5	18.9	107.5	16.7	114.8	8.0	107.5	11.8	124.6
Saint Vincent and the Grenadines +	26.0	121.5	16.8	102.5	19.8	107.5	17.2	114.8	8.0	107.5	12.1	124.6
Saudi Arabia +	3.6	-	5.7	-	6.1	-	7.1	-	5.3	-	*6.8*	-
Senegal +	19.4	30.0	15.6	30.0	11.3	30.0	16.6	29.9	5.9	28.1	19.0	30.0
Serbia and Montenegro +	19.9	-	13.8	-	11.9	-	20.6	-	17.1	-	26.2	-
Seychelles +	32.2	-	50.0	-	41.7	-	38.7	-	21.9	-	25.7	-
Sierra Leone	20.0	39.8	19.7	39.8	16.3	40.0	17.9	39.5	9.0	40.0	19.1	40.0
Singapore	0.0	9.5	0.0	10.0	0.0	10.0	0.0	9.7	0.0	10.0	0.0	9.1
Solomon Islands	46.5	80.0	28.3	80.0	30.7	61.3	26.5	72.0	5.0	71.9	53.0	87.0
South Africa	*10.3*	30.1	*9.2*	68.9	*4.2*	73.7	*10.6*	41.2	*2.5*	30.8	*16.1*	44.2
Sri Lanka +	27.0	50.0	28.0	50.0	*19.4*	50.0	24.6	49.7	15.7	50.0	26.1	49.9
Sudan +	43.8	-	30.8	-	25.7	-	30.5	-	14.1	-	40.0	-
Suriname +	*X*	20.0	*X*	20.0	*30.0*	20.0	*X*	19.9	*9.4*	20.0	*17.2*	20.0
Swaziland	*10.3*	30.1	*9.2*	68.9	*4.2*	73.7	*10.6*	41.2	*2.5*	30.8	*16.1*	44.2
Switzerland	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*
Syrian Arab Republic +	30.8	-	30.7	-	18.4	-	21.1	-	7.2	-	12.5	-
Taipei, Chinese	*21.4*	*20.2*	*9.5*	*8.4*	53.3	49.5	*14.0*	*13.6*	*2.6*	*2.8*	*40.9*	*37.6*
Tajikistan +	14.0	-	7.7	-	5.0	-	7.3	-	5.0	-	12.9	-
Tanzania	24.3	120.0	23.3	120.0	23.1	120.0	24.0	120.0	13.9	120.0	23.9	120.0
Thailand +	43.9	*X*	31.3	*X*	*26.6*	48.9	29.2	*X*	*X*	35.7	31.4	*29.6*
Togo +	19.4	80.0	15.6	80.0	11.3	80.0	16.6	80.0	5.9	80.0	19.0	80.0
Trinidad and Tobago	24.1	97.5	15.6	80.7	18.9	100.0	16.2	96.0	7.0	63.4	23.9	91.8
Tunisia	111.8	141.4	41.3	85.6	34.3	100.0	73.2	128.4	56.4	73.7	90.8	109.4
Turkey +	38.2	40.4	*X*	80.2	*53.8*	114.8	*30.0*	51.4	30.3	146.3	128.6	138.4
Turkmenistan +	37.7	-	0.0	-	1.9	-	8.5	-	6.3	-	0.6	-
Uganda +	15.0	79.2	10.0	77.9	11.0	78.1	11.2	78.1	8.2	73.8	13.0	73.3
Ukraine +	*X*	-	*X*	-	*X*	-	*X*	-	*8.8*	-	*X*	-
United Arab Emirates	...	15.0	...	15.0	...	15.0	...	15.0	...	15.0	...	37.8
United States	*X*	*X*	*2.6*	*2.6*	*X*	*X*	*3.3*	*3.1*	*X*	*X*	*3.3*	*X*
Uruguay +	12.4	34.0	15.3	34.0	19.0	30.0	14.5	35.2	6.6	43.8	10.8	36.3
Uzbekistan +	27.9	-	10.0	-	3.8	-	6.0	-	0.0	-	0.0	-
Vanuatu +	23.6	-	22.9	-	21.9	-	13.2	-	0.0	-	23.2	-
Venezuela	15.9	36.3	17.9	31.3	16.8	95.1	17.0	71.8	12.9	99.5	17.5	59.0
Viet Nam +	36.0	-	37.9	-	17.7	-	28.4	-	14.7	-	20.1	-
Yemen +	21.3	-	17.5	-	9.8	-	12.3	-	11.3	-	15.3	-
Zambia +	23.6	125.0	22.9	94.2	23.8	125.0	20.5	125.0	5.0	100.0	21.3	125.0
Zimbabwe	34.3	150.0	33.5	139.6	26.9	150.0	25.2	*143.3*	15.0	142.2	34.8	150.0

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO, CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

Tariff Profiles Table III
Average MFN applied and bound tariffs for agricultural products by category (cont'd)

(18) Oil seeds, fats & oils & their products		(19) Cut flowers, plants, vegetable materials; lacs, etc.		(20) Beverages and spirits		(21) Dairy products		(22) Tobacco		(23) Other agricultural products		Import markets
Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	Applied	Bound	
10.7	49.4	5.9	58.8	19.9	193.9	16.3	32.8	12.2	61.1	6.8	50.0	Niger +
32.7	150.0	22.6	150.0	76.1	150.0	48.1	150.0	89.4	150.0	21.2	150.0	Nigeria
2.8	*X*	9.5	*0.9*	*X*	*X*	*X*	*X*	0.0	*X*	*2.8*	*X*	Norway
4.6	19.7	4.0	14.7	53.5	104.5	2.0	17.0	100.0	150.0	5.9	14.6	Oman
8.1	100.0	17.2	100.0	62.3	100.0	25.0	100.0	25.0	100.0	12.1	80.6	Pakistan +
9.7	23.6	41.5	29.4	13.7	30.6	39.7	42.4	11.7	27.2	8.0	24.6	Panama
6.2	36.0	6.0	35.0	*X*	*X*	0.0	20.2	*X*	*X*	2.9	27.3	Papua New Guinea+
7.8	34.0	6.3	35.0	17.0	30.3	15.1	34.3	16.6	25.2	7.0	33.6	Paraguay
8.6	30.0	9.5	30.0	15.4	30.0	20.0	36.7	12.9	30.0	8.5	30.0	Peru
5.6	36.6	3.2	29.3	8.5	44.8	3.9	26.4	7.1	45.3	2.9	23.1	Philippines
4.9	14.7	4.4	14.8	42.7	85.2	5.0	15.1	*X*	200.0	4.9	16.6	Qatar
12.7	68.7	10.0	35.0	82.6	204.9	39.6	176.7	79.3	110.2	19.0	73.9	Romania +
8.3	-	*9.3*	-	*X*	-	*X*	-	*12.5*	-	6.4	-	Russian Federation
14.6	79.5	8.8	76.7	29.0	63.9	24.8	16.0	14.4	80.0	6.9	76.3	Rwanda
15.3	129.9	4.7	100.0	*22.8*	113.5	6.9	98.8	18.3	100.0	3.3	98.3	Saint Kitts and Nevis
17.7	127.9	4.6	100.4	27.4	125.9	5.7	100.0	16.7	104.6	3.5	100.5	Saint Lucia
17.6	127.9	6.7	100.4	*23.8*	125.7	6.5	100.0	25.0	104.6	5.2	100.5	Saint Vincent and the Grenadines +
5.6	-	4.4	-	*7.9*	-	7.1	-	100.0	-	4.6	-	Saudi Arabia +
10.7	30.0	5.9	30.0	19.9	29.5	16.3	27.4	12.2	30.0	6.8	30.0	Senegal +
8.0	-	8.9	-	28.1	-	24.0	-	18.3	-	4.5	-	Serbia and Montenegro +
21.1	-	36.0	-	*99.4*	-	28.6	-	200.0	-	40.2	-	Seychelles +
13.0	40.0	9.6	39.7	28.2	50.3	19.8	40.0	21.7	40.0	9.0	39.6	Sierra Leone
0.0	10.0	0.0	10.0	0.0	*X*	0.0	7.0	0.0	*X*	0.0	9.3	Singapore
30.2	78.3	20.0	9.6	*X*	*X*	17.5	32.5	*X*	*X*	24.0	63.1	Solomon Islands
7.7	47.3	5.1	8.9	*18.9*	123.9	*X*	94.8	*35.3*	50.7	2.3	15.1	South Africa
18.9	49.7	9.2	48.8	*X*	50.3	23.6	48.5	157.3	50.0	9.4	49.5	Sri Lanka +
31.7	-	22.1	-	45.0	-	43.7	-	45.0	-	26.3	-	Sudan +
23.4	19.0	*X*	19.9	*38.5*	20.0	*8.4*	20.0	*50.0*	20.0	*X*	20.0	Suriname +
7.7	47.3	5.1	8.9	18.9	123.9	*X*	94.8	35.3	50.7	2.3	15.1	Swaziland
X	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	Switzerland
6.9	-	8.9	-	81.4	-	18.8	-	23.4	-	10.4	-	Syrian Arab Republic +
12.5	11.5	6.4	6.3	14.9	13.9	*12.0*	*11.6*	19.4	17.2	3.9	3.7	Taipei, Chinese
5.7	-	9.3	-	*X*	-	13.5	-	*5.0*	-	6.4	-	Tajikistan +
16.8	120.0	1.5	120.0	24.0	120.0	24.0	120.0	16.7	120.0	5.3	120.0	Tanzania
21.1	*X*	*22.8*	*27.0*	57.1	*X*	23.9	*34.0*	60.0	*X*	7.7	*26.5*	Thailand +
10.7	80.0	5.9	80.0	19.9	80.0	16.3	80.0	12.2	80.0	6.8	80.0	Togo +
17.0	92.8	2.7	75.2	*20.4*	100.0	13.7	100.0	20.0	100.0	1.8	78.6	Trinidad and Tobago
37.5	114.2	36.1	123.5	59.1	112.1	95.2	134.9	32.4	70.4	24.1	95.2	Tunisia
13.6	24.5	9.7	29.4	37.0	74.7	*120.9*	165.8	34.9	113.7	6.5	24.6	Turkey +
6.1	-	0.0	-	*X*	-	5.0	-	*75.0*	-	3.5	-	Turkmenistan +
9.8	77.9	5.0	78.2	15.0	80.0	15.0	80.0	15.0	80.0	10.6	77.5	Uganda +
X	-	*X*	-	*X*	-	*X*	-	*X*	-	*6.6*	-	Ukraine +
...	19.9	...	15.0	...	116.5	...	15.0	...	200.0	...	15.0	United Arab Emirates
X	*X*	*1.2*	*1.2*	*X*	*X*	*X*	*X*	*X*	*X*	*0.9*	*0.8*	United States
10.1	34.2	7.7	29.6	19.3	31.6	17.1	43.9	18.0	29.4	8.8	31.0	Uruguay +
0.7	-	12.6	-	27.1	-	0.0	-	16.7	-	4.5	-	Uzbekistan +
1.1	-	7.9	-	*X*	-	22.5	-	*X*	-	6.2	-	Vanuatu +
15.8	90.1	9.0	33.7	19.1	40.0	19.3	95.6	17.2	40.0	8.9	43.0	Venezuela
13.4	-	5.3	-	70.0	-	*X*	-	52.5	-	5.4	-	Viet Nam +
11.5	-	11.1	-	17.7	-	14.4	-	25.0	-	12.0	-	Yemen +
14.8	125.0	9.4	125.0	24.0	125.0	22.5	125.0	21.7	125.0	12.9	125.0	Zambia +
13.8	146.2	10.3	117.0	*41.8*	150.0	35.9	150.0	84.8	150.0	11.2	134.2	Zimbabwe

