FEATURE ARTICLE

Estimating the Value-Added from Singapore's Exports to Key Markets

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EXECUTIVE SUMMARY

- The value-added (VA) from Singapore's exports to key markets in 2005 was estimated using the Input-Output (IO) tables. In aggregate, VA from exports is estimated to have accounted for 54 per cent of Singapore's GDP in 2005. Of this, 30 per cent of GDP was attributed to merchandise goods, while 24 per cent of GDP was attributed to services exports.[2]
- The G-3 dominated as a source of export VA in 2005, both for merchandise goods and services.[3] This was partly because the basket of goods exported to the G-3, such as biomedical manufacturing and electronics products, had higher VA than the goods exported to other economies.
- Merchandise goods exports to Asia generated lower VA than those to the G-3, primarily because of the quality of the basket of goods exported to these economies. However, services exports to emerging Asia generated significant VA to the Singapore economy, primarily due to exports of healthcare and financial services.

INTRODUCTION

Singapore has actively pursued a strategy of export diversification in recent years, following the recommendation by the Economic Review Committee (ERC) to diversify exports, reduce volatility and ensure sustained and stable growth (ERC, 2003). As a result, export destinations diversified significantly between 2003 and 2010. For example, the share of domestic exports to the G-3 fell from 37 per cent in 2003 to 26 per cent in 2010, whereas the share of domestic exports to Greater China rose from 20 per cent to 24 per cent in the same period. There were similar trends in re-exports of goods as well as exports of services, with the share of the "traditional" G-3 markets decreasing and that of emerging Asia and the rest of the world rising (Exhibit 1).

Exhibit 1: Trade Shares of Key Economies (Per Cent)

	Domestic Exports		Re-Exports		Services Exports**	
	2003	2010	2003	2010	2003	2009
G-3	37.2	25.7	23.4	15.8	40.2	36.0
Greater China*	19.9	24.0	19.4	27.5	14.1	14.2
ASEAN	25.3	24.3	40.7	36.8	15.8	14.2
Rest of the World	17.6	25.9	16.5	19.9	29.9	35.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: International Enterprise Singapore, Singapore Department of Statistics.
* Greater China refers to China, Hong Kong and Taiwan.
** Services exports only include exports reported in the Trade in International Services (TIS) Survey.

The views expressed in this paper are solely those of the authors and do not necessarily reflect those of the Ministry of Trade and Industry or the Government of Singapore.

[1] This paper updates and extends earlier work by Neo and Thia (2009). We thank Singapore Department of Statistics and International Enterprise Singapore for their kind assistance in data compilation. We also thank Thia Jang Ping, Yong Yik Wei, Chua Boon Loy, Cheng Li Choo, James Teo, Dominic Soon, Jason Teo, Jerome Chow, Francis Tan and Heng Shu Ling for helpful discussions and suggestions. Any remaining error belongs to the authors.
[2] In this analysis, merchandise goods refers only to domestic exports as reported by International Enterprise Singapore, and excludes re-exports. For more details, see Annex.
[3] G-3 refers to the United States, Japan and the European Union.

However, headline export shares may not accurately depict demand linkages between countries. This is because the composition of export basket varies significantly by country, and different types of exports generate different VA impacts.

METHODOLOGY AND RESULTS

This paper used the recently-released 2005 Input-Output (IO) tables to estimate the VA from Singapore's exports to key markets (Refer to Annex for more details on methodology).

Our results show that in aggregate, VA from exports accounted for 54 per cent of Singapore's GDP in 2005.[4] Of this, 30 per cent of GDP was attributed to VA from merchandise exports, whereas 24 per cent of GDP was attributed to VA from services exports.

Merchandise exports accounted for a larger source of export VA for Singapore, due to their *quantity*. In 2005, the value of merchandise exports accounted for 102 per cent of GDP, while services exports accounted for a much lower 44 per cent. From a *quality* perspective, however, total VA per dollar of merchandise export demand was lower at 30 cents per dollar, compared to 60 cents per dollar for services. For example, one dollar of export by the electronics industry generated 37 cents in VA to the Singapore economy, whereas a dollar of export by the financial services industry generated 78 cents in VA (Exhibit 2). In general, exports of goods generate lower VA impacts than those of services, in part because goods-producing industries use more imported intermediate goods than services-producing industries. Within goods-producing industries, biomedical manufacturing (BMS) exports generated the highest VA per dollar.

