Compilation and Uses of the ADB-Multiregional Input-Output Table

Evidence-based policymaking to facilitate deeper integration of Asia and LAC: Trade-in-value added analysis
6-7 October 2020
Outline

Data value chain

Data Collection
- Coverage and structure
- Data source
- Harmonization of classification

Data Processing
- Construction of bilateral matrices
- Reconciliation and balancing

Data Analysis
- Application
- Extension
### Main features of various databases

<table>
<thead>
<tr>
<th>Database</th>
<th>Number of countries</th>
<th>Number of products and industries</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>EORA MRIO</td>
<td>190 countries</td>
<td>Varying across countries; simplified version with 26 industries</td>
<td>1990-2015</td>
</tr>
<tr>
<td>EXIOBASE Versions 2 and 3 are more enhanced</td>
<td>43 countries; 5 world regions</td>
<td>220 products; 163 industries</td>
<td>2000, 2007</td>
</tr>
<tr>
<td>FIGARO</td>
<td>28 EU countries; USA; Rest of the World</td>
<td>64 industries; 64 products</td>
<td>2010; 2010-2018 in progress</td>
</tr>
<tr>
<td>Global MRIO LAB</td>
<td>220 countries</td>
<td>Flexible choice: 6357 products, industry root classification</td>
<td>1990-2015 (preliminary data)</td>
</tr>
<tr>
<td>OECD-ICIO</td>
<td>64 (including Rest of the World)</td>
<td>36 industries; 36 products</td>
<td>1995-2011 (ISIC 3; nowcasted 2012-2014); 2005-2015 (ISIC 4)</td>
</tr>
<tr>
<td>WIOD (2013 and 2016 release versions)</td>
<td>44 (including Rest of the World)</td>
<td>64 products; 56 industries</td>
<td>2000-2014</td>
</tr>
<tr>
<td>ADB MRIO</td>
<td>63 (including Rest of the World)</td>
<td>Varying SUT dimensions; harmonized to 35 industries</td>
<td>2000; 2007-2019</td>
</tr>
</tbody>
</table>
## Schematic of multi-country / multi-regional input-output tables (MRIO)

<table>
<thead>
<tr>
<th></th>
<th>COUNTRY A</th>
<th>COUNTRY B</th>
<th>Rest of the World</th>
<th>Output in A</th>
<th>Output in B</th>
<th>Output in R.O.W.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intermediate</strong></td>
<td>Industry</td>
<td>Industry</td>
<td>Industry</td>
<td>Final</td>
<td>Final</td>
<td>Final</td>
</tr>
<tr>
<td><strong>Industry</strong></td>
<td>Intermediate use of domestic output</td>
<td>Intermediate use by A of exports from B</td>
<td>Intermediate use by A of exports from R.o.W.</td>
<td>Final use of domestic output</td>
<td>Final use by A of exports from B</td>
<td>Final use by A of exports from R.o.W.</td>
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<tr>
<td><strong>Final</strong></td>
<td>Final use by B of exports from A</td>
<td>Final use by B of exports from B</td>
<td>Final use by R.o.W. of exports from R.o.W.</td>
<td>Final use by R.o.W. of exports from A</td>
<td>Final use of domestic output</td>
<td>Final use of domestic output</td>
</tr>
<tr>
<td><strong>Value Added</strong></td>
<td>Value Added</td>
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</tbody>
</table>
Data partners and stakeholders

Core
- WIOD and Country national accounts

Direct-core
- Country data sources
- Users of direct data sources

Extended core
- Internationally comparable sources / databases
- Complementary country sources
- Complementary international databases

Users of comparative database
Harmonization of classifications

### ISIC - UN Correspondence Tables

<table>
<thead>
<tr>
<th>FROM / TO</th>
<th>ISIC Rev. 2</th>
<th>ISIC Rev. 3</th>
<th>ISIC Rev. 3.1</th>
<th>ISIC Rev. 4</th>
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### CPC Correspondence Tables

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Aggregation and Disaggregation
Aggregation and Disaggregation

Administrative sources (e.g. turnover data, merchandise trade, employment)

Partner country statistics (e.g. use of ‘similar’ country structure, esp. when there is presence of regional firms)

Similar ICIO databases (e.g. use of OECD ICIOT 2015 / 2018 versions)

Modelled estimates (e.g. use of varied research publications [UN, WB, industry reports] for indicators; most useful on the expenditure side)
Availability of annual national data

- **Option 1:** Trends and extrapolation anchored on annual national accounts statistics, direct input coefficients of benchmark year; normalized such that each element adds up to control figures (see for instance Timmer et al, 2013; Eurostat 2008); Back casting techniques using ‘balanced’ bilateral trade database of BACI

- **Option 2:** Marginal inputs coefficients (Miller & Blair, 2009) relate the change (from year $t - r$ to year $t$) in the amount of input $i$ purchased by industry $j$ to the change (over the same period) in the total amount of $j$ produced.

  \[
  d_{ij}^*(t) = \frac{z_{ij}(t) - z_{ij}(t - r)}{x_j(t) - x_j(t - r)} = \frac{\Delta z_{ij}}{\Delta x_j}
  \]

- **Option 3:** G-RAS (Temurshoev 2013) and M-RAS algorithm (Paelinck and Waelbroeck 1963)
Construction of bilateral matrices

- **Moving towards dual approach** (export / import) of the OECD Regional-Global TiVA Expert Group

- Important data sources:
  
  1) UN Comtrade (by trade partner; HS-6 digit) and EBOPS;
  
  2) Data published by national statistics agencies (for missing years / countries (e.g. for splitting BEL-LUX economic union; Taipei, China));
  
  3) IMF Direction of Trade Statistics (IMF-DOTS);
  