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO, CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

Tariff Profiles Table IV

MFN applied and bound tariffs and binding coverage for non-agricultural products by category

(Percentage)

Import markets	(01) Wood, pulp, paper and furniture			(02) Textiles and clothing			(03) Leather, rubber, footwear and travel goods			(04) Metals			(05) Chemicals and photographic supplies			(06) Transport equipment		
	Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty	
	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage
Albania	9.0	0.5	100	9.8	11.5	100	10.7	13.7	100	10.1	4.4	100	4.0	4.2	100	5.0	8.1	100
Algeria +	19.4	-	-	25.8	-	-	19.3	-	-	16.5	-	-	14.7	-	-	11.0	-	-
Angola +	11.4	60.0	100	13.9	60.2	100	10.3	60.0	100	5.7	60.1	100	4.9	60.0	100	4.9	60.0	100
Antigua and Barbuda +	*8.9*	52.5	100	10.8	50.2	100	9.3	50.7	100	6.0	50.5	100	6.1	50.6	100	9.8	56.4	100
Argentina +	12.8	33.4	100	19.7	35.0	100	15.9	35.0	100	13.0	34.1	100	9.6	21.3	100	13.6	34.5	100
Armenia	1.4	3.4	100	4.0	10.8	100	3.4	14.0	100	0.2	4.9	100	0.2	0.3	100	3.2	9.6	100
Australia	3.5	7.0	100	12.8	24.9	91	7.0	14.4	86	3.4	6.7	98	1.8	9.0	100	4.1	12.6	99
Azerbaijan +	11.1	-	-	12.5	-	-	12.4	-	-	7.2	-	-	4.6	-	-	*4.4*	-	-
Bahamas	27.8	-	-	26.9	-	-	30.2	-	-	34.7	-	-	32.7	-	-	36.8	-	-
Bahrain	5.1	37.8	28	5.0	35.0	99	5.0	35.0	38	5.1	35.0	95	4.9	35.0	19	4.1	35.0	100
Bangladesh +	20.3	38.1	5	25.9	37.5	0	19.0	3.0	1	17.8	31.9	1	15.2	43.0	2	15.9	20.1	10
Barbados	13.0	70.0	100	16.4	70.1	100	10.9	72.0	100	7.4	70.2	100	6.9	70.2	100	9.6	97.2	100
Belarus	*13.0*	-	-	*10.8*	-	-	*8.0*	-	-	9.5	-	-	6.9	-	-	10.8	-	-
Belize +	10.9	51.6	100	11.0	56.4	100	10.0	50.3	100	5.7	50.0	100	6.2	50.1	100	9.4	50.0	100
Benin	10.8	5.0	4	17.4	16.7	39	13.1	15.1	26	11.9	4.2	6	7.1	19.7	1	8.7	13.4	73
Bermuda +	18.9	-	-	11.0	-	-	19.6	-	-	22.0	-	-	20.6	-	-	31.1	-	-
Bhutan +	21.3	-	-	26.4	-	-	25.7	-	-	19.0	-	-	14.0	-	-	16.1	-	-
Bolivia +	9.8	40.0	100	10.0	40.0	100	10.0	40.0	100	9.9	40.0	100	10.0	40.0	100	8.0	39.9	100
Bosnia and Herzegovina +	5.5	-	-	10.7	-	-	7.8	-	-	5.4	-	-	3.4	-	-	5.8	-	-
Botswana	7.6	10.7	100	*X*	29.7	100	13.3	20.9	98	4.5	12.7	100	3.0	12.3	100	6.6	18.4	100
Brazil	11.0	28.8	100	17.7	34.8	100	14.2	35.0	100	11.4	33.0	100	8.4	21.0	100	18.3	33.3	100
Brunei Darussalam +	4.1	25.3	98	0.6	27.0	100	3.0	23.6	100	0.0	20.0	98	0.4	21.0	94	13.8	24.5	67
Bulgaria	8.4	18.1	100	16.3	32.6	100	9.9	29.4	100	6.6	23.7	100	7.3	11.6	100	5.8	22.5	100
Burkina Faso	11.0	83.0	23	17.3	16.7	39	13.1	15.1	26	12.3	4.2	6	7.2	23.4	1	8.5	13.4	73
Burundi	18.5	19.3	9	35.5	25.2	27	22.2	73.1	25	15.8	8.6	1	14.0	7.0	8	19.0	76.3	13
Cambodia +	16.9	24.8	100	19.8	12.2	100	24.1	28.3	100	11.5	19.8	100	10.1	9.3	100	19.4	24.3	100
Cameroon	19.2	...	.	22.9	50.0	0	21.3	...	.	15.8	...	...	11.6	80.0	0	15.1	...	.
Canada	1.1	1.4	100	11.3	12.5	100	5.6	7.6	100	1.7	2.7	100	2.8	4.4	100	5.7	5.6	94
Central African Republic +	19.2	50.0	10	22.9	42.1	1	21.3	48.8	23	15.8	44.8	76	11.6	31.2	84	15.1	38.6	89
Chad +	19.2	...	.	22.9	...	.	21.3	...	.	15.8	...	...	11.6	80.0	0	15.1	75.0	9

