Singapore Input-Output Tables 2005

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Introduction

Input-Output (I-O) tables provide systematic and detailed information on the production activities of an economy by recording the transactions between producers and consumers in an economic system. They are primarily related to the production account in the System of National Accounts (SNA) and are made up of a set of supply and use tables and a set of symmetric tables.

To date, the Singapore Department of Statistics (DOS) has published seven sets of I-O tables for the reference years 1973, 1978, 1983, 1988, 1990, 1995 and 2000. The set of 2005 benchmark I-O tables is the latest in the series and has been used to reconcile the Gross Domestic Product (GDP) estimates by production, expenditure and income approaches in the rebasing of Singapore's National Accounts to reference year 2005.

This article explains the basic structure of the set of supply and use tables[1], and presents information on the sources and methodology used in the compilation of the 2005 benchmark I-O tables.

Basic Structure of Tables

In the Singapore I-O tables, the supply and use tables consist of three basic matrices, viz.

make matrix, absorption matrix and import matrix. These tables bring together the production, expenditure and income measures of GDP which when balanced provide a single measure of GDP, integrating the components of value-added (VA), output and final demand.

The 2005 benchmark I-O tables have been compiled based on 136 industries and 136 commodities. An industry comprises enterprises and establishments performing the same or similar kinds of economic activity while a commodity consists of goods and services of a similar nature.

The classification of industries in I-O tables is based on the 2005 Singapore Standard Industrial Classification (SSIC 2005), and the classification of commodities follows the Standard International Trade Classification, Rev. 3 (SITC Rev.3) and Harmonised Commodity Description and Coding System Nomenclature 2002 (HS 2002).

For the purpose of this paper, the supply and use tables are presented using 9 industrial sectors and commodities.

Make Matrix

The make matrix records all domestic production in Singapore, broken down by industries and commodities (Table 1). The

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1   Please refer to the publication "Singapore Input-Output Tables 2005" for a discussion on the symmetric tables and applications of I-O tables.

sum of each row gives the total output of an industry, while the sum of each column shows the total output of a particular commodity.

Primary commodities of industries are reported in the diagonal of the make matrix while the secondary commodities are reported off the diagonal. As the primary commodity output of a producing unit is related to its primary production activity which in turn determines its industry classification, the diagonal entries of the make matrix always show a higher value vis-à-vis the off-diagonal entries.

In 2005, the Singapore economy produced $563.3 billion worth of goods and services. The services sector[2] accounted for 53 per cent of total domestic output and the goods sector contributed to the remaining 47 per cent.

Absorption Matrix

The absorption matrix records the commodities purchased or used by industries as intermediate inputs to current production (Table 2). In line with convention in the presentation of I-O tables, other relevant information is shown together with the absorption matrix.

To the right of the absorption matrix is the final demand matrix which records the use of commodities by final demand components such as final consumption expenditure (FCE - comprising private consumption expenditure (PCE) and government consumption expenditure (GCE)), gross capital formation (GCF - comprising gross fixed capital formation and changes in inventories), and exports of goods and services. A separate

TABLE 1   MAKE MATRIX

Million Dollars

Sales by Industry	Sales by Commodity									Total Output
	Agric	Mfg	Uti	Constr	Com	Tpt/I	Fin	Biz	Oth	
Agriculture	233	0	0	0	1	0	0	3	0	237
Manufacturing	0	216,555	674	5	6,330	208	0	628	116	224,516
Utilities	0	0	8,861	0	4	0	0	135	0	9,001
Construction	0	0	0	29,914	55	27	0	233	0	30,230
Commerce	0	192	0	3	69,783	997	0	4,065	521	75,562
Transport & InfoComm	0	34	8	0	1,455	80,224	2	2,183	29	83,935
Financial Services	0	0	0	0	91	274	44,183	581	118	45,248
Business Services	0	0	170	0	461	212	2	42,424	34	43,303
Other Services	0	1	0	0	798	58	0	177	50,260	51,293
Total Output	233	216,782	9,713	29,922	78,978	82,000	44,188	50,430	51,078	563,325

Note:

Agric	= Agriculture	Constr	= Construction	Fin	= Financial Services
Mfg	= Manufacturing	Com	= Commerce	Biz	= Business Services
Uti	= Utilities	Tpt/I	= Transport & InfoComm	Oth	= Other Services

