Disaggregating multi-regional input-output tables

Topic: Input-Output Theory and Methodology (1)
Author: Jan WEINZETTEL
Co-Authors: Birte Ewers, Karl Schoer, Richard WOOD

Product detail is often seen as a limiting factor in the precision of the results of the input-output analysis as different types of products are aggregated into one group and treated as identical in the production recipe and sales structure. As the disaggregation of MRIOT can be seen as a computationally, data and time-demanding procedure, we aim to answer the research question: How can multi-regional input-output tables (MRIOT) be disaggregated to increase the product or sectoral detail efficiently regarding time and computational capacity?

In this contribution, we present a novel method to disaggregate MRIOT to increase the product detail and make the results more reliable. Before starting the disaggregation, we harmonize the input data on total output, detailed country-by-country international trade, and the original MRIOT. We prepare a set of input coefficients for the disaggregated product groups derived or estimated from existing data. The MRIOT is disaggregated country by country, always taking the block of columns for each country at once. The procedure is taken in the following steps for each country separately: first, the regions of origin (the rows) are aggregated, resulting in the total IOT for each country. An initial estimate of the disaggregated total IOT with the required product detail is obtained from the total output and input coefficients for the detailed product groups. A GRAS algorithm is applied to balance the initial estimate to meet the constraints of row and column totals and the original IOT. Afterward, the product's origin is added, assuming an identical sales structure for the same product originating from different countries. We see this as an important limitation of this approach. Next, the resulting matrix is balanced again using the same balancing algorithm, resulting in a column block of one country's disaggregated part of the MRIO, which complies with the data on detailed international trade, the original MRIOT, and the detailed total output. This procedure is repeated for all countries, resulting in a disaggregated MRIOT.

We successfully applied this procedure to disaggregate the EU part of the Figaro MRIOT from the level of 64 product groups to 182 product groups consistent with the Eurostat RME model to calculate the material footprint of the EU. However, we note that this type of disaggregation is not precise. We performed a test in which we aggregated the Figaro MRIOT from 64 product groups to 10 product groups and then applied our method to disaggregate it back to the level of 64 product groups. This allows us to analyze whether this disaggregation procedure with limited information improves the results of the MRIO analysis. This test proved that our disaggregation method improves the precision of the Leontief inverse matrix.

Research question: How can multi-regional input-output tables (MRIOT) be disaggregated to efficiently increase the product or sectoral detail regarding time and computational capacity?

Method used: We developed a novel procedure for MRIOT disaggregation. We use the existing procedures of creating the initial estimate from the input coefficients and total output and the GRAS algorithm to balance the initial estimate to the three constraints: row total, column total, and the original IOT, allowing negative entries in the column of changes in inventories and valuables.

Limitation: We assume an identical sales structure for the same product originating from different countries.

Data used: We applied this procedure to disaggregate the EU part of the Figaro MRIOT from 64

product groups to 182 product groups.

Novelty: The novelty is in harmonizing the input data before the disaggregation and disaggregating the MRIOT country by country, which significantly reduces the computational requirements.