Import markets	(07) Non-electric machinery			(08) Electric machinery			(09) Mineral products and precious stones and metals			(10) Manufactured articles not specified			(11) Fish and fish products			(97) Petroleum		
	Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty	
	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage
Albania	2.2	3.7	100	5.3	4.5	100	7.6	10.3	100	8.9	9.5	100	12.0	0.1	100	9.2	9.3	100
Algeria +	9.1	-	-	17.3	-	-	16.5	-	-	22.0	-	-	29.2	-	-	19.5	-	-
Angola +	2.5	60.0	100	5.1	60.0	100	13.0	61.1	100	9.8	60.0	100	31.3	60.0	100	22.5	70.0	100
Antigua and Barbuda +	5.9	50.6	100	10.2	54.2	100	8.0	54.0	100	13.8	52.4	100	22.6	...	...	3.7	79.6	100
Argentina +	5.7	34.9	100	13.8	34.9	100	9.3	33.2	100	15.5	33.5	100	12.0	33.9	100	0.3	34.9	100
Armenia	0.3	9.3	100	3.7	9.9	100	4.0	10.9	100	4.2	10.6	100	9.4	15.0	100	0.0	5.0	100
Australia	3.2	8.2	96	3.3	10.3	98	1.8	6.9	97	1.5	6.3	98	0.0	0.8	100	0.0	0.0	100
Azerbaijan +	3.6	-	-	9.4	-	-	11.0	-	-	10.2	-	-	*X*	-	-	6.5	-	-
Bahamas	33.1	-	-	35.6	-	-	31.4	-	-	31.6	-	-	26.3	-	-	*X*	-	-
Bahrain	5.0	35.0	100	5.0	35.0	100	4.9	35.0	11	5.0	35.0	98	3.3	...	...	5.0	35.0	50
Bangladesh +	9.9	48.6	6	17.0	26.5	1	17.6	31.3	1	18.5	22.1	6	27.6	41.4	10	28.7	...	...
Barbados	5.9	72.8	100	9.9	75.7	100	11.5	77.2	100	15.9	77.8	100	31.2	...	...	*5.5*	114.0	100
Belarus	9.1	-	-	12.2	-	-	12.0	-	-	13.4	-	-	10.5	-	-	5.0	-	-
Belize +	5.6	50.0	100	9.6	50.0	100	11.0	50.5	100	15.3	50.4	100	30.4	110.0	5	*0.0*	60.0	100
Benin	7.0	5.3	91	11.2	7.0	94	11.4	41.1	23	14.8	7.4	2	14.4	6.5	15	7.2	8.0	50
Bermuda +	22.3	-	-	23.8	-	-	16.0	-	-	20.1	-	-	6.4	-	-	*X*	-	-
Bhutan +	10.2	-	-	12.1	-	-	27.3	-	-	19.5	-	-	30.0	-	-	19.5	-	-
Bolivia +	5.2	39.8	100	8.8	40.0	100	10.0	40.0	100	9.9	40.0	100	10.0	40.0	100	10.0	40.0	100
Bosnia and Herzegovina +	6.0	-	-	6.7	-	-	4.5	-	-	6.5	-	-	2.8	-	-	2.0	-	-
Botswana	1.5	9.2	100	5.4	17.2	100	3.8	9.4	89	3.5	12.9	96	*X*	24.7	3	*X*	...	...
Brazil	13.0	32.4	100	14.6	32.0	100	7.6	32.7	100	15.7	33.2	100	10.1	33.5	100	0.2	35.0	100
Brunei Darussalam +	6.3	28.1	100	14.2	39.0	77	0.5	20.8	99	5.0	24.6	88	0.0	21.0	100	*X*	20.0	100
Bulgaria	5.7	21.9	100	6.6	19.4	100	7.1	27.1	100	6.2	25.6	100	11.4	30.0	100	16.4	17.1	100
Burkina Faso	7.0	5.3	91	11.2	7.0	94	11.5	9.5	5	15.1	44.5	3	14.7	6.5	15	3.9	8.0	50
Burundi	15.9	6.0	3	17.6	2.5	1	20.4	8.1	5	29.7	42.9	5	39.2	6.0	5	*13.8*	...	...
Cambodia +	14.5	15.3	100	24.7	26.6	100	15.9	21.6	100	17.2	24.9	100	19.3	23.5	100	15.1	22.7	100
Cameroon	12.3	...	...	16.8	...	...	18.7	...	...	22.9	...	...	24.4	...	...	10.0	...	...
Canada	1.4	3.4	100	2.3	4.3	100	1.7	2.8	99	2.8	4.0	100	1.0	1.3	100	2.8	6.9	50
Central African Republic +	12.3	32.0	87	16.8	37.0	93	18.7	29.5	33	22.9	49.8	89	24.4	...	...	10.0	30.0	100
Chad +	12.3	...	...	16.8	...	...	18.7	...	...	22.9	...	...	24.4	...	...	10.0	...	...

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO-CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

Tariff Profiles Table IV
MFN applied and bound tariffs and binding coverage for non-agricultural products by category (cont'd)
(Percentage)

Import markets	(01) Wood, pulp, paper and furniture			(02) Textiles and clothing			(03) Leather, rubber, footwear and travel goods			(04) Metals			(05) Chemicals and photographic supplies			(06) Transport equipment		
	Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty	
	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage
Chile	6.0	25.0	100	6.0	25.0	100	6.0	25.0	100	6.0	25.0	100	6.0	25.0	100	5.5	24.9	100
China	5.7	5.0	100	12.9	11.5	100	13.7	13.7	100	7.0	7.1	100	6.8	6.7	100	13.1	11.5	100
Colombia	13.2	35.0	100	18.4	36.9	100	13.7	34.9	100	10.0	35.0	100	8.0	34.9	100	12.7	35.4	100
Congo +	19.2	10.0	2	22.9	30.0	1	21.3	...	.	15.8	30.0	0	11.6	12.5	1	15.1	10.0	21
Costa Rica +	6.4	43.0	100	10.2	45.0	100	7.7	45.7	100	2.3	41.8	100	1.8	43.7	100	6.1	51.5	100
Croatia	2.3	1.5	100	8.7	8.9	100	4.8	7.5	100	2.7	3.6	100	1.3	4.6	100	6.1	6.7	100
Cuba	8.9	4.0	10	16.9	20.8	8	12.3	8.1	8	7.6	5.7	9	9.5	6.3	12	9.1	7.7	23
Côte d'Ivoire +	10.8	5.0	4	17.4	17.3	24	13.1	7.8	20	11.9	4.1	6	7.1	16.5	1	8.7	11.1	67
Democratic Republic of the Congo +	15.6	92.1	100	16.0	99.9	100	14.6	100.0	100	11.5	99.7	100	8.5	97.2	100	8.8	87.7	100
Djibouti +	31.2	40.0	100	32.9	40.0	100	33.1	40.0	100	32.9	40.0	100	32.5	40.1	100	34.0	39.1	100
Dominica +	8.7	50.0	86	10.0	50.0	100	10.6	50.0	82	5.5	50.0	98	7.0	50.1	93	8.8	50.0	100
Dominican Republic	8.1	36.4	100	9.4	39.1	100	11.5	38.7	100	7.3	37.4	100	4.9	21.9	100	8.1	39.9	100
Ecuador +	12.7	23.6	100	18.2	28.5	100	13.0	24.1	100	9.1	20.6	100	7.5	11.1	100	10.6	23.5	100
Egypt +	22.3	36.4	100	*X*	31.2	100	*26.4*	42.7	90	17.2	28.7	99	13.2	18.9	100	21.7	35.0	94
El Salvador +	6.2	34.8	100	18.5	38.7	100	8.6	40.6	100	2.4	34.8	100	1.9	37.6	100	4.4	34.5	100
Equatorial Guinea +	19.2	-	-	22.9	-	-	21.3	-	-	15.8	-	-	11.6	-	-	15.1	-	-
Eritrea +	6.8	-	-	13.3	-	-	9.1	-	-	3.2	-	-	3.1	-	-	7.3	-	-
Ethiopia +	12.9	-	-	32.5	-	-	24.4	-	-	11.9	-	-	11.2	-	-	12.7	-	-
European Communities	1.1	0.9	100	7.9	7.9	100	4.2	4.2	100	1.9	1.9	100	4.5	4.6	100	4.1	4.1	100
Fiji	10.8	...	...	12.9	40.0	87	11.6	...	...	4.6	40.0	65	4.5	40.0	6	*12.8*	...	...
Former Yugoslav Republic of Macedonia +	7.2	2.5	100	16.7	11.4	100	11.6	10.3	100	5.4	3.6	100	4.5	3.3	100	7.6	7.0	100
Gabon +	19.2	15.5	100	22.9	15.1	100	21.3	15.0	100	15.8	15.1	100	11.6	15.2	100	15.1	15.0	100
Gambia	15.4	...	...	15.2	...	...	16.7	...	...	12.7	...	...	7.8	110.0	0	10.9	70.9	9
Georgia	5.0	3.6	100	9.6	9.4	100	10.9	10.8	100	5.4	4.2	100	6.6	6.3	100	10.2	10.0	100
Ghana +	16.8	40.9	4	17.7	45.0	0	14.6	...	...	11.8	40.0	1	11.7	99.0	0	6.0	32.1	6
Grenada +	9.4	50.0	100	11.0	50.0	100	10.2	50.0	100	6.5	50.0	100	*7.0*	50.0	100	9.0	50.0	100
Guatemala	6.4	36.8	100	13.2	44.7	100	8.8	44.2	100	2.3	40.8	100	1.9	38.9	100	6.1	40.4	100
Guinea	6.9	19.7	15	6.5	16.9	40	6.0	15.0	26	6.8	4.1	6	6.8	17.5	1	5.6	13.7	74
Guinea-Bissau +	10.8	50.0	100	17.4	50.0	100	13.1	50.0	100	11.9	50.0	100	7.1	50.0	100	8.7	50.0	43
Guyana	9.4	50.0	100	11.1	50.0	100	10.3	50.0	100	6.5	50.0	100	6.7	50.0	100	10.0	50.0	100