2   The services sector comprises commerce, transport and infocomm, financial services, business services and other services whereas the goods sector consists of the agriculture, manufacturing, utilities and construction industries.
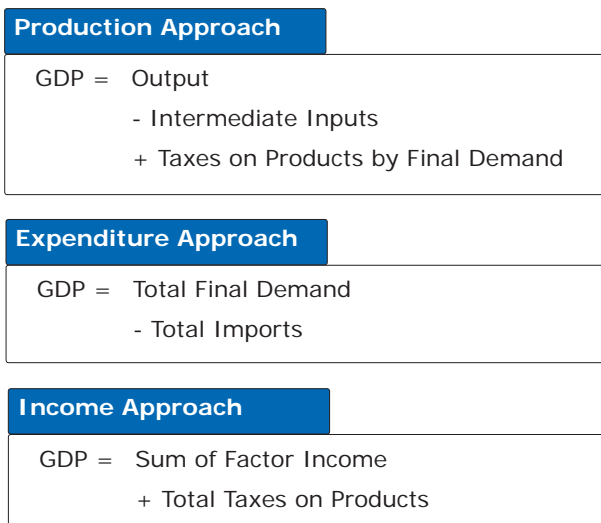
TABLE 2   ABSORPTION MATRIX

Million Dollars

Sales by Commodity	Purchases by Industry									Total Inter-mediate Output	Final Demand				Total Output
	Agric	Mfg	Uti	Constr	Com	Tpt/I	Fin	Biz	Oth		FCE	GCF	Exports of G & S	Total	
Domestic Production	67	37,966	2,511	18,368	28,562	21,210	19,868	15,425	17,300	161,276	78,130	25,039	298,880	402,049	563,325
Agriculture	4	12	0	0	29	0	0	0	3	49	56	-1	129	184	233
Manufacturing	8	17,299	88	1,882	1,130	1,351	105	802	1,812	24,477	3,882	1,949	186,474	192,305	216,782
Utilities	7	2,500	2,042	63	776	341	98	374	880	7,082	1,615	58	958	2,631	9,713
Construction	1	289	19	12,219	32	35	17	316	784	13,711	0	15,440	771	16,211	29,922
Commerce	15	4,632	72	2,004	2,009	2,395	357	2,082	1,661	15,227	13,705	2,610	47,436	63,751	78,978
Transport & InfoComm	10	3,540	47	396	13,760	12,581	2,529	3,832	2,178	38,872	6,435	1,486	35,208	43,129	82,000
Financial Services	7	2,013	78	493	2,498	802	14,468	1,598	1,597	23,553	5,255	0	15,379	20,634	44,188
Business Services	11	6,286	112	1,115	6,757	2,692	1,939	5,651	6,041	30,604	4,426	3,496	11,903	19,826	50,430
Other Services	5	1,395	53	196	1,571	1,012	355	770	2,344	7,701	42,756	0	621	43,377	51,078
Imports of Goods & Services	59	132,968	3,572	5,586	8,339	34,317	4,675	5,015	7,838	202,370	20,092	15,037	0	35,130	237,499
Taxes on Products	1	119	73	1	32	29	52	10	96	412	7,460	1,624	0	9,084	9,496
Value-added at Basic Prices	111	53,464	2,846	6,275	38,629	28,378	20,653	22,853	26,059	199,268	0	0	0	0	199,268
Taxes on Production	3	444	159	158	358	598	100	816	785	3422	0	0	0	0	3,422
Compensation of Employees	52	15,817	407	4,517	16,173	10,661	9,398	10,705	16,209	83,939	0	0	0	0	83,939
Gross Operating Surplus	55	37,203	2,279	1,600	22,098	17,119	11,155	11,332	9,065	111,907	0	0	0	0	111,907
Total Input	237	224,516	9,001	30,230	75,562	83,935	45,248	43,303	51,293	563,325	105,683	41,700	298,880	446,263	1,009,588

GCF = Gross Capital Formation
G & S = Goods & Services

row vector on imports of goods and services below these matrices shows the amount of retained imports used as intermediate inputs or as final demand. The next row vector represents taxes on products; following which, is a matrix of gross value-added (GVA) components at basic prices.

This systematic way of presentation reveals very clearly the reconciliation of GDP by the three approaches, viz., production approach, expenditure approach and income approach (Chart 1).

CHART 1   DERIVATION OF GDP
            AT CURRENT MARKET PRICES

Production Approach

GDP =   Output
        - Intermediate Inputs
        + Taxes on Products by Final Demand

Expenditure Approach

GDP =   Total Final Demand
        - Total Imports

Income Approach

GDP =   Sum of Factor Income
        + Total Taxes on Products

In 2005, the intermediate inputs supplied by domestic industries aggregated to $161.3 billion reflecting 29 per cent of total domestic production (Table 2). The services sector accounted for a larger share of 63 per cent and the goods sector, the remaining 37 per cent. The amount of goods and services imported by domestic industries for use in their production process was $202.4 billion, with the goods sector using the bulk of the imported inputs.

