

International Trade: Lecture 1

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Higher School of Economics

Fall 2017

Organization: Lectures

- Lectures (Alexander Tarasov, Ph.D.):
 - Tuesday 13.40-15.00, 15.10-16.30
 - the "way of teaching": lectures and seminars "together", slides+blackboard (examples, derivations, pictures)
 - materials: slides, problem sets (some with solutions) posted online
- Webpage: piazza.com
 - <https://www.hse.ru/en/org/persons/160474249#teaching>
- Office hours: Wednesday, 16.00 - 17.30 by appointment, room 1218 (building 1)
- E-mail: atarasov@hse.ru

Organization: Assistants

- Kharis Sokolov (kharis-sokolov@outlook.com)
- Kharis will organize meetings where he will consider some additional problems related to the material taught on lectures (the information about the time and place will be posted on the course webpage)

Organization: Final Grade

- The midterm test (45%), the final test (55%) → the final grade is cumulative
→ if you fail, there will be a commission in January
- For each part: 0-100 points → final points (based on the corresponding weighting) → final grade on the 0-10 scale
- The final test will cover all the material
- There will be no make-up for the mid-term test. With an official excuse (e.g. illness with a valid medical proof), her or his final test score will account for 100% of the course grade.
- **Important:** no loud and constant talks during the lectures!

Key Facts About International Trade: Global Dynamics

Globalization over 5 centuries (1500-2011)

Shown is the sum of world exports and imports as a share of world GDP (%)

The individual series are labeled with the source of the data

Our World
in Data



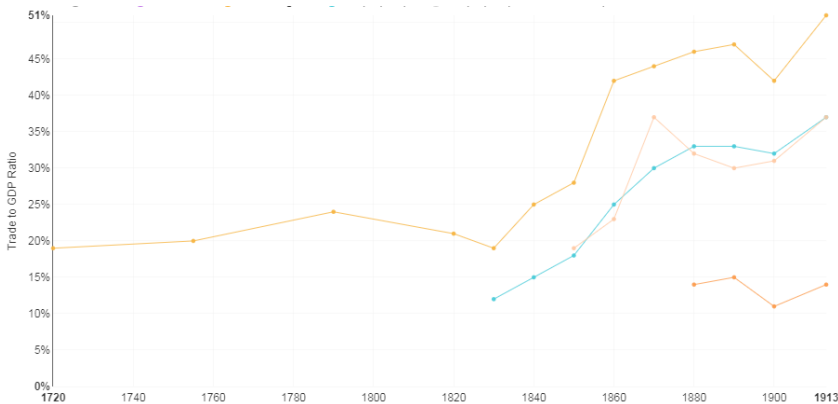
Data sources: Klasing and Milionis (2014), Estevadeordal, Frantz and Taylor (2003) and the Penn World Tables Version 8.1
The interactive data visualization is available at OurWorldinData.org. There you find the raw data and more visualizations on this topic.

Licensed under CC-BY-SA by the author Max Roser.



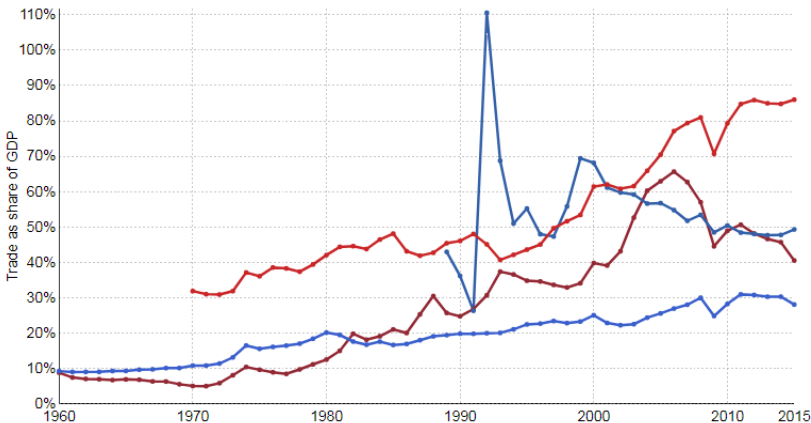
Key Facts About International Trade: Global Dynamics

Exports plus imports as share of GDP in Europe, 1655-1913 – Our World in Data, with data from Broadberry and O'Rourke (2010)