Exhibit 2: VA Per Dollar of Final Demand for Major Industrial Sectors, 2005[5]

	Total VA per Dollar ($)
Chemicals	0.18
Electronics	0.37
Biomedical Manufacturing	0.53
Precision Engineering	0.42
Transport Engineering	0.47
Construction	0.55
Wholesale & Retail Trade	0.74
Hotels & Restaurants	0.71
Transport & Storage	0.47
Information & Communications	0.51
Financial Services	0.78
Business Services	0.76

Source: Singapore Department of Statistics (DOS, 2010), Authors' calculations.

[4] Our estimates of VA are valued at market prices. This is because we mapped trade data that is valued at market prices into the IO tables, notwithstanding the fact that the IO tables themselves are valued at basic prices. For more details on this discrepancy, please see Annex.

[5] VA is defined as the sum of gross operating surplus, compensation of employees and taxes on production.

MERCHANDISE EXPORTS

VA per dollar of merchandise exports also varied significantly by markets (Exhibit 3). The basket of goods exported to the EU provided the highest VA of 38 cents per dollar of merchandise exports. This was primarily because of the high VA content of pharmaceutical and electronics exports to the EU, which made up 26 per cent and 34 per cent respectively of total exports to the EU in 2005. Australia had the lowest VA per dollar of exports (21 cents), as dominant exports to Australia were petroleum and petroleum products which generate relatively low VA per dollar of export value.

As a result of the variation in VA per dollar of goods exported to key markets, the VA shares of markets varied significantly from their export shares. However, the G-3 as a whole continued to dominate as a source of merchandise export VA, accounting for 39 per cent of total such VA in 2005. Within the G-3, the EU continued to be the largest source of VA, as it accounted for 19 per cent of total VA from merchandise exports in 2005. The VA shares of Hong Kong and key ASEAN economies were less than their export shares, reflecting relatively lower-value exports to these markets.

Exhibit 3: Value-Added from Merchandise Exports to Key Markets, 2005

Market	Share of Exports (Per Cent)	Share of VA (Per Cent)	Total VA from Exports ($ Billion)	Total VA per Dollar of Exports ($)
US	11.0	12.4	7.6	0.34
EU	15.3	19.4	12.0	0.38
Japan	6.0	6.7	4.2	0.33
China	8.5	8.6	5.3	0.30
Hong Kong	9.4	7.6	4.7	0.24
Taiwan	3.9	4.3	2.6	0.33
South Korea	2.6	3.0	1.8	0.34
Malaysia	9.9	9.2	5.7	0.28
Indonesia	7.9	7.2	4.5	0.28
Thailand	3.7	4.1	2.5	0.33
Australia	4.7	3.3	2.1	0.21
Brazil	0.5	0.6	0.4	0.33
India	2.2	2.0	1.2	0.27
Rest of ASEAN	4.7	3.7	2.3	0.24
World	100.0	100.0	61.9	0.30

Source: Authors' calculations.

SERVICES EXPORTS

Within markets, Hong Kong had the highest VA (67 cents) per dollar of services exports, primarily due to the large share of high VA financial services in Singapore's services exports to Hong Kong. Other markets with high VA per dollar of services included Indonesia (66 cents), Brazil (65 cents) and Thailand (64 cents). Services exports to the US had the lowest VA per dollar, at 53 cents.

As a result of this divergence in the VA per dollar of services exports, the VA share of the US economy was slightly less than its services export share (Exhibit 4). The shares of the EU and Japan were roughly in line with their export shares. As a whole, the G-3 continued to be the largest source of services export VA.