Final demand components absorbed $402.0 billion or 71 per cent of total domestic output in 2005. Exports of goods and services amounted to $298.9 billion or 53 per cent of total domestic output, reflecting the economy's high dependency on external demand.

GVA in 2005 recorded $199.3 billion which was about 35 per cent of total domestic output. Compensation of employees was $83.9 billion, making up 42 per cent of GVA.

Import Matrix

Similar to the absorption matrix, the import matrix records the retained imports by commodity entering industries as intermediate inputs and the final demand sectors as consumption or capital formation; it is an expansion of the row vector of retained imports in Table 2.

Total imports of goods and services in 2005 was $237.5 billion of which $202.4 billion was purchased by industrial sectors as inputs for their production, with only $35.1 billion retained for final demand.

Sources and Methodology

Data Sources

Data for compiling 2005 I-O tables are obtained primarily from surveys and censuses conducted by DOS and other government agencies (Table 3). These are further supplemented by administrative data collected by various government departments in the course of their normal operations.

TABLE 3   MAIN DATA SOURCES BY SECTOR

Sector	Sector Description	Data Source
1	Agriculture	Census of Agriculture & Fishing Industry
2	Manufacturing	Census of Manufacturing Activities
3	Utilities	Survey of Utilities, Sewerage & Waste Management
4	Construction	Census of Construction Industry
5	Commerce	Annual Survey of Services - Wholesale Trade / Retail Trade Annual Survey of Services - Hotels & Catering
6	Transport & InfoComm	Annual Survey of Services - Transport, Information & Communications
7	Financial Services	Annual Survey of Services - Financial Services Survey of Services - Financial Institutions / Insurance Companies
8	Business Services	Annual Survey of Services - Business Services & Real Estate
9	Other Services	Annual Survey of Services - Community, Social & Personal Services/ Non-Profit Organisations
10	Exports and Imports of Goods & Services	Singapore's Merchandise Trade Statistics Survey of International Trade in Services

Valuation

In the Singapore I-O tables, the valuation of all inputs and outputs is at basic price which is defined as the amount receivable by the producer from the purchaser for a unit of good or service minus any tax payable and plus any subsidy receivable on the product.

This valuation is adopted for the compilation of I-O tables as it is the most consistent valuation basis for all transactions. The trade and transport margins deducted are allocated to their own industry/commodity groups, and taxes on products are shown separately.

Treatment of Imports and Exports

Goods that are imported and then subsequently re-exported without being processed are omitted in the compilation of the Singapore I-O tables. Exports of goods are valued free on board (f.o.b.) i.e., at the prices at the domestic customs frontier before being shipped out. This is equivalent to basic prices at the border of Singapore. For imports which are valued at cost, insurance, freight (c.i.f.) at the domestic customs frontier, the basic value of the goods is shown separately from the associated freight and insurance payments in the import matrix.

Methodological Improvements

Conceptual changes are also introduced in the 2005 benchmark I-O tables following the recommendation of the SNA93/SNA08. The main improvements incorporated are the measurement of implicit charges for financial services produced by financial intermediaries or financial intermediation services indirectly measured (FISIM) and the refinement on implicit service charges associated with the transaction of debt securities[3].

With the implementation of these methodological improvements, the "imputed bank service charge" (IBSC) as nominal industry in earlier I-O tables no longer exists. The IBSC column has thus been removed from the absorption matrix of the 2005 benchmark I-O tables. This is consistent with other macroeconomic statistics released by DOS.

Conclusion

Similar to the earlier I-O tables, the 2005 benchmark I-O tables have been used to derive and reconcile the three GDP estimates in the rebasing of Singapore's National Accounts to reference year 2005.

I-O tables also provide a comprehensive and integrated framework for checking the consistency of statistics obtained from different sources.

Conceptual changes and methodological improvements implemented in the 2005 benchmark I-O tables include the measurement of the implicit charges for FISIM, and refinement on implicit service charges associated with the transaction of debt securities.

Information on the applications of I-O tables, along with the complete set of the 2005 benchmark I-O tables at the detailed industry and commodity levels, can be found in the publication "Singapore Input-Output Tables 2005".

This report is available for free downloading from the Singstat website at:

http://www.singstat.gov.sg/pubn/economy/IO2005%20Tables.pdf

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3   Please refer to the information paper on "Rebasing of Singapore's National Accounts to Reference Year 2005" for a more detailed discussion on FISIM.