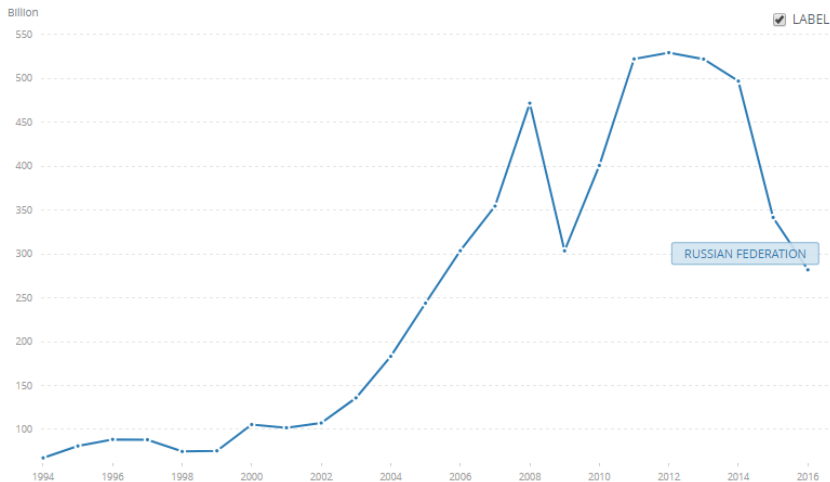
Key Facts About International Trade: Global Dynamics

Trade Openness, 1950 to 2011 (trade openness is measured as the sum of a country's exports and imports as a share of that country's GDP (in %))



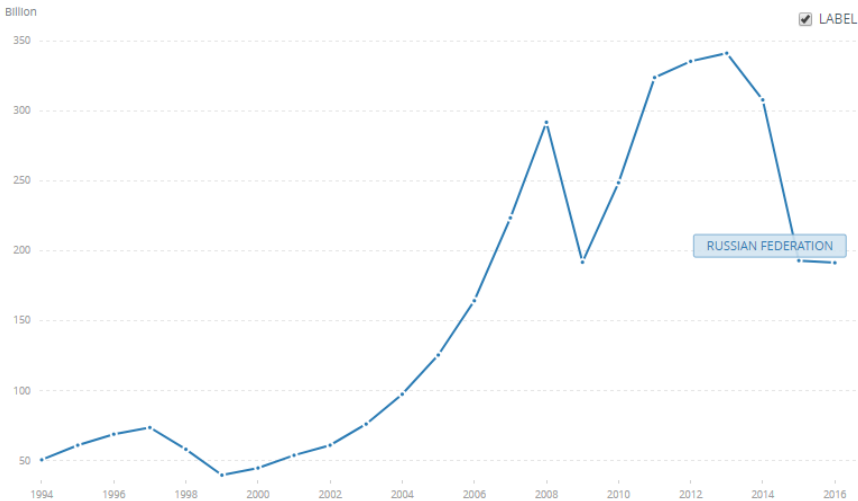
Key Facts About Russian Trade

Merchandise exports (current US\$, The World Bank Data):



Key Facts About Russian Trade

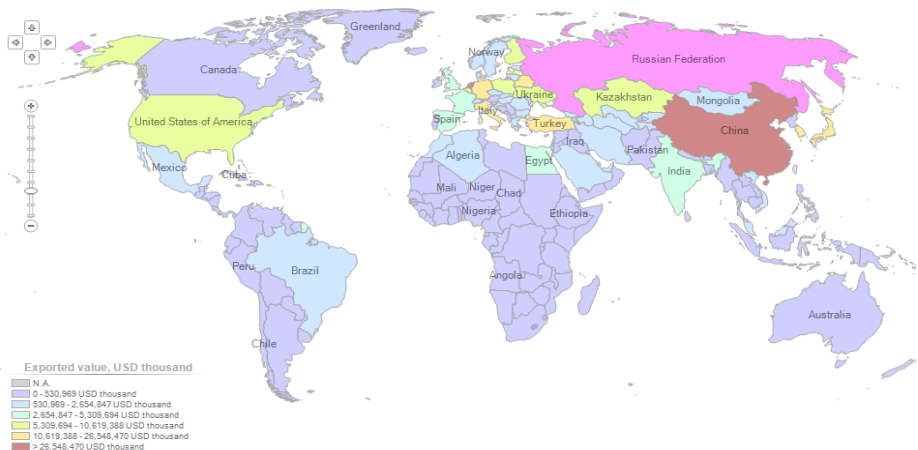
Merchandise imports (current US\$, WTO Data):