  4) OECD-WTO Balanced Trade in Services;
  
  5) Other MRIOs;
  
  6) Observatory of Economic Complexity (OEC-MIT)
Construction of bilateral matrices

Goods import vector (cif)
- Available from Balance of Payments;
- Estimates from partner countries fob exports;
- CIF-FOB bilateral margins

Goods import vector (fob)
- Services import vector
- Services import vector

Import matrix
- Various databases
  - BEC classification
- Published by NSO:
  - Import matrix from SUT to IOT transformation; or
  - EORA structure

Intermediate uses
- Final consumption
- Capital goods

Partner country A
Partner country B
Partner country C

Export matrices by trade partner
(see ‘dual approach’ of OECD Regional-Global Expert TiVA Group)
Ideally M of c from k should be equal to the E of k to c

By trade partner
- UN Comtrade
- IMF-DOTS
- OECD-WTO BaTIS

By product i
- UN Comtrade;
- UN EBOPS
- Proportionality assumption

By industry j
- Eora MRIO;
- OECD ICIOT
Construction of bilateral matrices

SOME INVESTIGATIVE APPROACHES:

▪ **Which trade flow? Imports** are usually recorded with more accuracy than exports because imports generally generate tariff revenues while exports don’t *(Based on WITS, echoed by Timmer et al 2012)*

▪ **Which reporter? Reliability indicators** *(Guo, Webb, and Yamano (2009) and Gehlhar, Wang and Yao (2008), and more recently Fortanier & Sarrazin (2016; 2017) suggest indicators for reporter reliability based on discrepancies at the commodity-partner level. E.g. reported exports and imports are then reconciled using a “symmetry index” that gives more weight to those countries whose data more often agree with those of their trading partner

\[
S_{i_kt}^x = \sum_j \frac{X_{ijkt}^r}{X_{ijkt}} \quad \text{and} \quad S_{i_kt}^m = \sum_j \frac{M_{ijkt}^r}{M_{ijkt}}
\]

Where $X^r$ and $M^r$ reflect retained exports and retained imports, i.e. those bilateral flows that meet certain criterion (e.g. 30% in the case of OECD BATiS).*

▪ **Top-down approach** is also used which checks highest levels of aggregation before looking at subcomponents; enables compiler to flag misdirected and misclassified trade.
Reconciliation and balancing

- **Manual balancing:** 35 sectors, 63 “economies”, 2000-2019*
  - Evaluation of underlying sources
  - Before and after comparison
  - Commodity flow approach for ‘rest of the world’
  - Timeseries analysis (checks for outliers)

- **Modified RAS approach** (separately for domestic and external trade matrices)

**Examples of plausibility checks**

- GVA to output ratios
- Changes in GVA weights
- Changes in IC and IU ratios (consumption vs. use)
- Changes in export-to-output ratios
- Changes in import intensity
- Movement of stocks / inventories
- Fluctuations in exchange rates
- Changes in final demand categories’ composition
Application of MRIOTs

1. INTERNATIONAL TRADE
2. ENVIRONMENT & ECONOMY
3. LABOR MARKETS & GLOBALIZATION
Application of MRIOTs

Trade in computer, electronics, and optical equipment

US' exports to PRC
PRC's exports to US

Value added in exports of respective economies (VAX_G)
US: 74% (2014)
PRC: 46% (2014)

“Third country” effects
(value-added contribution of other countries or FVA)
Application of MRIOTs

Backward participation (GVCPrt_B)

Forward participation (GVCPrt_F)

2000
Application of MRIOTs
Application of MRIOTs


- Other services
- Construction
- Wholesale, retail trades, accommodation and catering
- Manufacture of general and special purpose machinery
- Transport, storage and postal services
- Manufacture of foods and tobacco

Legend:
- Rural
- Urban
- Government
- Capital
- Net export
Application of MRIOTs

Changes in number of jobs induced by foreign and domestic demand, 2005-2015

Source: Bertuflo, Gentile and de Vries (2019) using ADB MRIOTs
Application of MRIOTs

Transmission of single-country shocks to the five largest euro area economies through supply and demand linkages

Source: Di Nino and Veltri (2020) using WIOD, ADB MRIO database, ECB staff calculations

Notes: Shocks are indexed to the smallest shock in terms of euro area GDP (the Netherlands), which is set to 1; the other aggregate shocks are multiples of it. For instance, the initial shock to Germany takes on the value of five because it has five times more weighting in euro area GDP.
Application of MRIOTs

Impact of the COVID-19 pandemic on GDP and value-added exports

GDP losses, % of 2020 counterfactual GDP

ASEAN+3 Economies

Value-added exports losses, % of 2020 counterfactual exports

ASEAN+3 Economies

Country Codes: CAM = Cambodia; INO = Indonesia; LAO = Lao People’s Democratic Republic; MAL = Malaysia; PHI = Philippines; KOR = Republic of Korea; SIN = Singapore; THA = Thailand; VIE = Viet Nam; PRC = People’s Republic of China; JPN = Japan.

Source: ADB estimates using ADB MRO 2019 and World Bank January 2020 regional forecasts

Source: Mariasingham, Consing III, and Juani (upcoming) using ADB MRICT
### Extension and ways forward

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<th>WIOD</th>
<th>ADB</th>
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<tr>
<td>LAC</td>
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</tbody>
</table>

- **2007, 2011, 2017**
- **71 economies**
- Rest of Latin American Countries (ROLAC)
- Rest of the World (RoW)
- **35 sectors**
- **38 sectors (pending)**
Extension and ways forward

More countries and years

Sectoral disaggregation (also updating ISIC)


Extended input-output tables (e.g. employment, capital)

Satellite accounts

Constant prices

Social accounting matrices
Thank you.

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