Import markets	(07) Non-electric machinery			(08) Electric machinery			(09) Mineral products and precious stones and metals			(10) Manufactured articles not specified			(11) Fish and fish products			(97) Petroleum		
	Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty	
	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage
Chile	5.9	25.0	100	5.6	25.0	100	6.0	25.0	100	6.0	25.0	100	6.0	25.0	100	6.0	25.0	100
China	8.5	8.4	100	9.0	8.8	100	9.6	9.7	100	12.3	12.3	100	11.5	11.0	100	5.1	3.3	100
Colombia	7.0	35.0	100	10.0	35.0	100	10.1	35.0	100	10.8	35.0	100	19.0	38.2	100	10.1	35.0	100
Congo +	12.3	10.0	4	16.8	10.0	1	18.7	...	...	22.9	16.7	15	24.4	30.0	1	10.0	...	...
Costa Rica +	1.2	41.0	100	2.4	34.2	100	5.0	44.4	100	6.4	40.5	100	9.1	46.1	100	8.8	44.3	100
Croatia	3.0	3.9	100	3.2	4.7	100	5.5	7.2	100	2.7	5.3	100	7.3	7.3	100	11.2	6.9	100
Cuba	9.7	8.7	62	10.4	10.8	63	7.8	2.6	14	12.8	15.5	17	4.9	2.6	12	2.4	3.0	50
Côte d'Ivoire +	7.0	5.1	77	11.2	7.0	79	11.4	9.2	4	14.8	8.4	4	14.4	5.8	12	7.2	8.1	50
Democratic Republic of the Congo +	6.9	85.5	100	10.7	91.4	100	13.0	99.5	100	13.5	97.2	100	16.9	92.6	100	9.0	100.0	100
Djibouti +	33.0	39.6	100	33.0	39.3	100	30.5	40.2	100	35.8	40.0	100	20.2	40.0	100	33.0	0.0	100
Dominica +	3.0	50.0	100	9.2	50.0	100	8.1	50.0	96	12.7	50.0	99	27.2	...	...	3.2	50.0	100
Dominican Republic	3.6	35.4	100	7.5	35.0	100	8.6	32.4	100	12.5	38.0	100	16.2	39.9	100	5.1	40.0	100
Ecuador +	7.5	20.0	100	10.0	22.5	100	9.6	19.6	100	13.3	24.2	98	19.0	28.8	100	7.7	17.1	100
Egypt +	10.1	18.3	99	17.6	25.9	96	19.9	35.9	99	19.6	31.3	100	18.8	27.9	100	8.8	20.0	100
El Salvador +	1.2	30.3	100	2.7	26.6	100	5.4	37.5	100	7.8	34.7	100	9.1	45.7	100	8.1	40.0	100
Equatorial Guinea +	12.3	-	-	16.8	-	-	18.7	-	-	22.9	-	-	24.4	-	-	10.0	-	-
Eritrea +	3.7	-	-	9.4	-	-	4.7	-	-	13.2	-	-	23.1	-	-	2.0	-	-
Ethiopia +	9.1	-	-	17.8	-	-	17.7	-	-	26.0	-	-	30.9	-	-	2.5	-	-
European Communities	1.7	1.7	100	2.5	2.4	100	2.0	2.0	100	2.5	2.5	100	11.6	11.2	100	3.1	2.0	100
Fiji	2.1	40.0	99	4.5	40.0	100	3.9	40.0	8	7.2	40.0	9	15.6	...	...	*3.0*	...	.
Former Yugoslav Republic of Macedonia +	5.7	5.1	100	8.6	7.2	100	10.1	8.5	100	8.7	6.7	100	7.8	0.3	100	14.0	14.0	100
Gabon +	12.3	15.0	100	16.8	15.0	100	18.7	16.1	100	22.9	18.6	100	24.4	15.0	100	10.0	15.0	100
Gambia	8.0	...	...	16.5	...	...	11.6	42.5	4	15.8	...	...	17.9	...	...	18.0	...	...
Georgia	3.6	3.4	100	3.0	2.8	100	11.8	11.8	100	7.0	6.9	100	2.3	0.3	100	12.0	12.0	100
Ghana +	2.7	30.0	2	10.3	...	...	12.8	30.0	5	16.1	50.0	0	11.4	...	...	55.0	...	...
Grenada +	5.9	50.0	100	10.3	50.0	100	9.1	50.0	100	13.4	50.0	100	27.8	50.0	100	7.3	50.0	100
Guatemala	1.2	36.2	100	2.9	39.5	100	5.6	41.5	100	7.3	44.3	100	9.1	40.7	100	7.8	45.0	100
Guinea	4.7	5.2	91	6.8	7.0	94	6.6	9.5	5	6.9	15.8	3	7.0	6.5	15	7.0	8.0	50
Guinea-Bissau +	7.0	50.0	99	11.2	50.0	100	11.4	50.0	89	14.8	50.0	99	14.4	50.0	100	7.2	...	...
Guyana	5.9	50.0	100	9.6	50.0	100	10.7	50.4	100	15.6	50.0	100	29.3	50.0	100	7.8	50.0	100

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO-CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

Tariff Profiles Table IV
MFN applied and bound tariffs and binding coverage for non-agricultural products by category (cont'd)
(Percentage)

Import markets	(01) Wood, pulp, paper and furniture			(02) Textiles and clothing			(03) Leather, rubber, footwear and travel goods			(04) Metals			(05) Chemicals and photographic supplies			(06) Transport equipment		
	Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty	
	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage
Haiti	...	10.9	70	...	*X*	77	...	21.7	86	...	*12.0*	87	...	22.6	100	...	12.9	100
Honduras	6.4	33.7	100	11.9	34.3	100	7.9	35.0	100	2.3	33.6	100	1.8	32.1	100	5.0	29.1	100
Hong Kong, China	0.0	0.0	96	0.0	0.0	7	0.0	0.0	45	0.0	0.0	77	0.0	0.0	8	0.0	0.0	14
Iceland	2.5	11.5	92	5.2	12.1	90	5.9	11.7	91	0.8	6.2	100	1.0	4.3	99	2.1	9.7	44
India +	25.7	36.5	62	28.0	*X*	66	28.6	35.2	51	29.0	38.7	54	29.3	39.6	89	37.0	35.8	70
Indonesia	5.2	39.4	99	10.5	28.7	100	7.7	39.8	99	7.3	38.4	98	5.4	38.1	97	12.2	38.9	54
Iran, Islamic Republic of +	20.8	-	-	33.4	-	-	45.7	-	-	15.0	-	-	12.0	-	-	29.3	-	-
Israel	6.0	14.0	74	*X*	*11.6*	41	6.0	12.0	75	3.6	8.4	89	2.4	8.2	85	3.3	*13.3*	41
Jamaica +	6.6	49.2	100	8.0	49.6	100	7.5	40.2	100	2.4	45.1	100	2.6	24.7	100	6.7	47.3	100
Japan	0.9	0.9	98	*6.7*	*6.7*	100	6.4	6.6	100	1.0	1.0	100	2.5	2.0	100	0.0	0.0	100
Jordan	15.3	21.5	100	15.4	16.8	100	19.2	24.2	100	11.1	19.2	100	2.6	5.0	100	11.7	13.4	100
Kazakhstan +	12.8	-	-	16.2	-	-	10.6	-	-	9.7	-	-	4.2	-	-	7.4	-	-
Kenya +	22.0	...	...	25.7	...	...	17.9	...	...	16.0	...	...	10.2	31.9	2	11.9	62.0	1
Korea, Republic of	2.4	2.8	90	10.1	19.4	99	7.9	12.2	97	4.3	7.0	99	5.8	5.8	97	5.4	8.2	82
Kuwait +	3.9	100.0	100	4.0	100.0	100	4.0	100.0	100	4.0	100.0	100	4.0	100.0	100	4.0	100.0	100
Kyrgyz Republic	0.4	0.7	100	8.8	9.6	100	3.7	9.4	100	2.5	3.3	100	2.7	5.4	100	4.8	9.0	100
Lao People's Democratic Republic +	13.4	-	-	9.2	-	-	10.8	-	-	6.0	-	-	6.8	-	-	13.7	-	-
Lebanon +	7.4	-	-	3.0	-	-	9.8	-	-	3.4	-	-	2.5	-	-	4.1	-	-
Lesotho +	7.6	60.0	100	24.2	60.0	100	14.3	60.0	100	4.6	60.0	100	3.1	60.1	100	7.1	60.0	100
Libyan Arab Jamahiriya +	13.3	-	-	18.4	-	-	24.0	-	-	8.0	-	-	8.1	-	-	40.3	-	-
Macao, China	0.0	0.0	8	0.0	0.0	2	0.0	0.0	52	0.0	0.0	17	0.0	0.0	24	0.0	...	...
Madagascar	3.0	2.5	2	12.3	17.5	1	5.6	15.0	3	2.8	15.0	11	1.1	30.0	60	4.8	23.9	39
Malawi	13.9	41.8	11	20.6	45.0	0	19.5	41.8	17	10.5	41.2	6	6.9	40.2	61	14.2	52.7	23
Malaysia +	12.5	18.7	88	16.2	19.5	98	15.1	21.5	87	8.8	19.7	62	3.8	11.9	74	19.6	14.2	61
Maldives	16.7	30.0	100	21.0	30.0	100	25.7	31.8	100	22.1	30.0	100	15.5	30.5	100	43.2	134.8	70
Mali +	10.8	52.9	31	17.4	16.7	39	13.1	15.1	26	11.9	31.7	12	7.1	19.7	1	8.7	13.4	73
Mauritania	9.8	5.0	4	15.0	16.7	39	11.3	20.6	41	10.0	4.2	6	6.1	18.2	1	11.0	16.0	87
Mauritius	24.7	65.0	1	30.7	...	.	*23.5*	...	.	12.9	65.0	3	7.5	64.3	1	22.1	65.0	2
Mexico	15.7	34.0	100	24.5	35.0	100	20.5	34.9	100	15.6	34.4	100	12.8	35.2	100	17.4	36.9	100
Moldova +	4.2	6.1	100	8.0	9.1	100	7.4	9.0	100	0.7	1.5	100	3.5	4.5	100	*2.0*	4.3	100