Key Facts About Russian Trade: Exports across World

List of importing markets for a product exported by Russian Federation in 2015

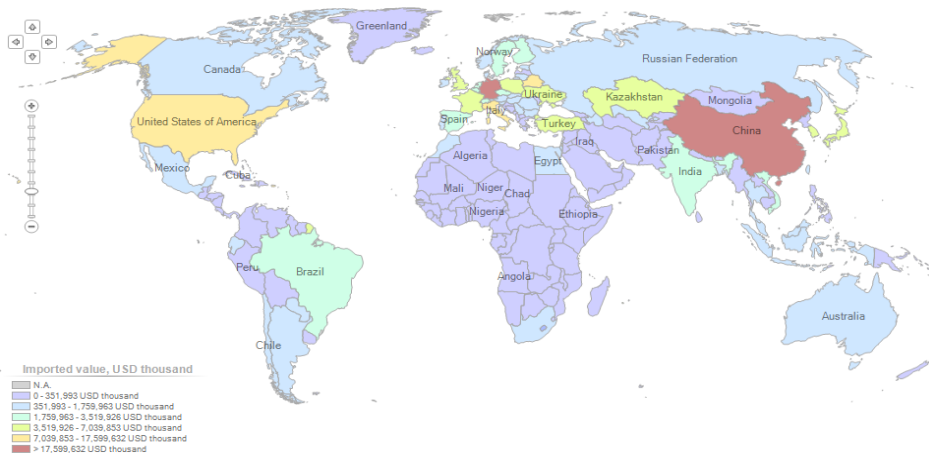
Product : TOTAL All products



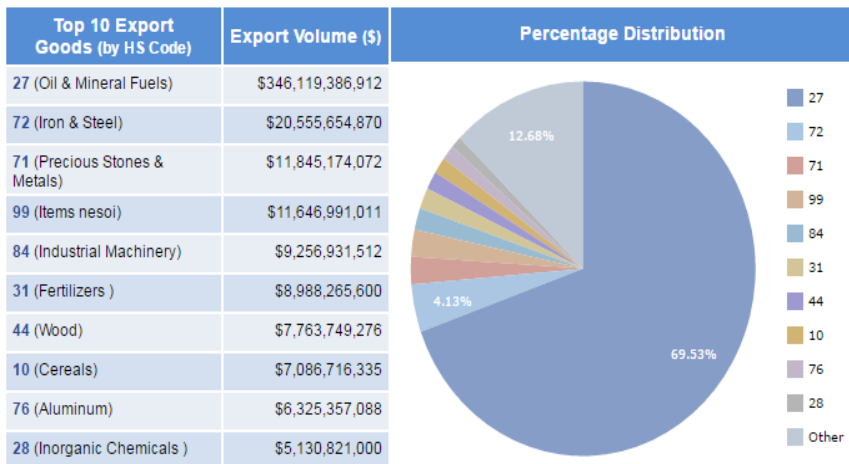
Key Facts About Russian Trade: Imports across World

List of supplying markets for a product imported by Russian Federation in 2015

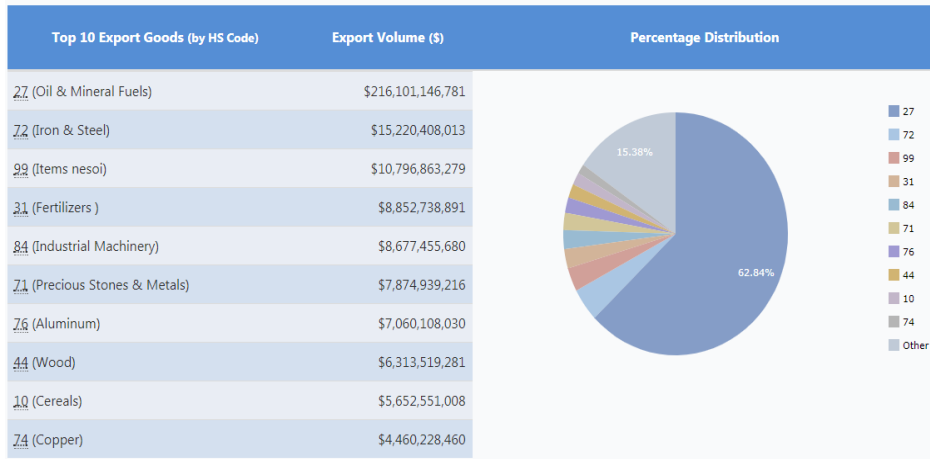
Product : TOTAL All products



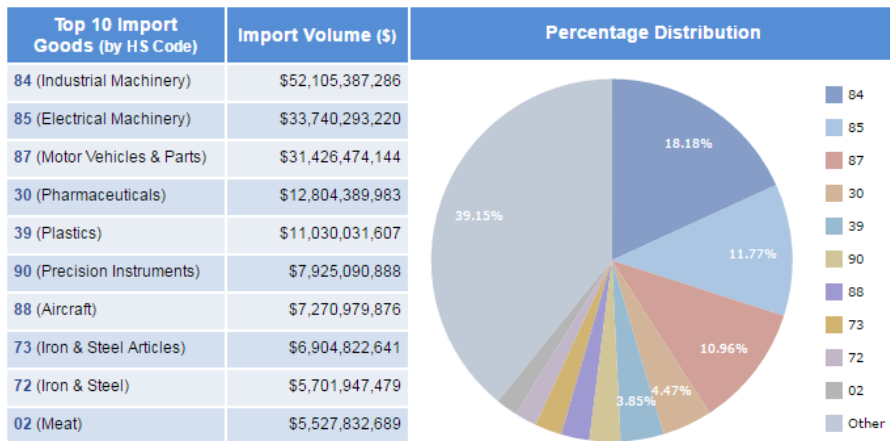
Key Facts About Russian Trade: Composition of Exports (2014)



