



**THE INTERNATIONAL SCHOOL  
OF INPUT-OUTPUT ANALYSIS**

**MODULES**

**7th Edition of the International School of I-O Analysis  
June 19, 2017, Atlantic City, New Jersey, USA**

1. • COMPUTABLE GENERAL EQUILIBRIUM MODELS: AN INTRODUCTION ..... 2
2. • ANALYSING TRADE IN VALUE ADDED THROUGH GLOBAL VALUE CHAINS: SECTORAL  
AND MACRO INDICATORS, METHODOLOGIES AND DIAGNOSTICS ..... 3
3. • ENTROPY ECONOMETRICS APPLIED TO INPUT-OUTPUT ..... 5
4. • WORKING WITH OECD'S ICIO AND INDICATORS: A HANDS-ON APPROACH USING "R"6

# 1. • COMPUTABLE GENERAL EQUILIBRIUM MODELS: AN INTRODUCTION

Lecturer: Professor M. Alejandro Cardenete (Universidad Loyola Andalucía)



## Summary of the Training Session:

Computable General Equilibrium (CGE) Models have grown to satisfy the ever-expanding demand for assessing the potential impacts of policies in a wide-range of settings. The increasing interest on these analytical instruments stems from their ability to integrate the different parts of the economic system in a comprehensive economy-wide framework. The objectives of this training session are the following: to provide the linkages from Input-Output (IO) Analysis, Social Accounting Matrices (SAM) to CGE Models, to present the economic principals underlying CGE models and, to show participants how to build a CGE with the General Algebraic Modelling System (SAM) using empirical data. Apart from offering a complete overview of the CGE modelling, this training session should allow the participants to gain a better understanding of economic policy questions that can be approached with these versatile economic instruments.

## Structure and Contents of the Course:

### First Session: 1h 30'

1. Importance of Computable General Equilibrium Modelling for Economic Policy Decisions.
2. From Input Output Analysis to CGE Models: What makes the difference?

### Second Session: 1h 30'

3. An Overview of General Equilibrium Theory. 45'
  - 3.1. The Walras Law and the Walrasian Equilibrium.
  - 3.2. Normative Properties of Walrasian Equilibrium: The Relevance of Uniqueness and Existence for Static Comparative Analysis.
4. Building a “small” CGE Model with GAMS. Part I. 45'
  - 4.1. Getting started: Describing our economy.
  - 4.2. Equilibrium Equations.

### Third Session: 1h 30'

5. Building a “small” CGE Model with GAMS. Part II.
  - 5.1. Calibrating and Solving the Model.
  - 5.2. “Playing with the Model”: Evaluating Tax Policies.

### Remarks:

It could be necessary that participants have a basic level in Input-Output Tables, Social Accounting Matrices and Micro&Macro-economics foundations. Participants will bring with them their laptops.

Participants will be provided with a link where they can download a “Demo” GAMS version.

### Bibliography:

Applied General Equilibrium. An Introduction, M. A. Cardenete, A. I. Guerra and F. Sancho, Springer, 2012.

## 2. • ANALYSING TRADE IN VALUE ADDED THROUGH GLOBAL VALUE CHAINS: SECTORAL AND MACRO INDICATORS, METHODOLOGIES AND DIAGNOSTICS



**Lecturer: Hubert Escaith** Associate Researcher at Aix-Marseille University (Aix-Marseille School of Economics, France) and Visiting Scholar at SUIBE–WTO Research and Education / WTO Chair Program (Shanghai University of International Business and Economics, China). Ex-WTO Chief Statistician (Geneva) and ex-Director of Statistics and Economic Modelling, UN-ECLAC (Santiago de Chile).

### Objectives

The main objective of this one day training is to introduce the economics of trade in tasks and the main conceptual and analytical differences with the more traditional trade in final goods and services. In the process, we will review some of the main quantitative indicators used in trade analysis and learn the differences between the so-called “Ricardian” trade that founded the classical and neo-classical approaches of international economics, on the one hand, and trade in tasks along global value chains on the other hand.