Import markets	(07) Non-electric machinery			(08) Electric machinery			(09) Mineral products and precious stones and metals			(10) Manufactured articles not specified			(11) Fish and fish products			(97) Petroleum		
	Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty	
	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage
Haiti	...	14.2	99	...	*15.8*	100	...	*18.0*	82	...	17.1	89	...	*X*	37	...	*X*	100
Honduras	1.2	30.6	100	2.9	27.6	100	5.3	32.8	100	6.9	33.4	100	9.1	34.7	100	13.6	24.4	100
Hong Kong, China	0.0	0.0	29	0.0	0.0	41	0.0	0.0	51	0.0	0.0	53	0.0	0.0	100	0.0	...	...
Iceland	0.7	5.6	96	2.0	14.9	99	1.8	11.4	91	3.6	20.6	98	1.2	3.5	95	0.1	8.7	50
India +	25.2	28.3	94	24.8	26.8	94	26.8	37.6	70	27.0	31.4	42	30.0	100.7	13	18.0	...	...
Indonesia	2.2	34.9	98	6.0	30.3	98	5.1	39.6	98	7.5	35.7	88	4.9	40.0	100	2.1	40.0	100
Iran, Islamic Republic of +	11.9	-	-	21.5	-	-	16.9	-	-	20.3	-	-	19.8	-	-	7.8	-	-
Israel	4.2	8.1	75	4.3	5.1	100	3.7	8.0	79	5.6	12.0	78	*X*	*X*	53	1.6	25.0	50
Jamaica +	1.5	39.1	100	6.2	47.0	100	6.5	49.1	100	11.5	50.0	100	27.1	50.0	100	*0.0*	50.0	100
Japan	0.0	0.0	100	0.2	0.2	100	0.8	0.8	100	1.1	1.0	100	5.7	5.0	91	*X*	*3.5*	50
Jordan	7.4	10.3	100	15.5	16.7	100	15.6	19.8	100	19.8	20.6	100	21.1	19.8	100	22.3	14.1	100
Kazakhstan +	0.5	-	-	0.0	-	-	16.9	-	-	15.6	-	-	10.8	-	-	5.0	-	-
Kenya +	7.0	...	.	13.8	...	...	14.9	62.0	2	15.9	...	...	15.0	62.0	42	7.1	...	...
Korea, Republic of	6.0	9.5	97	6.0	9.0	74	5.7	8.8	90	6.4	10.0	95	16.1	15.0	54	5.1	12.3	50
Kuwait +	4.0	100.0	100	4.0	100.0	100	4.0	100.0	100	4.0	100.0	100	0.0	100.0	100	4.0	...	.
Kyrgyz Republic	5.0	6.6	100	3.6	6.5	100	7.0	9.4	100	5.2	7.3	100	10.1	10.2	100	5.0	*X*	100
Lao People's Democratic Republic +	6.0	-	-	6.6	-	-	5.6	-	-	10.4	-	-	16.6	-	-	7.3	-	-
Lebanon +	3.3	-	-	3.8	-	-	5.6	-	-	5.1	-	-	5.1	-	-	*X*	-	-
Lesotho +	1.5	60.0	100	5.5	60.0	100	3.9	60.0	100	3.5	60.0	100	*X*	60.0	100	*X*	60.0	100
Libyan Arab Jamahiriya +	10.5	-	-	24.6	-	-	20.8	-	-	32.9	-	-	6.4	-	-	*X*	-	-
Macao, China	0.0	0.0	9	0.0	0.0	35	0.0	0.0	5	0.0	0.0	27	0.0	...	...	0.0	...	...
Madagascar	4.0	18.4	33	5.0	19.9	14	3.8	...	...	6.1	17.5	0	2.9	...	...	0.0	5.0	50
Malawi	6.3	49.5	25	13.0	38.2	9	11.8	41.2	10	18.5	61.9	4	11.9	40.0	81	5.5	...	...
Malaysia +	3.7	9.1	88	8.1	13.8	89	9.9	15.3	69	6.2	9.9	91	6.4	7.8	56	*X*	5.0	100
Maldives	20.9	34.1	100	21.9	30.0	100	22.5	30.0	100	19.4	53.6	100	16.1	...	...	19.4	30.0	100
Mali +	7.0	5.3	91	11.2	7.0	94	11.4	9.5	5	14.8	45.2	7	14.4	6.5	15	7.2	8.3	50
Mauritania	5.8	5.3	91	9.6	7.0	94	10.7	9.5	5	12.8	18.1	4	19.9	17.3	26	6.9	8.0	50
Mauritius	6.5	14.4	10	20.2	12.6	36	14.5	52.0	1	23.2	0.0	11	10.7	...	...	23.5	...	...
Mexico	11.9	35.3	100	16.5	34.8	100	14.6	34.4	100	18.4	34.8	100	27.8	34.9	100	11.6	42.5	100
Moldova +	0.1	7.9	100	3.5	5.8	100	5.3	7.0	100	5.8	5.5	100	5.7	4.3	100	0.0	0.0	100

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO-CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

Tariff Profiles Table IV
MFN applied and bound tariffs and binding coverage for non-agricultural products by category (cont'd)
(Percentage)

Import markets	(01) Wood, pulp, paper and furniture			(02) Textiles and clothing			(03) Leather, rubber, footwear and travel goods			(04) Metals			(05) Chemicals and photographic supplies			(06) Transport equipment		
	Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty	
	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage
Mongolia	5.0	19.2	100	5.0	21.5	100	5.0	20.1	100	5.0	20.0	100	5.0	5.8	100	5.0	20.0	100
Montserrat +	*X*	-	-	*X*	-	-	*X*	-	-	*X*	-	-	*X*	-	-	*X*	-	-
Morocco	40.5	39.0	100	40.0	41.2	100	41.3	39.8	100	27.8	39.6	100	25.1	39.0	100	20.6	38.7	100
Mozambique +	11.6	...	...	20.3	...	...	13.6	...	...	7.8	...	...	5.9	100.0	0	9.5	...	...
Myanmar	6.6	...	...	10.6	26.0	1	5.3	...	...	2.9	20.2	8	2.3	36.9	4	3.9	0.0	3
Namibia	7.6	10.7	100	*X*	29.7	100	13.3	20.9	98	4.5	12.7	100	3.0	12.3	100	6.6	18.4	100
Nepal	14.8	25.0	100	16.1	27.4	100	16.8	27.5	100	12.5	25.3	100	12.9	21.7	100	20.1	28.1	99
New Zealand +	1.6	4.9	100	*7.3*	*17.6*	100	5.1	16.6	100	2.7	10.0	100	1.0	4.1	100	4.7	16.3	100
Nicaragua	4.7	40.0	100	8.3	46.6	100	6.8	42.1	100	1.6	40.0	100	1.5	40.0	100	3.6	45.2	100
Niger +	10.8	48.2	100	17.4	36.0	93	13.1	37.7	74	11.9	47.2	100	7.1	49.7	96	8.7	23.9	100
Nigeria	26.3	80.0	2	42.8	60.0	1	29.6	...	...	23.1	53.3	5	19.0	61.8	1	18.8	...	...
Norway	0.0	*0.4*	100	3.4	8.4	100	0.0	3.4	100	0.0	1.1	100	0.0	2.5	100	0.0	3.3	100
Oman	4.8	7.5	100	5.0	14.9	100	5.7	14.5	100	5.0	14.6	100	5.0	5.4	100	4.7	11.9	100
Pakistan +	18.8	46.8	50	21.6	21.9	96	18.2	41.4	10	15.1	36.2	4	12.7	48.4	53	31.6	33.8	11
Panama	8.0	27.9	100	6.1	28.8	100	9.0	26.3	100	7.3	27.5	100	4.1	6.1	100	12.9	23.1	100
Papua New Guinea +	14.5	55.9	100	10.6	29.9	100	4.7	34.6	100	1.7	26.1	100	1.3	19.3	100	0.7	36.3	100
Paraguay	10.8	33.2	100	17.9	33.6	100	13.4	34.8	100	11.1	34.5	100	8.2	33.8	100	8.7	31.3	100
Peru	10.5	30.0	100	17.3	30.0	100	10.6	30.0	100	8.1	30.0	100	7.0	30.0	100	6.3	30.0	100
Philippines	7.2	24.2	40	10.8	28.0	97	6.7	32.7	36	4.6	25.7	32	3.8	19.6	74	8.8	19.1	39
Qatar	4.8	17.0	100	5.0	16.4	100	5.0	16.8	100	5.0	15.1	100	4.8	7.6	100	4.1	13.6	100
Romania +	12.8	31.4	100	23.6	32.9	100	16.0	32.1	100	14.1	32.6	100	14.5	30.9	100	23.6	33.5	100
Russian Federation	*13.1*	-	-	*10.8*	-	-	*8.0*	-	-	9.5	-	-	7.0	-	-	10.5	-	-
Rwanda	17.8	95.5	100	21.2	74.5	100	22.8	95.1	100	19.1	99.3	100	8.9	92.8	100	23.4	96.9	100
Saint Kitts and Nevis	10.2	78.1	100	11.6	71.1	100	9.7	70.0	100	5.7	70.0	100	5.8	70.1	100	10.0	70.0	100
Saint Lucia	7.9	62.5	100	11.5	52.7	100	10.2	50.9	100	3.3	50.7	100	6.1	50.9	100	12.4	57.8	100
Saint Vincent and the Grenadines +	9.3	63.5	100	11.0	52.7	100	10.2	50.9	100	5.8	50.8	100	6.3	51.0	100	9.1	59.3	100
Saudi Arabia +	7.3	-	-	*5.7*	-	-	6.1	-	-	7.5	-	-	5.9	-	-	5.0	-	-
Senegal +	10.8	30.0	100	17.4	30.0	100	13.1	30.0	100	11.9	30.0	100	7.1	30.0	100	8.7	30.0	100
Serbia and Montenegro +	8.5	-	-	14.9	-	-	12.5	-	-	5.8	-	-	3.8	-	-	5.9	-	-
Seychelles +	29.7	-	-	20.9	-	-	43.2	-	-	22.8	-	-	29.7	-	-	36.7	-	-