However, the VA from services exports to Asia was higher than headline export shares suggest. Specifically, the VA share of Indonesia was 7.2 per cent in 2005, compared to its export share of 6.5 per cent. This was primarily due to tourism spending on healthcare services. Indonesia was the largest source of Singapore's tourism demand in 2005, with 1.8 million visitor arrivals accounting for 19 per cent of total tourism receipts. More broadly, major ASEAN countries accounted for 35 per cent of total visitor arrivals and 30 per cent of total tourism receipts in 2005.[6] Similarly, the VA share of Hong Kong was higher than its export share, primarily due to exports of financial services.

Exhibit 4: Value-Added from Services Exports to Key Markets, 2005

Market	Share of Exports (Per Cent)	Share of VA (Per Cent)	Total VA from Exports ($ Billion)	Total VA per Dollar of Exports ($)
US	13.6	12.2	6.2	0.53
EU	13.1	13.3	6.8	0.61
Japan	10.6	10.9	5.6	0.61
China	6.0	5.9	3.0	0.59
Hong Kong	5.4	6.0	3.1	0.67
Taiwan	2.1	2.2	1.1	0.61
South Korea	4.6	4.6	2.4	0.60
Malaysia	4.1	4.2	2.1	0.61
Indonesia	6.5	7.2	3.7	0.66
Thailand	3.4	3.7	1.9	0.64
Australia	5.0	5.0	2.6	0.60
Brazil	0.2	0.2	0.1	0.65
India	3.8	3.8	1.9	0.61
Rest of ASEAN	3.3	3.5	1.8	0.63
Rest of World	18.4	17.3	8.9	0.56
World	100.0	100.0	51.1	0.60

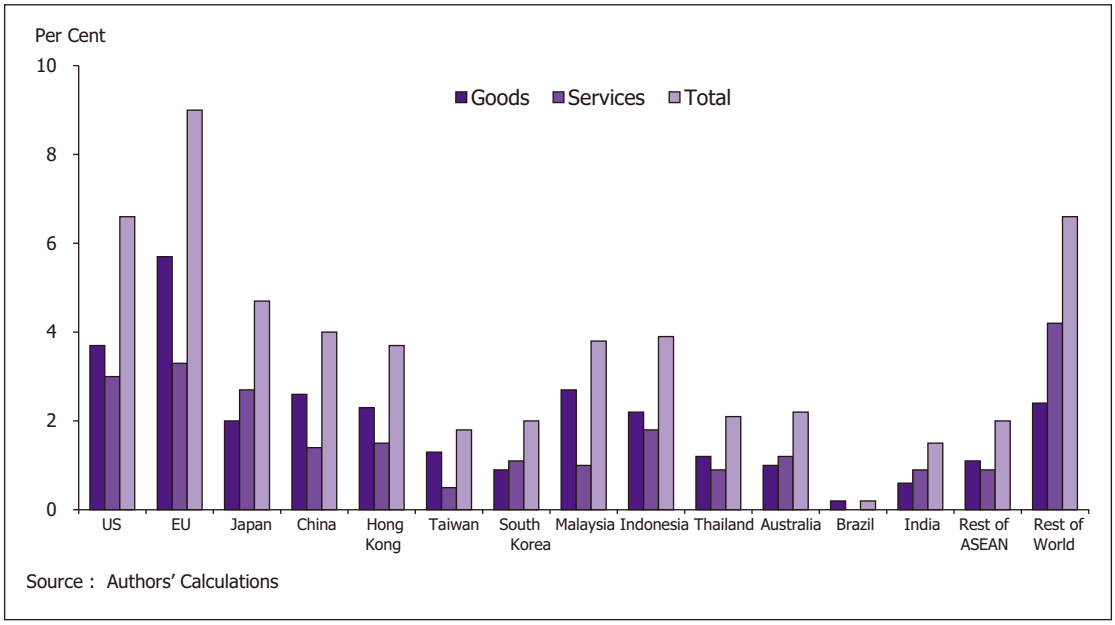
Source: Authors' calculations.

[6] Includes Indonesia, Malaysia, the Philippines and Thailand. Source: Singapore Tourism Board.

TOTAL EXPORTS

Overall, exports to the G-3 economies continued to be the largest source of total export VA in 2005, summing to 20 per cent of GDP (Exhibit 5). However, the shares of ASEAN and Greater China (China, Hong Kong and Taiwan) were also significant, at 12 per cent and 9.5 per cent respectively.