The lecture, to be organised in four blocks of one hour and half, focuses on the empirical aspects; references to the underlying theoretical models will be kept to a minimum and introduced only in an intuitive manner. The indicators and the (simple) hands-on exercises will build on the use of international input-output matrices and the measure of trade in value-added. The lecture will conclude on reviewing on-going lines of research.

Examples and exercises will remain didactic and use open-source applications (e.g., OpenOffice Calc and user-friendly applications of R) or MS Excel. Real-world examples will mainly be based on the OECD-WTO TiVA database. A syllabus including a reading list will be made available to the students.

### Contents

The lecture is articulated along two main lines of interest: the micro and sectoral approach, on the one hand, and the macro-global perspective, on the other one. The distinction remains relatively artificial and results from one section will be used in other ones. The empirical indicators will be presented in their relation to analytical or policy objectives.

### A. MORNING SESSIONS

#### a. Introduction

The first session will be devoted to introducing the concept of “trade in tasks” and the basics of measuring trade in value-added using international input-output tables. The session will define the main building blocks that will be used during the day when analysing supply (exports) and demand (imports) sides. The definitions will follow those of the OECD-WTO TiVA database, while mentioning some existing divergences in methodologies and terminology used by other sources. The section will also describe the main statistical limitations of the TiVA indicators used in the lecture.

#### b. Micro-Sectoral Trade Analysis

Value-Added Exports: Building on the measure of domestic value-added content in exports, the first step will be to explain the difference between direct and indirect domestic value-added contents in exports. Referring to the concept of inter-industry linkages, this module will also introduce the notion of upstream and downstream sectors and the associated limitations.

Revealed Comparative Advantages: RCAs are one of the main indicators used in applied trade analysis. When trade is in “tasks” rather than in final goods, this indicator may lead to biased estimates of comparative advantages and present the “trade in value-added” version of the indicator.

Constant Market Share Analysis: Another work-horse of the profession, CMSA looks at the evolution of market shares of one exports in an importing economy. To calculate CMSA from a trade in value added perspective, the section will look at the decomposition of value-added by sector origin in the final demand of importing countries.

Trade policy and competitiveness: Using the concept of Effective Protection Rates and Effective Exchange Rate in a trade in value-added context, this section shows how non-production costs (e.g., border and behind the border trade costs or currency misalignments) can hamper the competitiveness of exports by increasing the “price” of domestic value-added on the international markets.

## **B. AFTERNOON SESSIONS**

### **a. Macro-Global Trade Analysis**

Bilateral Trade Balance and Rebalancing: When trade is measured in value-added, the size (and sometimes the sign) of bilateral trade balances is modified, while the overall macro account does not change. After presenting the main results, the section will introduce the implications in terms of adjustment policies for the Marshal Lerner Condition (based on import and export elasticity).

Measuring the length and strength of global value chains: The availability of international input output tables allows calculating --up to some limitations that will be introduced in the lecture-- the length and strength of global value chains. The section will introduce the Average Propagation Length indicator and present, using simple examples, the (relatively convoluted) calculus used in calculating related indicators (e.g. counting border crossings; defining upstream and downstreamness GVC indicators).

International transmission of supply and demand shocks: This section uses international input output matrices to measure the vulnerability of the home economy to external shocks in the real economy. While shocks affecting final demand were already well known, the prevalence of trade along global value chains creates a new source of shock transmission linked to the disruption of the supply chain. In the process, the difference between direct and indirect impacts will be presented, building on the results of the micro-sectoral analysis.

### **b. Trade and Economic Development Policy**

Building on the results of the previous sections, this part will focus on the practical implications of input-output analysis and trade in value added for the design and monitoring of sustainable development policies.

