TIVA: CONSTRUCTING THE ICIO TABLE AND FUTURE WORK

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Overview of the presentation

• Recap: last session
  – What is TiVA
  – How are SUTs useful for constructing TiVA
  – What analytical and policy questions can be answered using TiVA

• This session:
  – How is TiVA constructed – and what parts of SUTs are particularly relevant
  – Future developments: extended SUTs
ICIO TABLE CONTENT AND CONSTRUCTION
Methodology: building an ICIO

• The inter-country input output table (ICIO) forms the core system from which the TiVA indicators (and many others) can be derived

• Constructed by combining:
  – National Supply-Use / Input-Output tables (preferably with split in domestic and imported use)
  – National accounts statistics
    • Main aggregates (GDP, final demand components, trade)
    • Value added and output by industry
  – Bilateral trade, by industry and end-use category
### A national IO table

**Domestic intermediate consumption**
What amount of products provided domestically by sector 2 is consumed by sectors 1, 2 and 3 within country A (for intermediate use).

**Imported intermediate consumption**
What amount of products provided from abroad (by another economy) by sector 2 is consumed by sectors 1, 2 and 3 within country A (for intermediate use).

**Final demand by category**
 Specifies by industry (row), how products are directly consumed by end users (e.g. households, governments, GFCF, exports) / imports in FD.

**Value added and output**
 Specifies by industry (column), shows value added (and its main components) and intermediate consumptions add up to total output.
Schematic outline of the ICIO

**Industry AND country dimension:**
How much of what is produced by Sector 2 in country C is consumed by sectors 1, 2, and 3 in countries A, B, and C (for intermediate use)

**Value added and output (NA consistent):**
Specifies by industry (column!) how e.g. the use of intermediates, and the produced value added (and its main components), add up to total output

**Final demand by category and country:**
Specifies by industry (row!) how produced value is directly consumed by end users (e.g. households, governments, GFCF. Excl Exports)
Where do we find the national data?

<table>
<thead>
<tr>
<th>Country A</th>
<th>Country B</th>
<th>Country C</th>
<th>Final Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector 1</td>
<td>Sector 2</td>
<td>Sector 3</td>
<td>Country A</td>
</tr>
<tr>
<td>Sector 2</td>
<td>Sector 3</td>
<td></td>
<td>Country B</td>
</tr>
<tr>
<td>Sector 3</td>
<td></td>
<td></td>
<td>Country C</td>
</tr>
</tbody>
</table>

**Directly taken from the national IO or SUT table:**
1. Intermediate domestic use; 2. Value added, output per ind.; 3. Final demand (EXCL exports)

**More effort required:**
4. Exports, by partner country (B and C) and INTERMEDIATE end use -> total export by industry (rows) taken from the national IO/SUT table, breakdown by importing industry and use category from partner country imports
5. Exports, by partner country (B and C), and FINAL end use -> ibid. 4.
6. Imports for intermediate use, by partner country and importing industry -> total imports by industry (columns) taken from the National IO/SUT table, broken down by partner
7. Imports for final use, by partner country and exporting industry -> ibid. 6
The production of an ICIO involves overcoming HUGE data challenges

- **Sheer amount of required data** (national SUT / IO tables (pref. with imported use); national accounts main aggregates; value added and output by industry; Bilateral trade (goods and services, by industry and end-use)
- **Availability** (of all required sources, but notably IOs, SUTs and import flow matrices)
- **Completeness** (no missing values are allowed in the ICIO system for it to work properly)
- **Timeliness** (e.g., national IOs and SUTs are often published only 2-3 years after the reference period)
- Level of **detail** in breakdown (e.g. by industry, country or product, depending on the respective data source) is not always sufficient
- **Harmonization** of different national classifications (of e.g. industries, products)
- **Consistency** across all national sources (SUT with NA with Trade)
- **Symmetry** of trade statistics (reporter vs mirror statistics)
National data inconsistencies example 1: SNA vs SUT
The UK and Greece, NC mil, 2005

