APEC TiVA Database: Necessity and Feasibility

Submitted by: China
APEC TiVA database: necessity and feasibility

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on behalf of
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MOFCOM, GACC, NBS, SAFE

The Global Value Chain Research Project Team, China

Coordinated by Ministry of Commerce of China (MOFCOM), including:

- 4 Chinese governmental agencies: MOFCOM, General Administration of Customs (GACC), National Bureau of Statistics (NBS), State Administration of Foreign Exchange (SAFE), and
- 3 academic institutions: the Chinese Academy of Sciences (Academy of Mathematics and Systems Science, University of CAS), University of International Business and Economics (UIBE)
- Consultants, domestic and overseas
Outline

- Introduction
- Major IO Databases related to TiVA & GVC research
- China TiVA research and database
- APEC TiVA databases: necessity & feasibility

Introduction

- International fragmentation: changed production patterns of world economy, goods of certain economy produced by more than one economy
- Not only an individual product, but also the economy in a more macro level, deeply involved into global value chain (GVC)
- Repeated computation of traditional foreign trade statistics, overstating the actual trade volume of some economies
- In recent years, value-added by international trade has been the focus of academic field, governments & international institutions, from the value chain of individual goods to the whole GVC
- As Mr. Lamy suggests in June 2011: Trade in value-added (TiVA)---a better measurement of world trade
Global value chain, an example

How to slice up the global value chain?

- Direct measurement at company level (e.g. Tempest, 1996; Dedrick, 2010; Linden, et al., 2009; Humphrey & Mamedovic, 2003; Lall, et al., 2004; Ivarsson, et al., 2011; ……)

- Measurement through standard trade statistics (e.g. Amador & Cabral, 2009; Swenson, 2005; Clark, 2006; Yeats, 1998; Gaulier et al, 2005; Stehrer, et al., 2011; ……)

- Through input-output (IO) model: popular tool to capture GVC, several major databases constructed, a pool of literate
Input-output (IO) model is widely accepted due to its ability to estimate both the direct and indirect effects of exports on domestic value added (DVA) by accounting for both international and inter-industry flow of the global production process.

### Table 1: A single-economy IO model

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
<th>Final use</th>
<th>Domestic output or imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate inputs</td>
<td></td>
<td>Production sectors 1, 2, ..., n</td>
<td>Total</td>
</tr>
<tr>
<td>Domestic intermediate inputs</td>
<td>( X^D_{ij} )</td>
<td>( F^D_C )</td>
<td>( F^D_I )</td>
</tr>
<tr>
<td>Intermediate inputs from imports</td>
<td>( X^M_{ij} )</td>
<td>( F^M_C )</td>
<td>( F^M_I )</td>
</tr>
</tbody>
</table>

### Single-economy Input-output (IO) model

GVC by National IO model, from two perspectives: Value-added, etc generated by exports; imports content in exports, i.e., vertical specialization (VS)

- **Non-competitive IO model**
  - \( A^0 X + F^D = X \), i.e., \( X = (I - A^0)^{-1} F^D \) \( (1) \)
  - Domestic value-added can be obtained:
    - \( v^F = A^F (I - A^D)^{-1} E^D \) \( (2) \)
    - Value-added, etc generated by exports:
      - \( v^E = A^E (I - A^D)^{-1} E^D \) \( (3) \)
    - imports content in exports:
      - \( m^F = A^M (I - A^D)^{-1} E^D \) \( (4) \)

Could capture value-added by export of individual economy & its VS, not effective to capture the value chain across the economies.
## International (inter-economy) IO models

Table 2 An international input output table layout

<table>
<thead>
<tr>
<th>Input</th>
<th>Intermediate Use</th>
<th>Final</th>
<th>Total output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Economy 1</td>
<td>Economy 2</td>
<td>...</td>
</tr>
<tr>
<td>Inter-mediate inputs</td>
<td>X^1_1</td>
<td>X^1_2</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>X^2_1</td>
<td>X^2_2</td>
<td>...</td>
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<tr>
<td></td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Economy n</td>
<td>X^n_1</td>
<td>X^n_2</td>
<td>...</td>
</tr>
<tr>
<td>Value-added</td>
<td>V^1</td>
<td>V^2</td>
<td>...</td>
</tr>
<tr>
<td>Total inputs</td>
<td>X^1</td>
<td>X^2</td>
<td>...</td>
</tr>
</tbody>
</table>

## Outline

- Introduction
- Major IO Databases related to TiVA & GVC research
  - China TiVA research and database
  - APEC TiVA databases: necessity and feasibility
Major IO Databases related to TiVA & GVC research (1)