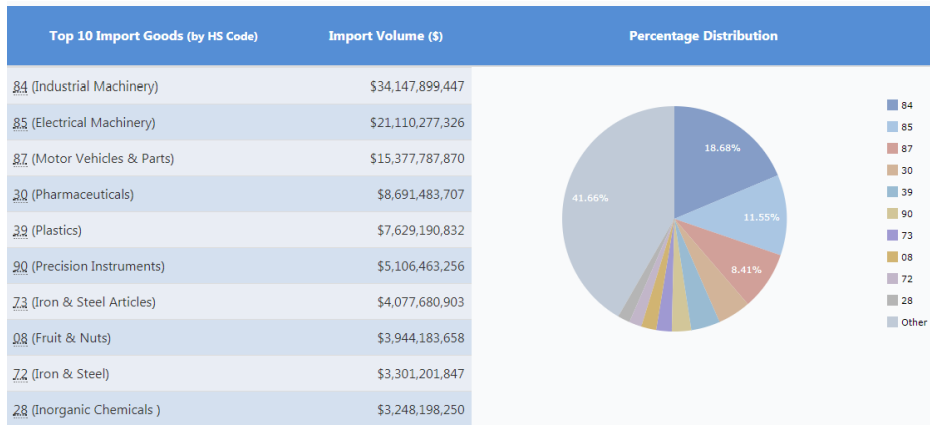
Key Facts About Russian Trade: Composition of Exports (2015)



Key Facts About Russian Trade: Composition of Imports (2014)



Key Facts About Russian Trade: Composition of Imports (2015)



Some Conclusions

- Until the end of 19th century trade volumes were not substantial
- Railroads and steam turbines gave a rise to international trade \implies the first "golden age" of trade
- WW1, the Great Depression, WW2 \implies a decrease in international trade
- After WW2 we observe a constant rise in international trade volumes (the second "golden age") \implies nowadays, the share of world trade is around 60%

Questions We Need to Answer

Since international trade seems to be important, economists need to understand:

- What factors give a rise in trade between countries and explain trade patterns (who imports/exports, what?)
- Are there gains from trade? If so, who gains? Can some group of population lose from trade?
- What is the size of gains/losses from trade?
- What are economic consequences of trade policies?
- What are consequences of outsourcing and offshoring?

This course is a small step towards answering all these questions!

This Course

PART 1: Comparative Advantage and Trade

- The first golden age of trade was characterized by inter-industry trade
 - England exchanged machines for Australian wool and Indian tea, clothes for Portugal wine
- Countries traded because they were different (differences in factor endowments, technologies, etc.) \implies the role of **comparative advantage in determining trade patterns ("foundations" of international trade)**
- The Ricardian model (differences in technologies) and the Heckscher–Ohlin model (differences in factor endowments) of trade

This Course

- On the one hand, trade definitely depends on the comparative advantage principle
 - USA, West Europe, Japan have a lot of skilled labor \implies export skilled-intensive products
 - Asian countries have a lot of unskilled labor \implies export "simpler" products (producing of which requires just unskilled labor)
- However, more than 50% of modern trade includes trade between similar countries and, moreover, these trade flows are usually within one industry (intra-industry trade)
 - the principle of comparative advantage cannot be applied here \implies
 - the New Trade Theory (by Paul Krugman and Elhanan Helpman)

This Course

PART 2: Increasing Returns to Scale (Economies of Scale) and Trade

- The CES consumer preferences
- The theory of monopolistic competition with homogenous firms
- The equilibrium in the model of trade with CES preferences and monopolistic competition
- The gains from trade
- The home market effect (brief discussion)
- The role of firm heterogeneity (?)

This Course

PART 3: The Magnitude of the Gains from Trade

- The gravity equation: theory and empirics
- The magnitude of the gains from trade: the structural approach
- Measuring the gains from trade: a natural experiment approach

PART 4: International Trade Policy

- Trade policy under perfect and imperfect competition (small and large economies)
- Some empirics on trade policies (?)

PART 5: Assorted Topics (will be decided later, if we have time)

The Principle of Comparative Advantage (David Ricardo, 1817)

- England and Portugal: clothes and wine
- Producing both clothes and wine was cheaper in Portugal (the climate is better), than in England (the **absolute advantage**)
- **BUT!** In relative terms: Portugal is relatively better in producing wine than clothes, while England is better in producing clothes than wine
- Portugal has a comparative advantage in producing wine, England in clothes
- David Ricardo: Portugal will export wine to England, while England will export clothes
- Both countries gain!

The patterns of trade are determined by comparative advantage!

Prior to Ricardo

- Mercantilism as dominant view in 17th and 18th centuries:
 - amount of gold and silver a nation holds symbolized its wealth
 - nations encouraged exports and restricted imports as a method to improve inflow of gold and silver
 - mercantilists viewed trade as a zero-sum game: trade between nations cannot be mutually beneficial to all parties
- Adam Smith 'The Wealth of Nations' (1776):
 - trade can be a positive-sum game
 - trade improved the allocation of labor, ensuring that each good would be produced in the country where the goods production required the least labor
 \implies all parties gain from trade
 - BUT! Adam Smith considered the absolute advantage!