<table>
<thead>
<tr>
<th></th>
<th>United Kingdom</th>
<th>Greece</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SNA (1)</td>
<td>SUT (2)</td>
</tr>
<tr>
<td><strong>Final consumption expenditure (FCE)</strong></td>
<td>1,084,211</td>
<td>169,662</td>
</tr>
<tr>
<td>Household FCE*</td>
<td>815,938</td>
<td>814,664</td>
</tr>
<tr>
<td>General government FCE</td>
<td>268,273</td>
<td>268,088</td>
</tr>
<tr>
<td><strong>Gross capital formation</strong></td>
<td>213,938</td>
<td>41,322</td>
</tr>
<tr>
<td>Gross fixed capital formation**</td>
<td>209,689</td>
<td>209,381</td>
</tr>
<tr>
<td>Changes in inventories</td>
<td>4,249</td>
<td>4,472</td>
</tr>
<tr>
<td><strong>Exports of goods and services</strong></td>
<td>340,424</td>
<td>330,794</td>
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<tr>
<td>Exports of goods</td>
<td>217,476</td>
<td>213,536</td>
</tr>
<tr>
<td>Exports of services</td>
<td>122,948</td>
<td>117,258</td>
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<tr>
<td><strong>Imports of goods and services</strong></td>
<td>375,862</td>
<td>373,641</td>
</tr>
<tr>
<td>Imports of goods</td>
<td>281,850</td>
<td>293,862</td>
</tr>
<tr>
<td>Imports of services</td>
<td>94,012</td>
<td>79,779</td>
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<tr>
<td><strong>Gross Domestic Product (GDP)</strong></td>
<td>1,262,710</td>
<td>193,050</td>
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<tr>
<td>Total Value Added***</td>
<td>1,125,300</td>
<td>1,116,664</td>
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<tr>
<td>Agriculture, hunting, forestry, fishing (A-B)</td>
<td>7,035</td>
<td>7,530</td>
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<tr>
<td>Mining, Manufacturing, Utilities (C-E)</td>
<td>184,756</td>
<td>192,249</td>
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<tr>
<td>Manufacturing (D)</td>
<td>133,390</td>
<td>148,111</td>
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<tr>
<td>Construction (F)</td>
<td>82,112</td>
<td>69,868</td>
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<tr>
<td>Wholesale, retail, restaurants and hotels (G-H)</td>
<td>193,664</td>
<td>162,712</td>
</tr>
<tr>
<td>Transport, storage and communication (I)</td>
<td>95,232</td>
<td>80,889</td>
</tr>
<tr>
<td>Other Activities (J-P)</td>
<td>562,501</td>
<td>603,400</td>
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</table>

Sources: SNA data are from UN; SUT are from Eurostat. Final consumption expenditure and Gross capital formation are in purchasers' price. Exports of goods and services include re-exports. *Household FCE includes non-profit institutions service households and **Gross fixed capital formation includes acquisitions less disposals of valuables. *** Letters in parenthesis refer to ISIC Rev.3 industry classifications

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## National data inconsistencies example 2: Merchandise trade and SUTs

The UK and Greece, NC mil 2005

<table>
<thead>
<tr>
<th>CPA</th>
<th>Merchandise Trade (MT)</th>
<th>SUT</th>
<th>Ratio (MT/SUT)</th>
<th>Merchandise Trade (MT)</th>
<th>SUT</th>
<th>Ratio (MT/SUT)</th>
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<td>1,270</td>
<td>1.120</td>
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<td>02</td>
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<td>6</td>
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<td>0.750</td>
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<td>05</td>
<td>369</td>
<td>400</td>
<td>0.923</td>
<td>293</td>
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<td>17</td>
<td>-</td>
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<td>32</td>
<td>32</td>
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<td>1.406</td>
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<td>117</td>
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<td>0.911</td>
<td>1,841</td>
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<td>2,867</td>
<td>3,183</td>
<td>0.901</td>
<td>624</td>
<td>651</td>
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<td>18</td>
<td>2,306</td>
<td>3,843</td>
<td>0.600</td>
<td>1,276</td>
<td>1,744</td>
<td>0.732</td>
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<tr>
<td>19</td>
<td>897</td>
<td>1,441</td>
<td>0.622</td>
<td>59</td>
<td>65</td>
<td>0.908</td>
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<td>354</td>
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<td>66</td>
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<td>22</td>
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<td>24</td>
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<td>33,574</td>
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<td>465</td>
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<td>1,661</td>
<td>0.867</td>
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<tr>
<td>28</td>
<td>4,277</td>
<td>4,202</td>
<td>1.018</td>
<td>382</td>
<td>378</td>
<td>1.011</td>
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<td>29</td>
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<td>18,630</td>
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<td>569</td>
<td>575</td>
<td>0.990</td>
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<tr>
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<td>9,808</td>
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<td>19</td>
<td>3.158</td>
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<td>391</td>
<td>454</td>
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</tr>
<tr>
<td>32</td>
<td>11,814</td>
<td>19,010</td>
<td>0.621</td>
<td>252</td>
<td>306</td>
<td>0.824</td>
</tr>
<tr>
<td>33</td>
<td>8,223</td>
<td>8,537</td>
<td>0.963</td>
<td>129</td>
<td>138</td>
<td>0.935</td>
</tr>
<tr>
<td>34</td>
<td>23,539</td>
<td>21,736</td>
<td>1.083</td>
<td>199</td>
<td>211</td>
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<tr>
<td>35</td>
<td>13,380</td>
<td>13,773</td>
<td>0.971</td>
<td>336</td>
<td>361</td>
<td>0.931</td>
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<td>36</td>
<td>4,536</td>
<td>4,717</td>
<td>0.962</td>
<td>140</td>
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<td>0.909</td>
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<tr>
<td>37</td>
<td>3</td>
<td>-</td>
<td></td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>101</td>
<td>166</td>
<td>0.608</td>
<td>8</td>
<td>15</td>
<td>0.533</td>
</tr>
<tr>
<td>Total</td>
<td>207,521</td>
<td>213,530</td>
<td>0.972</td>
<td>13,959</td>
<td>16,337</td>
<td>0.854</td>
</tr>
</tbody>
</table>
International data inconsistencies example 3: trade asymmetries