- **Asian International IO tables (AIO)**
  - by Institute of Developing Economies, Japan External Trade Organization (IDE-JETRO)
  - 10 economies in the Asia-Pacific region, i.e., China, Indonesia, Japan, R. Korea, Malaysia, the Philippines, Singapore, Chinese Taipei, Thailand, the United States.
  - 75-78 industries/commodities, including the Import Matrix of the above economies from Hong Kong, China, EU and rest of the world

- **GTAP Database**
  - GTAP of world production and trade is coordinated at Purdue University since 1993
  - National IO tables and bilateral trade statistics

Major IO Databases related to TiVA & GVC research (2)

- **World Input-output Database (WIOD)**
  - EU 7th Framework Programme, Coordinated by University of Groningen, 11 international institutes inside EU, including OECD participate.
  - WIOD: 40 economies, 35 industries, 59 commodities, time-series 1995-2011
  - Major sources is supply and use tables (SUT, hopefully annual) of involved economies, not symmetric IO tables
  - For years without SUT tables, estimate based on national accounting statistics and by RAS to balance (Timmer eds, 2012).
  - The database was open in May, 2012, http://www.wiod.org
  - A series of papers (Dietzenbacher E., Los B., Timmer M. et al, etc… )

- **Sino-Japan International IO table**
  - Compile Sino-Japan International IO table for 2007 with 77 sectors
  - Press release in Beijing on March 2 2012 for the table & related applications
Major IO Databases related to TiVA & GVC research(3)

- OECD-WTO TiVA database
  - Develops macro(sector) based estimates of TiVA across 57 economies.
  - Using inter-linked set of IO tables.
  - Develops TEC(Trade by Enterprise Characteristics) database, linking customs data and business statistics at the level of the firm and covers virtually the entire population of a economist's business and (internationally) trading population.
  - Further refine the quality of the import data used in the input-output tables but also to create sub-categories of industry groups that discriminate firms by: size; foreign/domestically 7 owned; export intensity, import intensity, import/export intensity etc; allowing for a more detailed understanding of international production networks.

Major IO Databases related to TiVA & GVC research(4)

- The UNCTAD/Eora TiVA Database
  - Provides a time series of input-output tables with matching environmental and social satellite accounts for 187 economies (http://worldmrio.com/)
  - A total of 15,909 sectors for 1990 to 2011 (satellite accounts to 2010).
  - Includes 35 types of environmental indicators covering air pollution, energy use, greenhouse gas emissions, water use, ecological footprint, and human appropriation of net primary productivity. These indicators have a high-resolution heterogeneous classification or a 25-sector harmonized classification.
  - See: Lenzen M, Kanemoto K; Moran D, and Geschke A (2012)
**ADB IO tables**


- **National Input-Output Tables**
  - Input-output table for domestic output at basic prices.
  - Matrix showing the use of imports
  - Input technical coefficients and Output technical coefficients matrices.
  - Inverse matrix.

Bangladesh; Bhutan; Brunei Darussalam; Cambodia; the People's Republic of China; Fiji; India; Indonesia; Malaysia; the Maldives; Mongolia; Nepal; Singapore; Sri Lanka; Chinese Taipei; Thailand; and Viet Nam.

**Outline**

- Introduction
- Major IO Databases related to TiVA & GVC research
- **China TiVA research and database**
  - APEC TiVA databases?
China’s trade structure & challenges for IO model

• Processing trade: around 50% of China’s total trade volume in the past more than one decades, though in recent years went down.

• In conventional IO model, however, no distinction of processing trade, which has different input structure and value-added ratio compared to other kinds of production

• How to estimate value-added by processing export in IO framework?

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A special model was proposed to differentiate processing trade (P) from other production in China’s IO model (IO modles capturing processing trade, abbreviated as DP model):


Later years (2006-2011): further divided China’s domestic production into three categories: production for domestic use (D), production for processing export (P), production for non-processing export and other production of FIEs (N) (DPN model):

### The table layout of China’s DPN model

<table>
<thead>
<tr>
<th>Input</th>
<th>Intermediate use</th>
<th>Final use</th>
<th>Gross output or imports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Domestic products (D)</td>
<td>Processing exports (P)</td>
<td>Non-processing exports and others (N)</td>
</tr>
<tr>
<td>1/n</td>
<td>X_{iD}</td>
<td>X_{iP}</td>
<td>X_{iN}</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>X_{iMD}</td>
<td>X_{iMP}</td>
<td>X_{iMN}</td>
</tr>
</tbody>
</table>

### Further information for DP model & DPN model (1)

- **1999-2001**: Our CAS team led by prof. Chen Xikang, Prof. Lawrence Lau (then Chinese University of Hong Kong) and other colleagues from Hong Kong, China and U.S
  - Proposing a methodology to estimate DVA and employment induced by exports.
  - Estimating the total DVA contained in China’s exports.

