1. Introduction

This document describes the steps to compile the Singapore database for the year 2007 for the Global Trade Analysis Project (GTAP). The source data is the 136-sector Singapore IO tables for 2007 published by the Department of Statistics Singapore.\(^1\) A notable feature of the Singapore economy is that it is dominated by secondary and tertiary industries. There is very little agriculture, and there are no mining activities.

2. IO Table Features

The data come from the three Basic Tables in the published data, namely:

- A commodity- by-industry MAKE matrix for 136 domestic sectors;
- An absorption matrix for domestically-produced commodities, which shows the production structure of 136 industries and sales destination of 136 commodities. The value added is distinguished by: compensation of employees, gross operating surplus, and other taxes on production.
- An absorption matrix for retained imports (commodity by user). The imported commodities consist of 136 competitive imports and one commodity called “Other goods and services”. The latter represents the “net resident expenditure abroad” by Singapore households.\(^2\)

Following are some features of the tables:

- All tables are valued at basic prices, in million of Singapore dollars.
- The export and import data are exclusive of re-exports.
- The tables are generally balanced, although there are small discrepancies between costs and sales due to rounding.
- There are very little agricultural activities in Singapore, and there are no mining or quarrying activities at all.

3. Challenges

- There are no separate tax matrices by commodity and user corresponding to the absorption matrices at basic prices. There are only:
  - one row vector for taxes on products, by user
  - one row vector for import duties, by user

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\(^2\) There is no documentation for the IO tables for 2007, but the structure of the tables is the same as that for the IO table for 2005. Therefore, we used the information on the “Other goods and services” import from the document accompanying the IO table for 2005 (Singapore Department of Statistics, 2010. *Singapore Input-Output Tables 2005*, available at [www.singstat.gov.sg/pubn/economy/IO2005%20Tables.pdf](http://www.singstat.gov.sg/pubn/economy/IO2005%20Tables.pdf)).
• There are three small negative numbers in non-stock cells (namely negative gross operating surplus for Other fishery (-$0.2m) and Fiber glass (-$8.8m), negative imported Oil rigs and oilfield machinery (-$69.5m) to be used for investment).

• There are no data on forestry or any of the mining industries.

Our task is to create these tax matrices. The procedure is described in the section below. The processing was conducted in two stages. First we adjusted the IO tables and created the commodity tax matrix with the original 136 sectors. We then aggregate the database to GTAP sectors.

4. Processing the database with the original 136 sectors

4.1. The negative operating surpluses in the ‘Other fishery’ and ‘Fiber glass were adjusted according to the recommendation in Huff et al (2000). The IO tables for 2005 shows that the operating surpluses for these two sectors in IO 2007 are positive. This means that the negative operating surpluses in 2007 are not usual. Hence we imputed the values of capital earnings in these sectors based on the ratios of capital earnings to all other costs for these same sectors from the IO tables for 2005. We then made an upward adjustment of the “changes in stocks” for these sectors.

4.2. To eliminate the negative imported Oil rigs and oilfield machinery (OROFM) used in investment, we re-estimated the values of domestic and imported OROFM based on the total use of this commodity in investment based on the share of domestic and imported OROFM in total use of this commodity in investment in 2005 and 2000 IO tables. These ratios are approximately 20% and 80% respectively. The domestic and imported values of “changes in stock” for OROFM are adjusted accordingly to ensure that the total sales of domestic and imported OROFM remain unchanged.

4.3. The tariff matrix was created by proportionately allocating the tariff revenue data from government revenue data for the year 2007 to the imported values of dutiable goods.

4.4. The commodity tax matrix was created by combining the values of the remaining taxes on products. The taxes include: Excise Duties, Good and Services tax, Motor Vehicle Taxes, and Betting Taxes. Government revenue account contains the aggregate revenue for each of these taxes. We allocated these revenues proportionately to the relevant commodity flows in the database. They were then scale to the total value of commodity taxes on the IO tables.

4.5. We split the value added of agricultural industries into payment to labour, capital and land using factor shares from corresponding sectors in GTAP 8.0 database for Singapore.

4.6. The “net resident expenditure abroad” value was allocated proportionately to all imports by private households.

4.7. The FRS (forestry) sector is split from the combined sector of ‘Nursery products’ and ‘Other agriculture’ based on the share of FRS in the crops plus FRS in the GTAP8.0 database for Singapore. Overall FRS comprises less than 8% of total production of crops and forestry.

4.8. All mining sectors are given zero values. This is because correspondence with compilers of Singapore IO tables for 2007 reveals that there are no mining or quarrying activities in Singapore.

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4.9. The full IO tables were then rebalanced using the Adjuster program written by Horridge (2004).\(^7\)

5. **Converting the Singapore IO table into GTAP format**

5.1. **Aggregation of the database to GTAP sectors**

The 136 sectors of the Singapore IO table were aggregated to a set of 42 sectors that best correspond to elements of GTAP’s standard 57 commodities. The correspondence between the 42 sectors, the GTAP 57 sectors and the original 136 IO sectors is reported in Table 1.