UK services exports to the US (and mirror statistics) (US$ bn)

US services exports to the UK (and mirror statistics) (US$ bn)
1. Collect national SUTs and IOs
   – At purchasers and basic prices -> if not: estimate
   – With breakdown between domestic and import use -> if not: estimate
2. Benchmark SUTs/IOs to most recent National Accounts totals
   – Ensuring a full time series -> if not: estimate
3. Harmonize national data to TiVA industry and product classifications
   – Moving to ISIC Rev 4, and CPA 2.1 in 2018
4. Develop balanced bilateral trade statistics (merchandise trade and trade in services), benchmarked to National Accounts totals
   – Trade asymmetries are explicitly and transparently reconciled

*This is a coarse rendering of the steps involved, and reflects current/future processes rather past practices*
5. Aligning balanced trade with national accounts and SUTs: exports
6. Aligning balanced trade with national accounts and SUTs: imports
7. Constructing a global supply table (bp) and use table (pp)
   • By breaking down exports and imports geographically with the SUT-aligned balanced trade figures
8. Converting the global use table to basic prices
   • Using standard conversion techniques also used for national tables
9. Converting the global SUT to the global industry*industry IO table
   • Using fixed product sales structure assumption
10. Final balancing
    • RAS > depending on preference for separate discrepancy column
BALANCED TRADE STATISTICS
Key characteristics and guiding principles

• **Transparency**: Each data point in the final balanced table can be traced back to both original sources and the exact calculations that were made.

• **Modularity**: Each step in the construction of a balanced trade database can be seen as an individual modules, which may be updated separately if new or better insights, methods or data become available.

• **Collaboration**: builds on work with statistical offices as well as with other international organizations, making insightful and visible the contributions of each to different components of the overall system

• **Long-term perspective**: The project has a long time-horizon. It is iterative and versioned, and is improved and extended incrementally in the years to come.

• **Catalyst for improved statistics**: Not ‘just’ an international analytical tool, but a process for increasing data consistency at the national/bilateral level of statistics
Currently disseminated as draft version for review prior to release

Covering 2007-2014, 190 countries and 5000+ 6-digit product codes

Next steps: official publication, additional years, additional modules
CIF-FOB dataset (cf ‘module B’)

- Coverage: 180 reporters and partners, 1258 HS 4-digit products, 1995-2014

- Next steps for 2017:
  - Update to 2015 (2016)
  - Include aggregates (2 digit HS, CPA 2 digit, reporters, partners)
  - Integrate more national data
    - Aggregated data for benchmarking received from: Germany, Italy, UK, France,...
OECD-WTO Balanced Trade in Services Statistics

| Data collection | • Data collection  
|                | • Data cleaning & preparation |
| Data estimation | • Additional national data, backcasting, forecasting, interpolations, derivations, integration of EBOPS2010 data, gravity-model based estimates |
| Trade balancing | • Symmetry-index weighted average |
| Trade balancing | • Country-specific conversions of EBOPS to CPA using correspondence tables, SUT information and STEC |

- Currently disseminated as draft version for review prior to release
- Covering 1995-2012, 190 countries/partners and all main EBOPS 2002 items
- Work on similar data in EBOPS 2010 from 2005 has started
BEYOND TIVA: FUTURE WORK
Beyond Trade in Value Added

