

Course title: Input-output analysis in world economy

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1. Course Description

a. Title of a Course:

Input-output analysis in world economy

b. Pre-requisites

Students should have some formal training in mathematics and economics. Fundamentals of linear algebra, differential and integral calculus, descriptive statistics, probability theory and mathematical statistics will be needed at some point of our discussion.

I will dedicate some time for revision of the main concepts needed for understanding of input-output analysis. However, the students are expected to recall them quickly.

c. Course Type (compulsory, elective, optional)

Elective

d. Abstract

This course deals with the theory of input-output analysis. The objective of the course is to introduce main modern aspects of input-output analysis to empower students with ideas and insights of how to address global economic issues. The course is essentially integrative, drawing on international economics and mathematics for economics courses to show how input-output tables can be used to analyze input-output linkages at the national and multi-regional level. We will pay particular attention to multi-country input-output tables, and their application to global value chain analysis. Classes will be a mixture of lecture and critical discussion of theory, and its application to practical problems.

2. Learning Objectives

- At the end of the course the student should be able to understand the structure, and work with input-output models,
- The students will be also aware of the advantages and limitations of these types of models.
- The students will be able to apply input-output theory to the analysis of the world economy

3. Learning Outcomes

As a result of the learning of this discipline the student will acquire the following competences.

4. Course Plan

Breakdown of topics and hours

№	Topic	Hours total	Contact hours			Homework
			Lectures	Seminars	Total	
1	Input-Output analysis: theory	48	16		16	32
2	Trade in Value Added: definition and calculations	32	16		16	16
3	Practical application to world economy	36	12		12	24
Overall total		116	44		44	72

TEACHING MATERIALS

We will use:

- 1) Books and textbooks of foreign authors.
- 2) Research articles of foreign authors.
- 3) Video materials
- 4) Instructions provided by the lector.

COURSE TOPICS DESCRIPTION

Part 1. Input-Output analysis: theory

1. Introduction. Review of linear algebra

Definition of matrix. Matrix operations. Identity matrix. Transposition. Linear equation systems. Division. Diagonal matrices.

Recommended readings (compulsory):

- Miller, Ronald & Blair, Peter. (2019). Input-output analysis: foundations and extensions / Ronald E. Miller, Peter D. Blair. Cambridge University Press; 2 edition.
 - Appendix A Matrix Algebra for Input-Output models

2. Foundations of Input–Output Analysis

Notation and fundamental relationships. Input–Output Transactions and National Accounts. Production Functions and the Input–Output Model. The Power Series Approximation of $(I - A)^{-1}$. Open Models and Closed Models. The Price Model.

Recommended readings (compulsory):

- Miller, Ronald & Blair, Peter. (2019). Input-output analysis: foundations and extensions / Ronald E. Miller, Peter D. Blair. Cambridge University Press; 2 edition.

- Chapter 2 Foundations of Input-Output Analysis

3. Input–Output Models at the Regional Level

Single-region models. Many-Region Models: The Interregional Approach. Many-Region Models: The Multiregional Approach. The Balanced Regional Model. The Spatial Scale of Regional Models.

Recommended readings (compulsory):

- Miller, Ronald & Blair, Peter. (2019). Input-output analysis: foundations and extensions / Ronald E. Miller, Peter D. Blair. Cambridge University Press; 2 edition.
 - Chapter 3 Input–Output Models at the Regional Level

4. Supply-Side Models, Linkages, and Important Coefficients

Supply Side Input–Output Models. Linkages in Input-Output models. Backward linkage. Forward linkage. The Sherman–Morrison–Woodbury Formulation.

Recommended readings (compulsory):

- Miller, Ronald & Blair, Peter. (2019). Input-output analysis: foundations and extensions / Ronald E. Miller, Peter D. Blair. Cambridge University Press; 2 edition.
 - Chapter 12 Supply-Side Models, Linkages, and Important Coefficients

Part 2. Trade in Value Added: definition and calculations

1. Introduction to Matlab programming

Setting programming space. Vector notations. Vector and matrices operations. Loops.

Recommended readings (recommended):

- Higham, Desmond J. & Higham, Nicholas J. (2005). Matlab guide. Society for Industrial and Applied mathematics. 2 edition.

2. Calculation of TiVA indicators using Matlab

Basic measures from OECD Inter-Country Input-Output (ICIO) database. Value added content of gross exports and imports. Decomposition of domestic value added in gross exports.

Recommended readings (compulsory):

- TiVA 2018 indicators - definitions. OECD. 2018

3. Calculation of TiVA indicators using Matlab

Final demand measures. Re-exported intermediate imports. Service value-added content.

Recommended readings (compulsory):

- TiVA 2018 indicators - definitions. OECD. 2018

4. Calculation of TiVA indicators using Matlab

Value added origin by source country and industry. Value added embodies in exports by final destination.

Backward and forward participation in GVCs.

Recommended readings (compulsory):

- TiVA 2018 indicators - definitions. OECD. 2018

Part 3. Practical application to world economy

1. Discussion of a scientific paper

Application of TiVA indicators to world economy. How TiVA can be calculated and analyzed. What are benefits of Input-output analysis for understanding world economy processes.

Recommended readings (compulsory):

- ITO, Koji, DESEATNICOV, Ivan, and Kyoji Fukao. 2017. "Japanese Plants' Heterogeneity in Sales, Factor Inputs, and Participation in Global Value Chains," RIETI Discussion paper series 17-E-117, 2017, Research Institute of Economy, Trade and Industry.

2. Practical work.

- Calculation of TiVA indicators using World Input-Output Tables (WIOT) database.