Exhibit 5: VA from Exports to Key Markets as a Percentage of GDP



In general, exports of goods were a larger source of VA than exports of services in 2005. But this was primarily due to the larger quantity of merchandise exports compared to services exports. On a VA per dollar basis, services exports were a larger source of export VA to Singapore. In aggregate, the VA from exports is estimated to have accounted for 54 per cent of Singapore's GDP in 2005.

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ANNEX: METHODOLOGY

We used a standard IO open multiplier model to calculate the VA from exports to key markets using the 2005 IO tables.[7]

$$X = AX + F$$

where A is the 136 x 136 matrix of industry-by-industry flow coefficients, X is the 136 x 1 vector of output, and F the 136 x 1 vector of final demand. Hence,

$$X = (I - A)^{-1} F$$

We also defined two other 136 x 15 matrices – the domestic export matrix F* and the output matrix X*. Each column of F* represents export demand from one market, and the corresponding column in X* represents domestic production needed to meet that markets' export demand. Hence, the previous equation modified to:

$$X^* = (I - A)^{-1} F^*$$

where the term $(I - A)^{-1}$ captured the output effect due to the linkages.

Next, we defined a 136 x 15 VA matrix by V*, which has the solution:

$$V^* = X^*. v$$

where v is a 136 x 15 vector holding the VA coefficients, assumed to remain the same across markets.

Each column sum of V* therefore provided the total VA from exports to a market. Each row sum of V* provided the total VA associated with a sector in the IO table.

To define the matrix F*, we needed export data for each of the 136 IO sectors, disaggregated by 15 identified trading partners. For this, we mapped domestic merchandise export data published by International Enterprise Singapore (IE Singapore) and services exports data from the Singapore Department of Statistics (DOS) into the IO categories.

For merchandise goods, we used IE Singapore's data on domestic exports, valued at market prices. We analysed the export data at the SITC 3-digit level, which gave us 264 classes of merchandise products. We used the SITC-IO concordance tables specified in DOS (2010) to map between SITC and the IO industries using the dominance rule.[8]

In this analysis, "merchandise exports" refers to domestic exports as reported by IE Singapore and exclude re-exports. This is because the IO tables exclude gross re-export flows and only include margins from re-exporting activities. Trade data on re-exports (disaggregated by trading partner) only consist of gross flows, and thus cannot be accurately mapped to the IO tables.

For services exports, we used data from DOS's Balance of Payment statistics. However, detailed destination data was only available for service component categories that are collected using the TIS survey. These accounted for 82 per cent of total services export data in 2005, and we mapped these by destination (at the SSIC 3-digit level) into the 136 IO industries. The remaining 18 per cent of

[7] For more details on the open multiplier, please refer to Low and Toh (1984).
[8] In the cases where one SITC-3 digit code maps into many sectors, we map at a more granular SITC-7 digit level.

services export data consisted of travel receipts, Financial Intermediation Services Indirectly Measured (FISIM) and implicit service charges on foreign exchange trading, government services as well as other services where further breakdown by partner country was not available.[9] Of this, travel receipts were the largest share of services exports. We mapped this into the IO industries, broadly using the methods specified in Low and Toh (1984) using data from Singapore Tourism Board's 2005 Annual Report on Tourism Statistics report. This report provided detailed Total Expenditure by Visitors data, cross-categorised by country and sector.

Finally, our estimates of VA are valued at market prices. The exports estimates in the Singapore IO tables, however, are valued at basic prices where the trade and transport margins from the merchandise trade commodities are removed and allocated to their own commodities which are dominantly in the services commodities. This valuation difference between basic and purchasers' price may create a downward bias in our estimates of VA from merchandise exports since the services-producing industries have a higher VA per dollar output than the goods-producing industries.

[9] This data is mapped into all 136 IO industries, i.e. we capture services exports by goods-producing industries as well as by services-producing industries. Nonetheless, services exports by goods-producing industries are only a small part of total services exports in 2005. We also use researcher discretion to deal with suppressed data.