Import markets	(07) Non-electric machinery			(08) Electric machinery			(09) Mineral products and precious stones and metals			(10) Manufactured articles not specified			(11) Fish and fish products			(97) Petroleum		
	Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty	
	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage
Mongolia	4.9	19.6	100	4.7	18.7	100	5.0	18.8	100	4.8	20.1	100	5.0	20.0	100	5.0	20.0	100
Montserrat +	*X*	-	-	*X*	-	-	*X*	-	-	*16.7*	-	-	28.3	-	-	*3.0*	-	-
Morocco	10.7	36.9	100	15.7	37.7	100	27.3	39.1	100	19.6	39.2	100	49.0	39.6	100	23.6	40.0	100
Mozambique +	6.6	6.6	4	10.7	...	...	8.7	...	...	17.4	...	...	24.2	...	...	6.2	...	...
Myanmar	1.6	8.6	13	4.2	0.0	0	4.3	31.0	6	6.4	29.6	6	8.1	68.2	5	*2.3*	25.0	100
Namibia	1.5	9.2	100	5.4	17.2	100	3.8	9.4	89	3.5	12.9	96	*X*	24.7	3	*X*	...	...
Nepal	7.7	19.9	100	14.7	20.2	100	15.5	25.2	98	14.9	20.4	95	10.8	21.9	100	*X*	15.0	20
New Zealand +	4.1	15.5	100	3.4	15.1	100	1.6	6.3	100	2.3	10.9	100	0.6	1.7	100	0.3	3.2	100
Nicaragua	0.9	39.8	100	2.2	40.0	100	4.1	40.3	100	6.0	40.0	100	9.0	40.0	100	8.8	40.0	100
Niger +	7.0	9.6	100	11.2	10.2	100	11.4	48.2	90	14.8	49.4	99	14.4	43.5	100	7.2	29.0	100
Nigeria	14.0	44.2	33	20.3	...	...	30.8	58.9	5	23.0	50.3	14	30.4	50.0	2	22.5	...	...
Norway	0.0	2.7	100	0.0	2.2	100	0.0	0.6	100	0.0	2.2	100	0.0	0.0	100	0.0	0.0	100
Oman	5.0	11.0	100	5.0	9.7	100	4.5	14.1	100	5.0	12.4	100	5.0	19.1	100	4.7	20.0	100
Pakistan +	11.6	50.0	14	16.2	50.0	23	14.9	39.1	10	15.1	49.4	11	12.0	100.0	10	*16.5*	...	...
Panama	5.0	25.9	100	8.0	25.4	100	6.8	26.1	100	15.0	27.3	100	12.9	17.4	100	3.2	28.0	100
Papua New Guinea +	0.4	28.5	100	0.0	32.4	100	3.5	31.3	100	2.2	32.9	100	27.7	53.8	100	0.0	32.5	100
Paraguay	3.5	33.1	100	10.6	32.7	100	7.4	33.8	100	13.4	32.8	100	10.1	34.6	100	0.2	35.0	100
Peru	5.3	30.0	100	7.5	30.0	100	8.2	30.0	100	9.4	30.0	100	11.9	30.0	100	11.6	30.0	100
Philippines	2.3	19.0	75	3.7	18.1	65	4.9	23.0	39	4.9	24.9	54	8.0	31.0	5	2.9	...	...
Qatar	5.0	14.9	100	5.0	18.6	100	4.7	18.9	100	5.0	14.9	100	3.3	15.0	100	5.0	15.0	100
Romania +	13.1	31.3	100	9.9	29.4	100	10.7	32.2	100	14.3	30.1	100	21.0	28.1	100	2.1	35.0	100
Russian Federation	9.1	-	-	12.2	-	-	12.0	-	-	13.4	-	-	10.5	-	-	5.0	-	-
Rwanda	13.0	97.0	100	28.2	98.7	100	15.7	95.4	100	26.7	96.3	100	16.4	87.6	100	12.8	100.0	100
Saint Kitts and Nevis	4.8	70.0	100	11.8	70.0	100	7.7	70.0	100	15.1	70.9	100	11.6	...	...	4.3	71.8	100
Saint Lucia	1.9	50.7	100	7.2	50.0	100	7.2	54.8	100	12.8	55.1	100	28.4	111.6	79	3.6	79.4	100
Saint Vincent and the Grenadines +	5.6	50.8	100	9.5	54.5	100	8.3	55.0	100	13.4	55.5	100	27.1	118.2	87	6.4	60.5	100
Saudi Arabia +	5.2	-	-	5.8	-	-	6.2	-	-	5.2	-	-	3.3	-	-	6.6	-	-
Senegal +	7.0	30.0	100	11.2	30.0	100	11.4	30.0	100	14.8	30.0	100	14.4	30.0	100	7.2	30.0	100
Serbia and Montenegro +	5.9	-	-	7.9	-	-	8.3	-	-	10.1	-	-	12.1	-	-	5.4	-	-
Seychelles +	16.9	-	-	19.2	-	-	24.3	-	-	32.0	-	-	85.5	-	-	*X*	-	-

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO-CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

Tariff Profiles Table IV
MFN applied and bound tariffs and binding coverage for non-agricultural products by category (cont'd)
(Percentage)

Import markets	(01) Wood, pulp, paper and furniture			(02) Textiles and clothing			(03) Leather, rubber, footwear and travel goods			(04) Metals			(05) Chemicals and photographic supplies			(06) Transport equipment		
	Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty	
	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage
Sierra Leone	13.0	49.4	100	22.5	50.0	100	17.7	49.9	100	8.5	48.3	100	7.9	49.2	100	8.9	49.3	100
Singapore	0.0	3.0	96	0.0	10.0	74	0.0	10.0	21	0.0	5.4	62	0.0	5.1	97	0.0	6.0	12
Solomon Islands	27.7	80.0	100	28.7	79.9	100	33.2	80.0	100	8.7	80.0	100	11.5	77.9	100	*18.3*	80.0	100
South Africa	7.6	10.7	100	*X*	29.7	100	13.3	20.9	98	4.5	12.7	100	3.0	12.3	100	6.6	18.4	100
Sri Lanka +	13.3	30.8	15	5.7	12.1	97	17.8	50.0	9	9.0	52.2	5	5.7	9.1	5	9.4	18.3	5
Sudan +	26.4	-	-	31.5	-	-	29.3	-	-	25.4	-	-	15.7	-	-	14.5	-	-
Suriname +	*X*	22.5	2	*X*	29.3	24	*X*	10.7	10	*X*	6.6	13	*X*	5.8	3	*X*	22.2	34
Swaziland	7.6	10.7	100	*X*	29.7	100	13.3	20.9	98	4.5	12.7	100	3.0	12.3	100	6.6	18.4	100
Switzerland	*X*	*X*	100	*X*	*X*	100	*X*	*X*	100	*X*	*X*	100	*X*	*X*	100	*X*	*X*	100
Syrian Arab Republic +	18.8	-	-	40.7	-	-	31.3	-	-	10.2	-	-	6.7	-	-	28.2	-	-
Taipei, Chinese	2.3	0.5	100	9.0	8.7	100	5.4	5.4	100	4.3	2.9	100	3.3	2.8	100	12.5	7.8	100
Tajikistan +	5.8	-	-	14.7	-	-	5.0	-	-	6.9	-	-	5.4	-	-	7.1	-	-
Tanzania	15.0	...	...	19.4	120.0	0	13.0	...	...	15.1	...	...	4.8	...	...	7.0	120.0	1
Thailand +	14.7	*X*	85	22.0	*X*	95	21.6	*29.9*	59	11.7	23.9	53	6.7	*29.4*	58	27.7	48.3	25
Togo +	10.8	...	...	17.4	...	...	13.1	80.0	6	11.9	80.0	5	7.1	80.0	0	8.7	...	...
Trinidad and Tobago	6.5	50.8	100	8.1	56.2	100	7.7	50.2	100	4.0	47.2	100	2.8	50.2	100	7.2	51.8	100
Tunisia	32.6	37.1	44	35.3	57.1	94	29.2	38.3	45	18.3	30.8	34	14.8	30.0	42	19.3	30.9	44
Turkey +	1.5	28.5	37	8.1	27.4	15	4.4	22.1	45	4.2	18.8	17	4.8	17.8	58	4.3	18.0	57
Turkmenistan +	0.6	-	-	15.8	-	-	4.4	-	-	0.0	-	-	0.7	-	-	4.0	-	-
Uganda +	9.1	50.0	2	12.8	...	...	9.2	50.0	4	7.0	...	...	2.5	50.0	4	5.9	42.0	12
Ukraine +	7.9	-	-	6.5	-	-	10.3	-	-	5.3	-	-	6.0	-	-	*7.3*	-	-
United Arab Emirates	...	12.0	100	...	14.9	100	...	15.0	100	...	15.0	100	...	7.1	100	...	13.8	100
United States	0.4	0.4	100	8.7	8.6	100	4.1	4.4	100	1.6	1.5	100	3.2	2.9	100	3.1	3.1	100
Uruguay +	12.8	29.1	100	19.6	34.6	100	16.0	33.7	100	13.3	33.6	100	10.1	22.3	100	12.1	32.8	100
Uzbekistan +	9.2	-	-	20.7	-	-	11.3	-	-	6.1	-	-	9.3	-	-	11.4	-	-
Vanuatu +	15.0	-	-	11.4	-	-	8.4	-	-	13.1	-	-	11.2	-	-	14.6	-	-
Venezuela	13.3	33.9	100	18.4	35.3	100	13.5	34.4	100	12.6	33.5	100	8.4	33.9	100	13.7	33.5	100
Viet Nam +	17.2	-	-	35.6	-	-	19.0	-	-	8.3	-	-	5.1	-	-	22.2	-	-
Yemen +	14.2	-	-	11.5	-	-	15.0	-	-	13.6	-	-	10.0	-	-	20.0	-	-
Zambia +	17.2	40.0	4	18.9	40.0	0	17.4	43.7	13	10.4	40.0	1	7.7	45.0	1	10.8	40.0	5
Zimbabwe	21.2	12.3	16	*20.0*	28.0	3	*18.2*	5.0	17	16.0	12.3	6	8.9	15.9	3	18.1	13.6	22