The Principle of Comparative Advantage (continued)

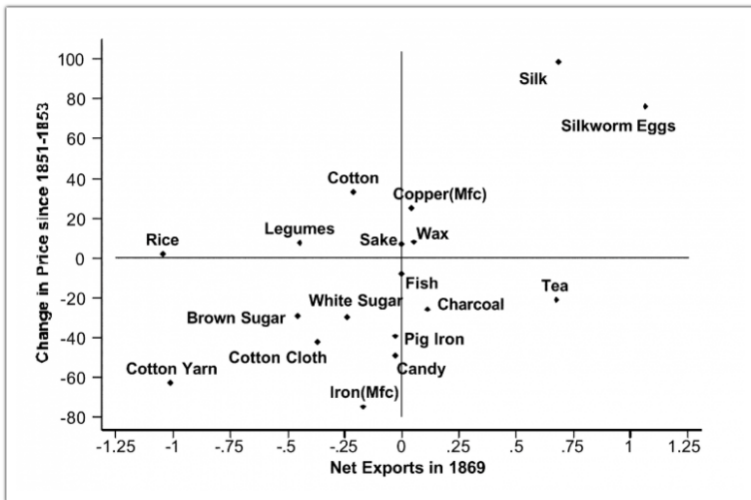
- The comparative advantage is not necessarily determined by climate:
 - different technologies
 - different factors of production
 - different financial development
 - different labor markets
- It is a very general concept!

Some Evidence

- All nations can gain from trade if each specializes in producing what they are relatively more efficient at producing, and import the rest
- The empirical evidence suggests that the principle of comparative advantage does help explain trade patterns
 - the next graph shows the price changes of the key tradable goods after the opening up to trade of Japan in 1850

Some Evidence

Net exports and price changes for 1869, Japan – Figure 4 in Bernhofen and Brown (2014)⁹



The Simplest Framework

- **Krugman, Obsfeld, Melitz: Chapter 3; Feenstra: Chapter 1**
- 2 countries: Home (H) and Foreign (F)
- 2 goods (sectors): good 1 and good 2
- 1 factor of production (labor)
- This is a $2 \times 2 \times 1$ model.

The Simplest Framework: Main Assumptions

- Labor is not mobile between countries (but perfectly mobile between sectors)
 \implies wages are determined in national labor markets
- Perfect competition \implies prices are determined by markets
- Full employment
- Identical homothetic preferences
- Different technologies
- Trade is free (no trade costs)

Technology

- To produce one unit of good 1 or 2: a_1 or a_2 and a_1^* or a_2^* units of labor are used at Home and Foreign, respectively.
- Alternatively: one unit of labor at Home can produce $1/a_1$ units of good 1 or $1/a_2$ units of good 2. Similar for Foreign.
- In terms of production functions:

$$y_1 = l_1/a_1, y_1^* = l_1^*/a_1^*$$

$$y_2 = l_2/a_2, y_2^* = l_2^*/a_2^*$$

- The endowments of labor are L and L^*

Production Possibility Frontier (PPF)

- PPF describes all the combinations of two goods that can be produced in an economy given its technology and factor endowments
- **Opportunity costs** of producing good 1: by how many units the production of good 2 should decrease to increase the production of good 1 by one unit
 - to produce one unit of good 1 at Home, we need a_1 units of labor
 - a_1 units of labor can produce a_1 / a_2 units of good 2 \implies the opportunity cost of good 1 at Home is a_1 / a_2
 - what about the opportunity cost of good 2?
- PPF is a line (discussion in the class): $a_1 y_1 + a_2 y_2 = L$ (the labor market clearing condition)

Equilibrium in the Closed Economy

- In the equilibrium we need to find: production and consumption of both products, the relative price p_1^a / p_2^a ('a' means autarky)
- A key point (from Microeconomics): given prices p_1 and p_2 , production in the competitive equilibrium maximizes the total GDP, $p_1 y_1 + p_2 y_2$ subject to PPF
- In our case, PPF is linear \implies if consumers like both products, then in the closed economy equilibrium $p_1^a / p_2^a = a_1 / a_2$ (otherwise, one of the products is not produced)
- Alternative way: if both products are produced, perfect competition implies $p_1^a = w a_1, p_2^a = w a_2 \implies p_1^a / p_2^a = a_1 / a_2$
- For Foreign, everything is the same. $p_1^{a*} / p_2^{a*} = a_1^* / a_2^*$

Equilibrium in the Closed Economy

- The budget constraint of the representative consumer:
 - $p_1^a c_1 + p_2^a c_2 = wL$
 - perfect competition $\implies p_1^a = wa_1, p_2^a = wa_2$
 - the budget constraint coincides with the PPF!!
- If there is no trade, consumption=production
- Equilibrium values are determined by the preferences (PICTURE)