Table 1. Concordance between the 40 sectors in the contributed table, GTAP 57 sectors and 136 Singapore I-O sectors

<table>
<thead>
<tr>
<th>42 sectors</th>
<th>Covering 57 GTAP sectors</th>
<th>Covering 136 original IO sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop</td>
<td>PDR, WHT, GRO, V_F, OSD, C_B, PFB, OCR, CTL</td>
<td>Part of Nursery products, Part of Other agriculture</td>
</tr>
<tr>
<td>Livestock</td>
<td>CTL, OAP, RMK, WOL</td>
<td>Livestock</td>
</tr>
<tr>
<td>FRS</td>
<td>FRS</td>
<td>Part of Nursery products and Other agriculture</td>
</tr>
<tr>
<td>FSH</td>
<td>FSH</td>
<td>Aquarium fish, Other fisheries</td>
</tr>
<tr>
<td>COA</td>
<td>COA</td>
<td>na (not applicable)</td>
</tr>
<tr>
<td>OIL</td>
<td>OIL</td>
<td>Na</td>
</tr>
<tr>
<td>GAS</td>
<td>GAS</td>
<td>Na</td>
</tr>
<tr>
<td>OMN</td>
<td>OMN</td>
<td>Na</td>
</tr>
<tr>
<td>SGR</td>
<td>SGR</td>
<td>Sugar, chocolate &amp; related products</td>
</tr>
<tr>
<td>VOL</td>
<td>VOL</td>
<td>Oils &amp; fats</td>
</tr>
<tr>
<td>MIL</td>
<td>MIL</td>
<td>Dairy products</td>
</tr>
<tr>
<td>B_T</td>
<td>B_T</td>
<td>Soft drinks, Alcoholic drinks &amp; tobacco products</td>
</tr>
<tr>
<td>OFD</td>
<td>CMT, OMT</td>
<td>Food preparations, Bread, biscuits &amp; confectionery, Coffee &amp; tea</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>PCR</td>
<td>Other food products</td>
</tr>
<tr>
<td>OFD</td>
<td>Yarn, fabrics &amp; textile articles</td>
</tr>
<tr>
<td>TEX</td>
<td>Wearing apparel</td>
</tr>
<tr>
<td>WAP</td>
<td>Footwear, leather &amp; fur products</td>
</tr>
<tr>
<td>LEA</td>
<td>Wood &amp; wooden products (except furniture)</td>
</tr>
<tr>
<td>LUM</td>
<td>Paper &amp; paper products</td>
</tr>
<tr>
<td>I_S</td>
<td>Industrial chemicals &amp; gases</td>
</tr>
<tr>
<td>NFM</td>
<td>Petrochemicals</td>
</tr>
<tr>
<td>FMP</td>
<td>Pharmaceutical products</td>
</tr>
<tr>
<td>P_C</td>
<td>Perfumes, cosmetics &amp; toilettries</td>
</tr>
<tr>
<td>PPP</td>
<td>Cleaning &amp; polishing preparations</td>
</tr>
<tr>
<td>WAP</td>
<td>Paints</td>
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<tr>
<td>WAP</td>
<td>Food chemicals &amp; additives</td>
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<tr>
<td>WAP</td>
<td>Other chemical products</td>
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<tr>
<td>WAP</td>
<td>Rubber &amp; rubber products</td>
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<tr>
<td>WAP</td>
<td>Plastic precision products</td>
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<tr>
<td>WAP</td>
<td>Other plastic products</td>
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<tr>
<td>NMM</td>
<td>Glass &amp; glass products</td>
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<tr>
<td>NMM</td>
<td>Fibreglass &amp; fibreglass products</td>
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<tr>
<td>NMM</td>
<td>Bricks, cement &amp; concrete products</td>
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<tr>
<td>NMM</td>
<td>Non-metallic mineral products</td>
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<tr>
<td>Metals</td>
<td>Basic metals</td>
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<td>Structural metal products</td>
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<td>NFM</td>
<td>Metal stampings</td>
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<tr>
<td>FMP</td>
<td>Metal precision components</td>
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<tr>
<td>FMP</td>
<td>Non-insulated cable products</td>
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<tr>
<td>FMP</td>
<td>Metal containers</td>
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<tr>
<td>FMP</td>
<td>Treatment &amp; coating of metals</td>
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<tr>
<td>FMP</td>
<td>Other metal products</td>
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<tr>
<td>ELE</td>
<td>Computers &amp; computer peripheral equipment</td>
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<td>Data storage</td>
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<td>Audio &amp; video equipment</td>
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<td>ELE</td>
<td>Electron tubes &amp; electronic display devices</td>
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<td>Printed circuit boards</td>
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<td>ELE</td>
<td>Communication equipment</td>
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<td>Other electronic products</td>
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<tr>
<td>OME</td>
<td>Lifting &amp; hoisting machinery</td>
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<td>OME</td>
<td>Other industrial machinery &amp; equipment</td>
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<tr>
<td>MVH</td>
<td>Land transport equipment</td>
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<tr>
<td>OTN</td>
<td>Building of ships &amp; boats</td>
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<td>OMF</td>
<td>Recorded media</td>
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<td>ELY</td>
<td>Electricity</td>
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<td>GDT</td>
<td>Gas</td>
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<td>WTR</td>
<td>Water</td>
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<td>CNS</td>
<td>Building construction</td>
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<tr>
<td>TRD</td>
<td>Wholesale trade of computer products</td>
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<tr>
<td>OTP</td>
<td>Passenger transport by land</td>
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<tr>
<td>WTP</td>
<td>Water transport</td>
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<td>ATP</td>
<td>Air transport</td>
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5.2. Converting the IO table from COM x IND to COM x COM

GTAP prefers commodity by commodity input-output tables. Our initial IO table is commodity by industry. To convert it to a commodity by commodity table, we use the technology assumption and the procedure described in Horridge et al. (2008)\(^8\).

5.3. Checking sectoral balance and non-negativity conditions

After converting the Singapore IO table to the format required by GTAP database, we conducted the sectoral balance and non-negativity checks. The new database passed the sectoral balance check and non-negativity conditions.

https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2850