

Singapore

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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 I-O 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 millions 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:

¹ Available at <http://www.singstat.gov.sg/stats/themes/economy/natac.html>.

² There is no documentation for the I-O tables for 2007, but the structure of the tables is the same as that for the I-O table for 2005. Therefore, we used the information on the “Other goods and services” import from the document accompanying the I-O table for 2005 (Singapore Department of Statistics, 2010. *Singapore Input-Output Tables 2005*, available at www.singstat.gov.sg/pubn/economy/IO2005%20Tables.pdf).

- one row vector for taxes on products, by user
- one row vector for import duties, by user
- 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

The negative operating surpluses in the ‘Other fishery’ and ‘Fiber glass’ were adjusted according to the recommendation in Huff et al (2000)³. The IO tables for 2005⁴ 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.

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.

The tariff matrix was created by proportionately allocating the tariff revenue data from government revenue data for the year 2007⁵ to the imported values of dutiable goods⁶.

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

³ Huff, K., McDougall, R. and Walmsley, T. 2000. “Contributing Input-Output Tables to the GTAP Data Base,” GTAP Technical Paper No. 1, Release 4.2, January.

⁴ Singapore Department of Statistics, 2010. Singapore Input-Output Tables 2005, available at www.singstat.gov.sg/pubn/economy/IO2005%20Tables.pdf.

⁵ Available at http://www.mof.gov.sg/budget_2009/revenue_expenditure/attachment/Revenue_Estimates.pdf

⁶ List of Dutiable Goods – Singapore Customs, available at www.customs.gov.sg/leftNav/trad/val/List+of+Dutiable+Goods.htm

then scale to the total value of commodity taxes on the I-O tables.

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.

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

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 GTAP 8.0 Data Base for Singapore. Overall FRS comprises less than 8% of total production of crops and forestry.

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.

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

42 sectors	Covering 57 GTAP sectors	Covering 136 original IO sectors
Crops	PDR	Part of Nursery products
	WHT	Part of Other agriculture
	GRO	
	V_F	
	OSD	
	C_B	
	PFB	
	OCR	
	CTL	
Livestock	CTL	Livestock
	OAP	
	RMK	
	WOL	
FRS	FRS	Part of Nursery products and Other agriculture

⁷ Horridge, J.M, (2004) Adjuster.Tab- a program to rectify imbalances in a CGE database, archive item number TPMH0058, available at <http://www.monash.edu.au/policy/archivep.htm>.

42 sectors	Covering 57 GTAP sectors	Covering 136 original IO sectors
FSH	FSH	Aquarium fish Other fisheries
COA	COA	na (not applicable)
OIL	OIL	Na
GAS	GAS	Na
OMN	OMN	Na
SGR	SGR	Sugar, chocolate & related products
VOL	VOL	Oils & fats
MIL	MIL	Dairy products
B_T	B_T	Soft drinks Alcoholic drinks & tobacco products
OFD	CMT OMT PCR OFD	Food preparations Bread, biscuits & confectionery Coffee & tea Other food products
TEX	TEX	Yarn, fabrics & textile articles
WAP	WAP	Wearing apparel
LEA	LEA	Footwear, leather & fur products
LUM	LUM	Wood & wooden products (except furniture)
PPP	PPP	Paper & paper products Newspapers, books & magazines Other printing
P_C	P_C	Petroleum & petroleum products
CRP	CRP	Industrial chemicals & gases Petrochemicals Pharmaceutical products Perfumes, cosmetics & toiletries Cleaning & polishing preparations Paints Food chemicals & additives Other chemical products Rubber & rubber products Plastic precision products Other plastic products
NMM	NMM	Glass & glass products Fibreglass & fibreglass products Bricks, cement & concrete products Non-metallic mineral products
Metals	I_S NFM	Basic metals
FMP	FMP	Structural metal products Metal stampings Metal precision components Non-insulated cable products

42 sectors	Covering 57 GTAP sectors	Covering 136 original IO sectors
		Metal containers Treatment & coating of metals Other metal products
ELE	ELE	Computers & computer peripheral equipment Data storage Audio & video equipment Semiconductors Electron tubes & electronic display devices Printed circuit boards Communication equipment Other electronic products
OME	OME	Lifting & hoisting machinery Other industrial machinery & equipment Refrigerators & air-conditioners Oil rigs & oilfield machinery General engineering works Electrical industrial apparatus Recorded media Household appliances Storage & primary batteries Electrical wires & cables Lamp & lighting fixtures Medical instruments Scientific instruments (including watches & clocks)
MVH	MVH	Land transport equipment
OTN	OTN	Building of ships & boats Repairing of ships & boats Marine engines & ship parts Aircraft
OMF	OMF	Recorded media Photographic & optical goods Furniture (except of stone) Jewellery Other manufacturing Scrap
ELY	ELY	Electricity
GDT	GDT	Gas
WTR	WTR	Water
CNS	CNS	Building construction Other construction
TRD	TRD	Wholesale trade of computer products Wholesale trade of other products Retail trade of computer products Retail trade of other products Food & beverage services

42 sectors	Covering 57 GTAP sectors	Covering 136 original IO sectors
		Accommodation services
OTP	OTP	Passenger transport by land Freight transport by land Logistics service providers & courier services Other transport services Warehousing services Sight-seeing & tourism
WTP	WTP	Water transport Supporting services to water transport Port operation services
ATP	ATP	Air transport Supporting services to air transport Airport operation services
CMN	CMN	Communications
OFI	OFI	Banks & finance companies Other financial services Fund management
ISR	ISR	Life insurance General & other insurance
OBS	OBS	Real estate Legal services Accounting & secretarial services Information technology Publishing Architectural & engineering services Industrial design services Petroleum & mining consultants Employment & labour contracting Advertising Exhibitions Leasing of machinery & equipment Management consultants Hotel management services Research & development Business representative offices & HQ activities Other business & technical services Environmental health services Repairs of household goods Repairs of road transport equipment
ROS	ROS	Media entertainment Museums, parks & performing arts Sports & recreation Personal & household services Domestic services
OSG	OSG	Producers of government services

42 sectors	Covering 57 GTAP sectors	Covering 136 original IO sectors
		Security services
		Education
		Medical & health services
		Non-profit bodies
DWE	DWE	Ownership of dwellings

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.

⁸ Horridge, M., Robert, M., Narayanan, B, and Walmsley, T. (2008) Exercises in Contributing I-O Tables to the GTAP Data Base. Available from https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2850