Global Value Chains and Emission Footprints: the Input-Output Background

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Background

Nowadays, people are well aware of the fact that the goods and services we consume are made in global supply chains. This is because Japanese cars, for example, include South Korean parts which use Chinese-made wiring. So, every Japanese car contains indirectly some Chinese production. Therefore, it also contains a little bit of Chinese labour and has caused some CO_2 emissions in China. Input-output is a tool that has been used widely to get some grip on aspects related to production in the presence of global supply chains. Instead of studying supply chains for a specific product, input-output (IO) examines the effects at the industry, the country, or the global level.

Many practitioners apply IO in a rather mechanical way and have built up expertise in specific aspects. However, a full overview of the models and their possible applications is lacking. This lecture series provides a brief introduction to IO.

Typical questions are the following. How much high-skilled labour in the UK is involved in satisfying the demand for German cars by households in Australia, reflecting trade in production factors? What is the greenhouse gas footprint of China, or how large are the Chinese "exports" of greenhouse gas emissions? What percentage of the growth in French GDP between 2000 and 2014 was due to the increased household consumption in the rest of the EU? To analyse these questions Global Multiregional Input-Output (GMRIO) tables are used.

Objectives

- The overall learning goal is to get participants acquainted with:
  - the methodologies and the large databases used in IO analysis,
  - the topical discussions in the recent literature.

- Upon completion of this module, the applicant is able to:
  - help her/himself further and expand her/his knowledge, for example by reading Miller and Blair's textbook on IO,
  - read and understand scientific papers with simple applications of IO,
  - identify cases where IO techniques can be applied meaningfully,
  - analyse and interpret the outcomes of IO analyses,
  - critically evaluate the working of the IO model in applications.

Lecture 1: A Crash Course in Input-Output and Applications with National IO Tables

This lecture gives a brief introduction of theoretical IO framework, starting from scratch. We begin with very simple IO table and make assumptions that allow us to build a model with which real-world exercises are carried out. We will develop the quantity and the price model, and touch upon some extensions. We will critically evaluate some of the model's assumptions (and implicitly answer the question for which problems IO might be used, but also for which questions is IO not recommended).

The applications deal with: virtual water trade by Andalusia; an examination of the pollution have hypothesis for India; the effects of processing trade in China on (1) vertical specialization, (2) its carbon dioxide emissions, and (3) its national income.

Lecture 2: Global Multiregional Input-Output (GMRIO) Tables and Applications

This lecture deals with GMRIO tables because many real-world issues related to global supply chains are analysed with such tables. Although they are huge and may look frightening, the key message is that there is nothing to be afraid of.

Vertical specialization, international fragmentation, global supply chains, offshoring and reshoring, globalization and slowbalization are the modern buzzwords. They are all related to the fact that goods and services are produced in chains that cross many borders. As a consequence, US products include some Chinese labour. This led President Trump to try and make us believe that the Chinese were stealing US low-skilled jobs.

Based on the idea that any action in any place has environmental consequences on the other side of the globe, we also analyze with trade in emissions. We will distinguish two types of emissions accounting: production-based and consumption-based accounting. The latter is at the heart of footprints.

Lecture 3: Structural Decomposition Analysis and Applications

What part of the growth in global greenhouse gas emissions can be attributed to changes in emission coefficients, what part is due to changes in the world production structure and how much of it is due to increases in consumption and investment levels? Structural Decomposition Analysis is a tool to quantify the contributions of changes in exogenous determinants (e.g. variables like exports or parameters like trade coefficients), to the actual change in an endogenous variable (like global greenhouse gas emissions or the number of employed high-skilled workers). In this lecture, the basics of the method will be taught first. Next, a number of solutions to practical issues will pass in review and theoretical issues will be discussed.

Prerequisites

- None. Except perhaps refreshing the basics of matrix algebra (from your first year's course in mathematics).