When Two Countries Can Trade

- We say that Home has a comparative advantage in good 1, if the opportunity cost of good 1 is lower at Home (hereafter, we assume this): $a_1 / a_2 < a_1^* / a_2^*$
 - what about a comparative advantage in good 2?
 - what about an absolute advantage?
- **Conjecture (Ricardo):** a country exports a product in which it has a comparative advantage
 - Home exports good 1, Foreign exports good 2
- To show this, we construct an equilibrium when the countries trade
- *The key idea is to construct the world relative supply and demand curves and find the equilibrium relative price*

When Two Countries Can Trade

Brief summary of the idea (the rest on the blackboard):

- If $p_1^w/p_2^w < a_1/a_2 < a_1^*/a_2^* \implies y_1 = y_1^* = 0 \implies$

$$RS = \frac{y_1 + y_1^*}{y_2 + y_2^*} = 0$$

- If $p_1^w/p_2^w = a_1/a_2 < a_1^*/a_2^* \implies y_1 \in [0, L/a_1], y_1^* = 0, y_2^* = L^*/a_2 \implies$

$$RS = \frac{y_1 + y_1^*}{y_2 + y_2^*} \in \left[0, \frac{L/a_1}{L^*/a_2}\right]$$

- If $a_1/a_2 < p_1^w/p_2^w < a_1^*/a_2^* \implies y_1 = L/a_1, y_1^* = 0, y_2^* = L^*/a_2, y_2 = 0 \implies$

$$RS = \frac{y_1 + y_1^*}{y_2 + y_2^*} = \frac{L/a_1}{L^*/a_2}.$$

- If $a_1/a_2 < p_1^w/p_2^w = a_1^*/a_2^* \implies y_1 = L/a_1, y_1^* \in [0, L^*/a_1^*], y_2 = 0 \implies$

$$RS = \frac{y_1 + y_1^*}{y_2 + y_2^*} \in \left[\frac{L/a_1}{L^*/a_2}, \infty\right).$$

When Two Countries Can Trade

- Overall, the relative supply curve is a step function
- The intersection of the relative demand (which is completely determined by the preferences) and relative supply curves gives the equilibrium world relative price p_1^w / p_2^w
- If we know the price, we can find production and consumption in each country (see the numerical example considered in the class)

The Pattern of Trade and the Gains from Trade

- Assume that the equilibrium price is such that $a_1/a_2 < p_1^w/p_2^w < a_1^*/a_2^*$
(between the two autarky prices, see the picture)
- In this case, we have complete specialization: $y_1 = L/a_1$, $y_2 = 0$, $y_1^* = 0$, $y_2^* = L^*/a_2^*$
 - Home exports good 1, Foreign exports good 2
 - what about the other cases?
- It is possible to show that both countries gain from trade (see the picture in the class)
 - the idea is based on the fact that in the trade equilibrium consumers have "better" consumption possibilities, since the relative price of the good the economy produces is higher than in the autarky equilibrium
 - what about the other cases?

Misconceptions about Comparative Advantage

- "Free trade is beneficial only if a country is more productive than foreign countries."
- "Free trade with countries that pay low wages hurts high wage countries."
- "Free trade exploits less productive countries."

The Ricardian Model: Continuum of Goods (Dornbusch, Fischer and Samuelson (1977))

Assumptions:

- two countries
- continuum of goods $z \in [0, 1]$
- different technologies and factor endowments:
 - $a(z)$ and $a^*(z)$ are labor requirements in industry z at home and abroad, respectively
 - L and L^* are labor endowments: labor is perfectly mobile between sectors, but immobile across countries

The Ricardian Model: Continuum of Goods

Let us arrange industries such that the relative unit labor requirement function

$$A(z) = \frac{a^*(z)}{a(z)}$$

is decreasing: $A'(z) < 0$. That is, the foreign country is relatively more productive in industries that are "closer" to 1.

Let us define w and w^* as nominal wages at home and abroad, respectively. The home country will produce all those commodities for which domestic unit labor costs are less than or equal to foreign unit labor costs. In other words, good z is produced at home if

$$a(z)w \leq a^*(z)w^*.$$

The Ricardian Model: Continuum of Goods

Hence, if we denote $\omega = \frac{w}{w^*}$, then there exists a cutoff \tilde{z} such that goods with index $z \leq \tilde{z}$ are produced at home, while goods with $z > \tilde{z}$ are produced abroad.

The cutoff \tilde{z} solves

$$A(\tilde{z}) = \omega.$$

In other words, given wages, the home country has comparative advantage in goods with $z \in [0, \tilde{z}]$, while the foreign country has comparative advantage in goods with $z \in (\tilde{z}, 1]$.