- A joint work with Lawrence J. Lau (Stanford University), Leonard K. Cheng (Hong Kong University of Science and Technology), K.C. Fung (University of California, Santa Cruz), supporting by Hong Kong University of Science and Technology. (Chen, Cheng, Fung and Lau, 2001, 2004)
Further information for DP model & DPN model (2)

- **2006-2011**: CAS team led by Prof. Chen Xikang, Prof. Lawrence Lau (Chinese University of Hong Kong), NBS, et al (Lau, Chen et al. 2006, 2007)
  - The difference between this stage and that during 1999-2001 is the further differentiation of the production non-processing exports and domestic use, as mentioned already in the previous slides.


Further information for DP model & DPN model (3)

- **2006-2011**: CAS team led by Prof. Chen Xikang, Prof. Lawrence Lau (then Chinese University of Hong Kong) & other colleagues from Hong Kong and U.S., National Bureau of Statistics (Lau, Chen et al. 2006, 2007)
- Empirical analysis, Data availability
  - Value-added & employment bilateral trade, by that of China exports to the world, to the US & to EU, by export type at each dimension; by that of US, EU to the world, to China
Other researches on VA by China export

- Koopman et al. (2008, 2012) and Dean et al. (2011) have constructed similar (yet bipartite) IO tables. They split the ‘ordinary’ IO table into two parts.

  ✓ ......

Since 2011, the research project coordinated by MOFCOM entitled ‘GVC and International Trade Benefits’

- Ministry of Commerce, the General Administration of Customs, National Bureau of Statistics, State Administration of Foreign Exchange jointly launched in May 2012, the Chinese Academy of Sciences (AMSS & UCAS), University of International Business and Economics undertook the research.
**Major objectives**

- To measure domestic value added (DVA) & employment by China’s export, incl.: by export category, by commodity, by major trading partners (US, EU27, ASEAN, R. of Korea, Japan, India)
- To measure DVA & employment by China’s import for the above six major trading partners (subject to change in the future)
- To re-examine trade imbalances: comparison between value-added and gross value
- To provide policy supports on trade related issues
- To Construct China TiVA database

**Current Progress**

- China IO tables capturing processing trade: 2010; IO tables: US, EU 27, ASEAN, Japan, India and R. Korea
- TiVA & employment estimates: by China export to the world; bilateral trade between China and six trading partners, for 2010-2012
- Construction of the online database on VA and employment by trade at a yearly basis under MOFCOM: available soon
Ongoing research

- SDA on changes of VA and employment by China export over years: 2002-2007, 2007-2010
- Further differentiation of D, P, N of China in WIOD and OECD-WTO international tables, some progress with the former for 2007, investigation on the methods with OECD-WTO TiVA database
- Trade remedies, e.g., anti-dumping and subsidies: effect on VA, employment etc (by case study).

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APEC TiVA databases: necessity (1)

- Intra-APEC merchandise trade (exports & imports) amounted to $9.9 trillion in 2010, accounting for 67% of APEC’s total merchandise trade.

- Crucial to have a TiVA database: to measure interdependency and benefits-sharing, to promote APEC value chains cooperation, in APEC member economies

- No full coverage for all APEC member economies in current TiVA or IO databases

- For some APEC member economies: IO tables not available from statistical units, e.g. Hong Kong, China. An opportunity for statistical agencies of these economies to construct IO tables on accounting data

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<table>
<thead>
<tr>
<th>APEC Member economies</th>
<th>Availability of IO tables</th>
<th>Coverage in Databases (ADB, GTAP: not inter-economy IO tables)</th>
<th>AIO</th>
<th>WIOD</th>
<th>OECD-WTO</th>
<th>TiVA</th>
<th>Eora MRIO</th>
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<td>17</td>
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</table>
APEC TiVA databases: necessity (2)

- Besides BAU issues, several highlights in constructing APEC TiVA database

  ✓ 1. Distinction between processing trade from other production type, e.g., China, Indonesia, Viet Nam (distinct input structure; method and models available from pilot research for China)

  ✓ 2. Import flow surveys, to provide crucial data and reference to construct inter-economy IO tables (as GACC & NBS of China have conducted for 2010, 2012)

  ✓ 3. Case studies, to modify input coefficients on a yearly basis

APEC TiVA databases: feasibility

- 20 APEC member economies had already IO accounts
- Estimate and update IO tables according to national accounting data as well as input structure of similar economies for past years, and most important in the near future
- Trade data available to link inter-economy IO table
- Statistical units, trade statistical units involved
- Academia and experts networking technical aid involved
- Possible GVC Information Centre supported by APEC Secretariat
Thanks! Your comments and questions please.

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