### **c. Conclusions: The way ahead**

The concluding remarks will be devoted to providing a sample of additional or new fields of research related to the analytics of GVC trade.

### 3. • ENTROPY ECONOMETRICS APPLIED TO INPUT-OUTPUT

Lecturer: Esteban Fernandez Vazquez

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In this module we will present the basic theory to apply entropy econometrics in the field of input-output analysis. Along the sessions in this module we will study, from a very practice oriented approach, how the tools derived from entropy theory can be useful in several aspects of empirical input-output analysis. The module is organized in four sessions of 1.5 hours each approximately, including presentations of the theory and its potential applications. These empirical applications will be presented by studying previous literature and by small-scale exercises to be solved. Not specific background is required and access to the relevant literature will be given to the students. The students should bring a laptop to the sessions. Laptops with a full license of a non-linear solver for GAMS are preferred, although the freely downloadable demo version ([www.gams.com/latest](http://www.gams.com/latest)) is enough to replicate the small-scale problems.

#### **Session 1 – Introduction to Maximum Entropy (ME) and Cross Entropy (CE)**

- Basis for the ME principle
- Basis for the CE estimation
- Some (non IO) applications

#### **Session 2 – Estimating IO data from partial information**

- The matrix balancing problem
- Connections with other solutions
- Conciliating databases
- Hands on ME and CE for matrix balancing

#### **Session 3 – Generalized Maximum Entropy (GME) and Cross Entropy (GCE)**

- Estimating SUT's by entropy econometrics
- Inference and diagnosis tools
- How to deal with errors: incorporating unreliable totals

#### **Session 4 – Extensions**

- Dealing with multiple priors
- Applications to non-linear IO modelling
- Estimating the Leontief matrix



## 4. • WORKING WITH OECD'S ICIO AND INDICATORS: A HANDS-ON APPROACH USING "R"

Lecturer: Joaquim Guilhoto and Norihiko Yamano

### Objective:

With the recent release in 2017 of the "R" files of the updated version of OECD's ICIO and Indicators database, consisting of 63 countries and the rest of the World, for 34 sectors and for each year from 1995 to 2011, this course will give the opportunity for the students, by a hands-on approach of this database, to have a better understanding of this database characteristics, its potentiality and limitations.

### Session 1: Introduction.

Overall view of the OECD's ICIO and Indicators database structure.

### Session 2: Working with OECD ICIO

Hands-on on understanding and working with ICIO database in "R".

### Session 3: Working with OECD ICIO/TiVA Indicators

Hands-on on understanding and working with OECD ICIO Indicators in "R".

### Session 4: Beyond the Value added analysis (employment, carbon footprint, etc)

While the first 3 sections were directly related to the understanding of the OECD database structure, this section will present hands-on examples in "R" to explore further examples and the potentialities of this database. This section will also give the students the opportunity to present their research agenda and to discuss how the OECD database can be used in it!

### Notes

- ✓ Basic knowledge of Interregional Input-Output Analysis
- ✓ Basic knowledge of the Software "R"
- ✓ Bring your own laptop (Windows/MacOS/Linux with 4GB+ memory recommended) with:
  - i. "R (<https://mran.microsoft.com/open/>)" and "R Studio (<https://www.rstudio.com/>)" installed;
  - ii. The "R" files of OECD's ICIO and Indicators downloaded from the OECD site:
    - a. Download link will be circulated to course participants
  - iii. The "R" files of the examples to be worked in the course and to be downloaded from:
    - a. Download link will be circulated to course participants

### Suggested references:

- <http://oe.cd/tiva/>
- Economic Systems Research, Volume 25, 2013 - Issue 1: Global Multiregional Input-Output Frameworks
- Miller R.E. and P.D. Blair (2009) *Input-Output Analysis: Foundations and Extensions*. Englewood Cliffs: Prentice-Hall.
- Isard W et al. (1998) *Methods of interregional and regional analysis*. Ashgate, Brookfield, VT