Import markets	(07) Non-electric machinery			(08) Electric machinery			(09) Mineral products and precious stones and metals			(10) Manufactured articles not specified			(11) Fish and fish products			(97) Petroleum		
	Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty		Applied Duty	Bound Duty	
	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage	Average	Average	Coverage
Sierra Leone	6.9	43.3	100	14.9	48.1	100	13.2	48.4	100	17.9	49.4	100	16.6	50.0	100	17.0	50.0	100
Singapore	0.0	6.3	64	0.0	5.4	60	0.0	7.9	15	0.0	3.1	32	0.0	10.0	100	0.0	...	...
Solomon Islands	10.7	80.0	100	22.3	80.0	100	23.5	74.4	100	27.9	87.0	100	66.4	85.0	100	*X*	*X*	100
South Africa	1.5	9.2	100	5.4	17.2	100	3.8	9.4	89	3.5	12.9	96	10.2	24.7	3	*X*	...	...
Sri Lanka +	5.1	7.7	14	9.9	*25.8*	12	11.5	45.2	9	10.1	32.9	19	12.7	50.0	95	6.7	28.3	50
Sudan +	12.4	-	-	17.0	-	-	25.6	-	-	23.7	-	-	43.7	-	-	10.0	-	-
Suriname +	3.4	6.2	32	*X*	17.7	20	*X*	8.0	1	*X*	20.0	17	*31.4*	22.7	11	*7.0*	*X*	50
Swaziland	1.5	9.2	100	5.4	17.2	100	3.8	9.4	89	3.5	12.9	96	*X*	24.7	3	*X*	...	...
Switzerland	*X*	*X*	100	*X*	*X*	100	*X*	*X*	97	*X*	*X*	100	*0.0*	*0.0*	100	0.0	*X*	50
Syrian Arab Republic +	11.4	-	-	18.8	-	-	17.0	-	-	23.2	-	-	14.4	-	-	8.0	-	-
Taipei, Chinese	3.6	3.7	100	4.6	4.1	100	3.6	3.4	100	4.0	3.3	100	*25.3*	*23.0*	100	3.8	6.2	100
Tajikistan +	5.0	-	-	5.0	-	-	10.6	-	-	8.2	-	-	10.6	-	-	5.0	-	-
Tanzania	6.0	120.0	0	15.6	...	...	11.8	...	...	18.0	120.0	0	24.2	...	...	*0.8*	...	...
Thailand +	8.4	20.2	89	12.8	18.2	73	10.7	*25.4*	46	12.8	24.9	74	10.1	8.8	93	*15.1*	...	...
Togo +	7.0	...	...	11.2	80.0	0	11.4	...	...	14.8	...	...	14.4	...	...	7.2	...	...
Trinidad and Tobago	2.1	50.0	100	8.5	53.0	100	7.2	43.1	100	12.2	49.1	100	28.4	50.0	100	4.2	31.6	100
Tunisia	9.9	27.2	54	20.5	33.7	55	23.3	34.2	15	21.9	35.2	52	39.8	56.4	7	6.6	...	...
Turkey +	1.9	11.1	63	2.6	11.0	67	2.1	19.2	30	2.6	14.3	41	46.7	57.1	18	3.4	...	...
Turkmenistan +	0.0	-	-	2.2	-	-	3.7	-	-	0.2	-	-	2.5	-	-	0.0	-	-
Uganda +	0.9	43.1	5	5.8	51.4	8	10.3	...	...	8.5	72.9	4	14.8	49.2	11	8.2	...	...
Ukraine +	4.7	-	-	7.8	-	-	8.4	-	-	10.1	-	-	*X*	-	-	*X*	-	-
United Arab Emirates	...	14.3	100	...	15.0	100	...	14.4	100	...	14.3	100	...	15.0	100	...	15.0	100
United States	1.2	1.2	100	1.9	1.6	100	1.9	1.9	100	*2.0*	*2.0*	100	1.1	1.1	100	*X*	*X*	50
Uruguay +	9.0	33.3	100	14.2	33.8	100	9.3	32.6	100	16.4	33.8	100	12.0	35.0	100	0.3	35.0	100
Uzbekistan +	0.5	-	-	9.1	-	-	17.7	-	-	15.4	-	-	0.0	-	-	7.2	-	-
Vanuatu +	7.8	-	-	20.2	-	-	12.9	-	-	23.2	-	-	27.9	-	-	*X*	-	-
Venezuela	9.1	32.7	100	11.3	33.8	100	10.4	34.0	100	11.4	33.1	100	19.0	34.6	100	10.0	35.0	100
Viet Nam +	5.4	-	-	12.8	-	-	13.9	-	-	15.2	-	-	31.3	-	-	17.5	-	-
Yemen +	7.9	-	-	14.1	-	-	13.5	-	-	14.7	-	-	23.2	-	-	9.2	-	-
Zambia +	8.1	44.8	20	14.8	...	...	12.4	35.0	7	17.5	...	...	22.9	...	...	11.4	...	...
Zimbabwe	8.8	9.5	14	17.0	2.8	11	17.0	13.9	2	20.7	*23.7*	8	13.0	1.9	70	27.0	...	...

Note: See Technical Notes for details on methodology and description of variables.
Source: WTO-CTS and IDB databases and UN Tariff and Market Access Database for applied tariff for those marked with "+".

TECHNICAL NOTES

(a) Composition of country groups

(i) New regional classification applied in Chapter IA "Recent Trends in International Trade"

North America: Canada, Mexico, United States of America, and territories in North America n.e.s.

South and Central America (including the Caribbean); *Central America*: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama; *Caribbean Countries:* Antigua and Barbuda, Aruba, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Netherlands Antilles, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago; and *South America*: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela and other countries and territories in South and Central America (including the Caribbean) n.e.s.

Europe: *European Union (25):* EU (new members 10): Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia and Slovakia; EU (old members 15): Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom.
Other Western Europe: Iceland, Norway, Switzerland and Liechtenstein.
South-East Europe: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Former Yugoslav Republic of Macedonia, Romania, Serbia and Montenegro, and Turkey.

Commonwealth of Independent States (CIS): Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

Africa, of which *North Africa*: Algeria, Egypt, Libyan Arab Jamahiriya, Morocco and Tunisia; and *Sub-Saharan Africa* comprising: *Western Africa*: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo; *Central Africa*: Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Rwanda, and Sao Tome and Principe; *Eastern Africa*: Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Seychelles, Somalia, Sudan, United Republic of Tanzania and Uganda; and *Southern Africa:* Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe and territories in Africa n.e.s.

The Middle East: Bahrain, Iraq, Islamic Republic of Iran, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates, Yemen and other countries and territories in the Middle East n.e.s.

Asia, of which *West Asia*: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka; and *East Asia (including Oceania)*: Australia; Brunei Darussalam; Cambodia; China; Fiji; Hong Kong Special Administrative Region of China (Hong Kong, China); Indonesia; Japan; Kiribati; Lao People's Democratic Republic; Macau, China; Malaysia; Mongolia; Myanmar; New Zealand; Papua New Guinea; Philippines; Republic of Korea; Samoa; Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu (Taipei, Chinese); Singapore; Solomon Islands; Thailand; Tonga; Tuvalu; Vanuatu; Viet Nam and other countries and territories in Asia and the Pacific n.e.s.

(ii) Standard regional classification used in other parts of the World Trade Report (if not otherwise specified)

North America: Canada, United States of America, and territories in North America n.e.s.

Latin America, of which Mexico; *Central America*: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama; *Caribbean Countries:* Antigua and Barbuda, Aruba, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Netherlands Antilles, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago; and *South America*: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela and other countries and territories in Latin America and the Caribbean n.e.s.

Western Europe: Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Serbia and Montenegro, Slovenia (the last five countries mentioned comprise the former Yugoslavia), and territories in Western Europe n.e.s.

Transition economies, of which *Central and Eastern Europe*: Albania, Bulgaria, Czech Republic, Hungary, Poland, Romania and the Slovak Republic; *the Baltic States*: Estonia, Latvia and Lithuania; and *the Commonwealth of Independent States (CIS)*: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. The grouping *former USSR* refers to the Baltic States and the CIS.