The Ricardian Model: Continuum of Goods

Finally, the prices are given by

$$P(z) = \min(wa(z), w^*a^*(z)).$$

Thus, the relative price of good z with respect to good z' is as follows:

$$\frac{P(z)}{P(z')} = \begin{cases} a(z)/a(z') & \text{if } z, z' \leq \tilde{z} \\ \omega a(z)/a^*(z') & \text{if } z < \tilde{z} < z' \\ a^*(z)/a^*(z') & \text{if } \tilde{z} < z, z' \end{cases}$$

The Ricardian Model: Continuum of Goods

Demand side:

Identical and homothetic preferences:

$$P(z)C(z) = b(z)Y > 0,$$

where $C(z)$ is demand for good z , Y is total income, and $b(z)$ is the fraction of income spent on good z . This fraction is exogenous. Moreover,

$$\int_0^1 b(z) dz = 1.$$

Therefore, the fraction of total income spent on the goods in which the home country has a comparative advantage:

$$\theta(\tilde{z}) = \int_0^{\tilde{z}} b(z) dz > 0$$

with $\theta'(\tilde{z}) = b(\tilde{z}) > 0$.

The Ricardian Model: Continuum of Goods

Factor market clearing condition:

The labor supply at home is given by L . Recall that the demand for good z is given by

$$\frac{b(z) Y^w}{P(z)}.$$

Therefore, if the good is produced at home, then labor, which is necessary to produce that good, is

$$a(z) \frac{b(z) Y^w}{P(z)} = \frac{b(z) Y^w}{w} \quad (\text{as } P(z) = wa(z)).$$

As a result, total labor demand is given by

$$\int_0^{\tilde{z}} \frac{b(z) Y^w}{w} dz = \theta(\tilde{z}) \frac{Y^w}{w}.$$

The Ricardian Model: Continuum of Goods

Equilibrium:

- Labor supply is equal to labor demand:

$$L = \theta(\tilde{z}) \frac{Y^w}{w} \iff$$

$$\omega = \frac{\theta(\tilde{z})}{1 - \theta(\tilde{z})} \frac{L^*}{L},$$

as $Y^w = wL + w^*L^*$.

- Finally,

$$\omega = A(\tilde{z})$$

So we have two equations and two unknowns (ω and \tilde{z}). This closes the model (see the picture in the class).

The Ricardian Model: Continuum of Goods

Gains from trade:

To analyze the gains from trade, we look at the changes in real return to labor (real income). Specifically, we look at $\frac{w}{P(z)}$ for all $z \in [0, 1]$.

In autarky: $P(z) = wa(z) \implies \frac{w}{P(z)} = \frac{1}{a(z)}$ for all z .

The Ricardian Model: Continuum of Goods

In the trade equilibrium,

- for $z \in [0, \tilde{z}]$, $P(z) = wa(z) \implies$

$$\frac{w}{P(z)} = \frac{1}{a(z)}.$$

No gains and losses!

- for $z \in [\tilde{z}, 1]$, $P(z) = w^*a^*(z) \implies$

$$\frac{w}{P(z)} = \frac{w}{w^*a^*(z)} = \frac{wa(z)}{w^*a^*(z)} \frac{1}{a(z)} > \frac{1}{a(z)},$$

as $wa(z) > w^*a^*(z)$. Consumers can buy greater amounts of goods with $z \in [\tilde{z}, 1]$.

The Ricardian Model with Transport Costs (Tariffs)

Consider the same model with continuum of goods, but also with non-zero transport costs. In particular, we consider the "iceberg" transport costs. That is, to deliver one unit of a good, τ units have to be sent, where $\tau > 1$. In other words, a fraction $\frac{1}{\tau}$ of a shipped good actually arrives. This modifies the equilibrium equations in the following way. If good z is such that

$$wa(z)\tau < w^*a^*(z),$$

then good z is produced at home and exported to the foreign country. This gives the cutoff \tilde{z} :

$$\omega\tau = A(\tilde{z}).$$

The Ricardian Model with Transport Costs (Tariffs)

If good z is such that

$$w^* a^*(z) \tau < w a(z),$$

then this good is produced abroad and imported by the home country. We have one more cutoff \tilde{z}^* :

$$\frac{\omega}{\tau} = A(\tilde{z}^*).$$

Lemma

$\tilde{z}^* > \tilde{z}$ if and only if $\tau > 1$.

Hence, we can see that if good z is such that $z \in (\tilde{z}, \tilde{z}^*)$, then this good is produced in both countries and not traded. In other words, we have a set of not traded goods (see the picture in the class). This is due to the presence of transport costs.

The Ricardian Model with Transport Costs (Tariffs)

Equilibrium:

In the same manner as before, we compute labor demand in the home country. In particular, if $z \in [0, \tilde{z}]$, then it is exported abroad and, thereby, the demand is given by $\frac{b(z)Y^w}{P(z)}$. However, if $z \in (\tilde{z}, \tilde{z}^*)$, then this good is not traded and, in this case, the demand is given by $\frac{b(z)Y}{P(z)}$, where Y is the total income in the home country.