Recommended readings (compulsory):

- TiVA 2018 indicators - definitions. OECD. 2018

3. Final presentations.

5. Reading List

a. Required

Miller, Ronald & Blair, Peter. (2019). Input-output analysis: foundations and extensions / Ronald E. Miller, Peter D. Blair. Cambridge University Press; 2 edition.

ITO, Koji, DESEATNICOV, Ivan, and Kyoji Fukao. 2017. "Japanese Plants' Heterogeneity in Sales, Factor Inputs, and Participation in Global Value Chains," RIETI Discussion paper series 17-E-117, 2017, Research Institute of Economy, Trade and Industry.

b. Optional

Ahmad, N., S. Araujo, A. Lo Turco, and D. Maggioni (2013) Using Trade Microdata to Improve Trade in Value Added Measures: Proof of Concept Using Turkish Data. In A. Mattoo, Z. Wang, and S.-J. Wei (eds.) Trade in Value Added: Developing New Measures of Cross-Border Trade. The International Bank for Reconstruction and Development/The World Bank, Chapter 8, 187–219.

Ahmad, N., and J. Ribarsky (2014) Trade in Value Added, Jobs and Investment (Paper prepared for the IARIW 33rd General Conference Rotterdam, the Netherlands).

Chen, X., L. Cheng, K.C. Fung, L. Lau, Y. Sung, C. Yang, K. Zhu, J. Pei, and Y. Duan (2012) Domestic Value Added and Employment Generated by Chinese Exports: A Quantitative Estimation. *China Economic Review*, 23, 850–864.

Fetzer, J., and E.H. Strassner (2015) Identifying Heterogeneity in the Production Components of Globally Engaged Business Enterprises in the United States. U.S. Department of Commerce, Bureau of Economic Analysis Working Paper, 2015-13.

Fetzer, J.J., T.F. Howells III, L.Z. Jones, E.H. Strassner, and Z. Wang (2018) Accounting for Firm Heterogeneity within U.S. Industries: Extended Supply-Use Tables and Trade in Value Added using Enterprise and Establishment Level Data, NBER Working Paper No. 25249.

Hummels, D., J. Ishii, and K.M. Yi (2001) The Nature and Growth of Vertical Specialization in World Trade. *Journal of International Economics*, 54, 75–96.

Johnson, R.C., and G. Noguera (2012) Accounting for Intermediates: Production Sharing and Trade in Value Added. *Journal of International Economics*, 86, 224–236.

Koopman, R., Z. Wang, and S.-J. Wei (2012) Estimating Domestic Content in Exports When Processing Trade is Pervasive. *Journal of Development Economics*, 99, 178–189.

Koopman, R., Z. Wang, and S.-J. Wei (2014) Tracing Value-Added and Double Counting in Gross Exports. *American Economic Review*, 104, 459–494.

Kowalski, P., J. Lopez Gonzalez, A. Ragoussis, and C. Ugarte (2015) Participation of Developing Countries in Global Value Chains: Implications for Trade and Trade-Related Policies. OECD Trade Policy Papers 179, OECD Publishing, Paris.

Ma, H., Z. Wang, and K. Zhu (2015) Domestic Content in China's Exports and its Distribution by Firm Ownership. *Journal of Comparative Economics*, 43, 3–18.

Meng, B., Y. Zhang, and S. Inomata (2013) Compilation and Applications of IDE-JETRO's International Input-Output Tables, *Economic Systems Research*, 25, 122–142.

Piacentini, M., and F. Fortanier (2015) Firm Heterogeneity and Trade in Value Added. STD/CSSP/WPTGS(2015)23, OECD Publishing.

Timmer, M.P., A.A. Erumban, B. Los, R. Stehrer, and G.J. de Vries (2014) Slicing Up Global Value Chains. *Journal of Economic Perspectives*, 28, 99–118.

Timmer, M.P., E. Dietzenbacher, B. Los, R. Stehrer, and G.J. de Vries (2015) An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production. *Review of International Economics*, 23, 575–605.

6. Grading System

Type of control	Form of control	1 year				Parameters
		1	2	3	4	
In-class period	Attendance	*	*			Participation in the class
	Homework	*	*			Reading of compulsory literature
	Independent work	*	*			Reviewing the material
Final	Report and presentation		*			Writing a report and presenting it

7. Guidelines for Knowledge Assessment

The class will meet once a week for 4 hours. Typically, there will be lectures and discussions of the material covered in the corresponding section. The classes dedicated to calculation of TiVA in indicators will be conducted in a computer classroom. Attendance and participation in the classes are required. The course concludes with a final presentation of the reports.

Methods of evaluation:

The final grade on the course will comprise the following:

- Classroom participation and attendance – 40%
- Final report – 30%
 - Based on the knowledge and practical experience obtained students should select several TiVA indicators and compute them using World Input-Output Tables (WIOT). They should describe the concepts and calculation process. The report should be 3-5 pages. In addition, students should submit Matlab code that they used to calculate these indicators.
- Final presentation – 30%
 - Students should present their final reports by providing rationale for TiVA indicators selection, calculation process and findings.

For each of the above aspects of evaluation the student receives, correspondingly, on a 10-point scale:

- For classroom participation - 0.4 x Q1;
- For final report - 0.3 x Q2;
- For final presentation - 0.3 x Q3

where Q1, Q2, Q3 are grades on a 10-point scale.

8. Methods of Instruction

Lectures, reading of compulsory and optional literature. Practical work with Input-output tables.

9. Special Equipment and Software Support (if required)

For classes 1-4: Blackboard, projector and screen. Blackboard and screen should be on different sides.

For classes 5-10: Computer classroom. **Matlab software must be installed at the computers.**

For class 11: Projector and screen.