• TiVA and its underpinning ICIO has already been used to shed new light on the relationships between trade, production and consumption. **But more is possible – and necessary!**

• Examples of policy questions:
  – Impact dimensions beyond economic growth:
    • What are the consequences for the **natural environment** (e.g. emissions and pollution related to GVCs)
    • What are the **social consequences** (employment: how many jobs are involved in GVCs, how to achieve inclusive globalisation)
    • And what about **taxes**?
  – Actors beyond industries:
    • What is the role of **SMEs** in Global Value Chains?
    • How do **MNEs** shape GVCs and the trade-investment nexus?
    • Or what about **processing firms**, or the **informal sector**?
The ICIO has already been used to address such policy questions…

Environmental footprint indicators:

Combining the ICIO with Green House Gas emissions data (by industry) to estimate consumption-based emissions
The ICIO has already been used to address such policy questions…

**Employment:**

*Combining the ICIO with a jobs by industry vector to estimate jobs sustained by foreign final demand*

*Estimated employment sustained by foreign final demand, by skill level, 2001 and 2013, as share of business sector employment*
For example:

• Analyse the role of FDI in production, consumption, GVCs and trade

• Address firm heterogeneity in GVCS: SMEs, trading firms, foreign owned enterprises, processing firms, ... (but also: informal sector)

• Better understand the role of investment and improving productivity estimates (e.g. via investment flow matrices)

• ...

*Extended supply and use tables are the core ‘tool’ for integrating disparate statistics, providing important scope for improved and coherent accounts, nationally AND – via global (extended) Supply and Use tables - internationally*
Architecture of Extended SUTs: three dimensions

- **Industries broken down by firm characteristics**, for example:
  - Ownership (foreign/domestic), firm size (SMEs/large); trading status (exporter/non-exporter); activities (processing/non-processing); informality (formal/informal);...

- **More detailed breakdowns of value added and supplementary rows on ‘Beyond GDP’ dimensions**, for example:
  - Property income flows (-trade-investment nexus and ‘stickiness’ of FDI);
  - Emissions, material flow matrices (environmental impact of GVCs, footprint indicators);
  - Employment, jobs, wages and business functions (inclusive globalisation);
  - Taxes on income, wealth (BEPS);
  - Capital flow matrices (improved productivity estimates)

- **Additional final demand breakdowns**, for example:
  - Separately identified re-exports;
  - Non-resident expenditures by product;
  - Gross flows related to global production arrangements
Comparison of SMEs’ contribution to exports in gross and value-added terms

Role of SMEs in international trade and GVCs greater than observed in gross export data alone

Value added exports of SMEs = Direct value added in SMEs’ exports + value added in inputs produced by SMEs and used by exporting firms
Example: Up to 20% of employment at non-trading sustained by foreign final demand

Share of employment that is embodied in exports, by firm type, 2013
Example: Domestic MNEs are a key channel to foreign markets for non-MNEs*

*Non-MNEs: domestic enterprises without foreign affiliates
OECD Expert Group on E-SUTs

• Develop the architecture of Extended Supply-Use Tables;
• Document the practical and innovative methods that can be used to construct such tables;
• Provide recommendations regarding best practices that:
  – Minimize heterogeneity, within given confidentiality constraints;
  – Shed light on beyond value-added dimensions;
  – Without imposing significant processing and compilation burdens on statistical institutes;
  – And with minimal impact on data collection, i.e. capitalizing on existing data sources and expertise such as TEC, FATS and SBS
Important compilation challenges remain…

• Absence of information on **product dimension** (purchases of intermediate inputs, by firm type)
• Integrating data sources with different **statistical units**
• Ensuring **representativeness** when integrating data sources with different sample size and grossing up factors
• Ideally, ESUTs should be developed **in tandem with SUTs** (or replacing SUTs)
• But when breaking down existing SUTs ex post:
  – Treatment of **trade though wholesalers**
  – **Level of detail** when using proportionality assumptions (> EGESUT proposes ~200 products)
    – Mimicking adjustments by SUT compilers in the microdata (e.g. in classifications)
• Nature of the **statistical system** and institutional arrangements (e.g. centralized systems, and systems that rely on administrative data, may have advantages)
• **Communication and dissemination** (possible policy messages, but also: confidentiality concerns)
• ...

Thank you

More information:
http://oe.cd/trade/valueadded
http://oe.cd/tiva-nowcast

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Christophe.Degain@wto.org