The Ricardian Model with Transport Costs (Tariffs)

Hence, the total labor demand is given by

$$\int_0^{\tilde{z}} a(z) \frac{b(z) Y^w}{P(z)} dz + \int_{\tilde{z}}^{\tilde{z}^*} a(z) \frac{b(z) Y}{P(z)} = \frac{(wL + w^*L^*)}{w} \int_0^{\tilde{z}} b(z) dz + \frac{wL}{w} \int_{\tilde{z}}^{\tilde{z}^*} b(z) dz$$

Labor market clearing condition:

$$L = \frac{(wL + w^*L^*)}{w} \int_0^{\tilde{z}} b(z) dz + \frac{wL}{w} \int_{\tilde{z}}^{\tilde{z}^*} b(z) dz \iff$$

$$\omega = \frac{L^*}{L} \frac{\int_0^{\tilde{z}} b(z) dz}{1 - \int_0^{\tilde{z}^*} b(z) dz}.$$

The Ricardian Model with Transport Costs (Tariffs)

Equilibrium conditions:

$$\omega = \frac{L^*}{L} \frac{\int_0^{\tilde{z}} b(z) dz}{1 - \int_0^{\tilde{z}^*} b(z) dz}$$

$$\omega \tau = A(\tilde{z})$$

$$\frac{\omega}{\tau} = A(\tilde{z}^*).$$

Three equations, three unknowns \implies we can find ω , \tilde{z} , and \tilde{z}^* .

Bringing Model to the Data

- The model above is very simple and stylized \implies what is the right test of the model?
- We consider some simple regressions that take the intuition of a 2-country Ricardian model.
- Not a true test of the model! **JUST SOME SUPPORTIVE EVIDENCE!**

The MacDougall Test

- MacDougall (Economic Journal, 1951):
 - used comparative productivity measures (for the UK and the USA in 1937) to 'test' the intuitive prediction of Ricardian theory
 - recall that Home exports good z if
$$wa(z) < a^*(z)w^* \implies a^*(z)/a(z) > w/w^*$$
 - $a(z)$ is inverted productivity or inverted output per worker
 - thus, if there are 2 countries in the world (UK and USA), then each country will export those goods for which the ratio of its output per worker to that of the other country exceeds the ratio of its money wage rate to that of the other country
 - in the model with more than two countries, this statement is not necessarily true!

The MacDougall Test: The Correlation

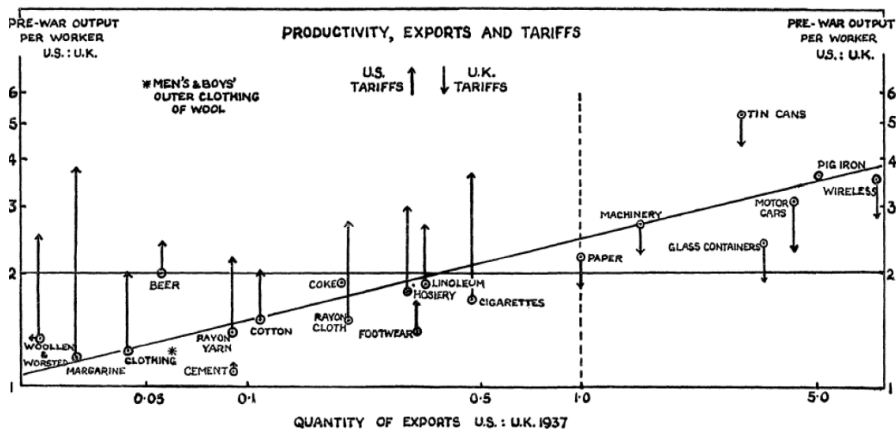


FIG. 1.

The MacDougall Test: Replication by Stern (1962)

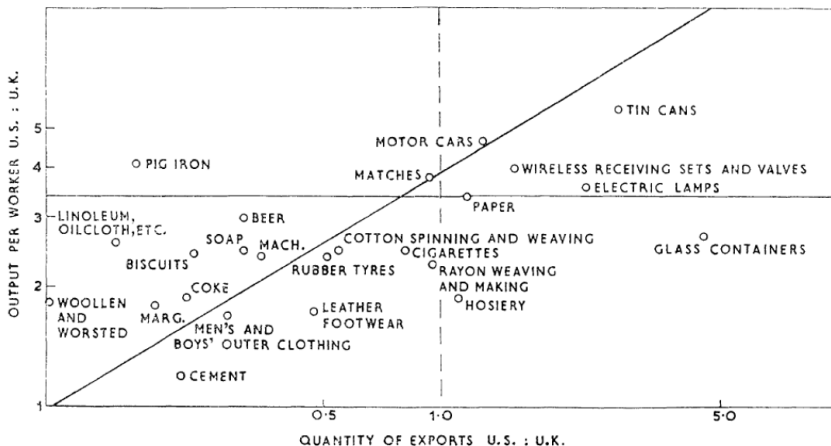


FIG. 1. Scatter diagram of American and British ratios of output per worker and quantity of exports, 1950.