Africa, of which *North Africa*: Algeria, Egypt, Libyan Arab Jamahiriya, Morocco and Tunisia; and *Sub-Saharan Africa* comprising: *Western Africa*: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo; *Central Africa*: Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Rwanda, and Sao Tome and Principe; *Eastern Africa*: Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Seychelles, Somalia, Sudan, United Republic of Tanzania and Uganda; and *Southern Africa:* Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe and territories in Africa n.e.s.

The Middle East: Bahrain, Iraq, Islamic Republic of Iran, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates, Yemen and other countries and territories in the Middle East n.e.s.

Asia, of which *West Asia*: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka; and *East Asia (including Oceania)*: Australia; Brunei Darussalam; Cambodia; China; Fiji; Hong Kong Special Administrative Region of China (Hong Kong, China); Indonesia; Japan; Kiribati; Lao People's Democratic Republic; Macau, China; Malaysia; Mongolia; Myanmar; New Zealand; Papua New Guinea; Philippines; Republic of Korea; Samoa; Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu (Taipei, Chinese); Singapore; Solomon Islands; Thailand; Tonga; Tuvalu; Vanuatu; Viet Nam and other countries and territories in Asia and the Pacific n.e.s.

WTO members are frequently referred to as "country", although some members are not countries in the usual sense of the word but are officially "customs territories". The definition of geographical and other groupings in this report does not imply an expression of opinion by the Secretariat concerning the status of any country or territory, the delimitation of its frontiers, nor on the rights and obligations of any WTO Member in respect of WTO Agreements. The colours, boundaries, denominations and classifications in the maps of this publication do not imply, on the part of the WTO, any judgement on the legal or other status of any territory, or any endorsement or acceptance of any boundary.

The Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu is referred to as Taipei, Chinese throughout this report.

(b) WTO Members tariff profiles

(i) Tariff calculations

The tariff calculations were based on data available in the WTO's Consolidated Tariff Schedules database (CTS) and the Integrated Data Base (IDB), complemented by data drawn from the UN Tariff and Market Access Database (UN TARMAC) of ITC and UNCTAD. The cut-off date for data inclusion was 28 February 2005.

Tariff profiles for MFN final bound duties were taken from the CTS, which includes final bound duties and other information such as implementation periods and initial negotiating rights. In early 2005 most Members had already fully implemented all their commitments. For some Members, in particular those who joined recently, some commitments will only be implemented by 2013. The CTS covers all WTO Members, contains all commitments on goods including pre and post Uruguay Round negotiations and is updated regularly. The tariff profiles for bound duties are shown for 122 Members.[1]

Tariff profiles for MFN statutory applied duties are sourced from the IDB. The IDB, based on Members' notifications, contains MFN applied and current bound duties and import statistics. It also includes preferences and *ad valorem* equivalents (AVEs) for non *ad valorem* tariff lines if provided by Members on a voluntary basis. The database covers WTO Members and Acceding countries for which processed information is available. In each case the latest available year has been selected.

The UN TARMAC database which contains national tariff and trade statistics is used to supplement the IDB for data on applied tariffs for non WTO Members and for cases in which IDB has received no notification from the Member or where its data is more up-to-date than the IDB's by at least two years.

The first step in the calculations consisted of aggregating all tariff line duties up to the level of HS 6-digit subheadings of the Harmonised System (HS) which offers a common structure that is not biased by the different levels of disaggregation in Members' tariffs. Only HS chapters 01 to 97 were taken into account. The definition of agriculture was based on WTO Agreement on Agriculture which has been transposed by the Secretariat to HS 1996 and HS 2002 nomenclatures.

For the calculation of HS 6-digit duty averages and maxima, only *ad valorem* duties, including AVEs if available, were used. However, the incidence of non *ad valorem* duties (specific, mixed, compound or other duties) is indicated in related tables. With respect to indicators for bound duties, only bound tariff lines were taken into account in the calculations. Any HS 6-digit subheading was considered to be bound if at least one tariff line within that subheading was bound. The duty averages were calculated only on bound tariff lines. Any HS 6-digit subheading where no tariff line within that subheading was bound was considered to be unbound. All subsequent steps in the calculations were based on these 'pre-aggregated' HS 6-digit duty averages.

Symbols used for tariff profiles:

- \- not applicable, not bound
- ... data not available
- x simple averages not calculated because more than 40 per cent of HS 6-digit subheadings contain at least one non-*ad valorem* duty
- *italics* is used for simple averages when between 10 and 40 per cent of HS 6-digit subheadings contain at least one non-*ad valorem* duty.

[1] The 25 member states of the European Communities are counted as one, and Switzerland and Liechtenstein are also counted as one.

Technical Note Table 1
Description of table headings in tariff profiles

COLUMN HEADING	DESCRIPTION OR METHOD OF CALCULATION
Import market	Name of country or territory.
Binding coverage (per cent)	Number of HS 6-digit subheadings containing at least one bound tariff line divided by the respective total number of HS 6-digit subheadings of the corresponding version of the HS nomenclature.
Simple average	Simple average of the *ad valorem* HS 6-digit duties.
Duty free (per cent)	Number of HS 6-digit subheadings for which all tariff line duties are equal to zero, divided by the respective total number of HS 6-digit subheadings.
Maximum	Maximum *ad valorem* duty based on tariff line duties.
Non *ad valorem* duties (per cent)	Number of HS 6-digit subheadings having at least one non *ad valorem* duty without *ad valorem* equivalent, divided by the respective total number of HS 6-digit subheadings. Duties not provided were treated as non *ad valorem*.
National peaks (per cent)	Number of HS 6-digit duties at least three times higher than the Member's overall simple average, divided by the respective total number of HS 6-digit subheadings.

Technical Note Table 2
Description of the different categories[1]

CATEGORY NUMBER	DESCRIPTION	HARMONIZED SYSTEM NOMENCLATURE HS 2002
01	Wood, pulp, paper and furniture	Ch.44, 45, 47, Ch. 48 (except 4815), Ch.49, 9401-04 (except 940490).
02	Textiles and clothing	300590, 330620, 392112-13, 392190, 420212, 420222, 420232, 420292, Ch. 50-63 (except 5001-03, 5101-03, 5201-03, 5301- 02), 640520, 640610, 640699, 6501-05, 6601, 701911-19, 701940-59, 870821, 8804, 911390, 940490, 950291, 961210.
03	Leather, rubber, footwear and travel goods	Ch. 40, Ch. 41 (except 4101-4103), 4201-05 (except 420212, 420222, 420232, 420292), 4302-04, Ch. 64 (except 640520, 640610, 640699), 9605.
04	Metals	2601-17, 2620, Ch. 72-76 (except 7321-22), Ch. 78-83 (except 8304-05).
05	Chemicals and photographic supplies	2705, Ch. 28-30 (except 290543-45 and 300590), Ch. 32-33 (except 3301 and 330620), Ch. 34 (except 3403, 3406), 3506-07, 3601-04 and Ch. 37-39 (except 380910, 3823, 382460 and 392112-13, 392190).
06	Transport equipment	Ch. 86 (except 8608), 8701-08 (except 870821), 8711-14, 8716, 8801-03, Ch. 89.
07	Non-electric machinery	7321-22, Ch. 84 (except 846721-29), 8608, 8709.
08	Electric machinery	846721-29, Ch. 85 (except 8519-24).
09	Mineral products and precious stones and precious metals	Ch. 25, 2618-19, 2621, 2701-04, 2706- 08, 2711-15, Ch.31, 3403, Ch. 68-71 (except 6807, 701911-19, 701940-59), 911310-20.
10	Manufactured articles not elsewhere specified	2716, 3406, 3605-06, 4206, Ch. 46, 4815, 6506-07, 6602-03, Ch. 67, 6807, 8304-05, 8519-24, 8710, 8715, 8805, Ch. 90-93 (except 9113), 9405-06 and Ch. 95-97 (except 950291, 9605 and 961210).
11	Fish and fish products	Ch. 03, 0509, 1504, 1603-05, 230120.
12	Fruit and vegetables	Ch. 07, Ch. 08, 1105-06, 2001-08.
13	Coffee, tea, maté, cocoa and preparations	0901-03, Ch. 18 (except 1802), 2101.
14	Sugars and sugar confectionery	Ch. 17.
15	Spices, cereal and other food preparations	0407-10, 0904-10, 1101-04, 1107-09, Ch. 19, 2102-06, 2209.
16	Grains	Ch. 10.
17	Animals and products thereof	Ch. 01, Ch. 02, 1601-02.
18	Oil seeds, fats and oils and their products	1201-08, Ch. 15 (except 1504), 2304-06, 3823.
19	Cut flowers, plants, vegetable materials; lacs, etc.	0601-03, 1211, Ch. 13, Ch. 14.
20	Beverages and spirits	2009, 2201-08.
21	Dairy products	0401-06.
22	Tobacco	Ch. 24.
23	Other agricultural products	Ch.05 (except 0509), 0604, 1209-10, 1212-14, 1802, 230110, 2302-03, 2307-09, 290543-45, 3301, 3501-05, 380910, 382460, 4101-03, 4301, 5001-03, 5101-03, 5201-03, 5301-02.
97	Petroleum	2709-10.

[1] These categories are commonly referred to as the Multilateral Trade Negotiations categories. Non-agricultural products are those classified under categories 01-11 and 97. The others are classified as agricultural products. Ch refers to HS Chapter.