

○ **FEATURE  
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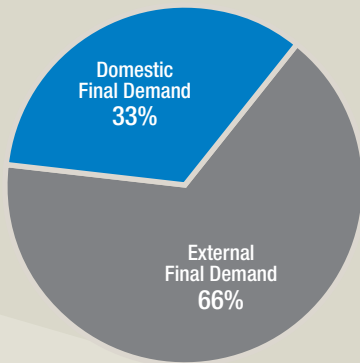


# FEATURE ARTICLE

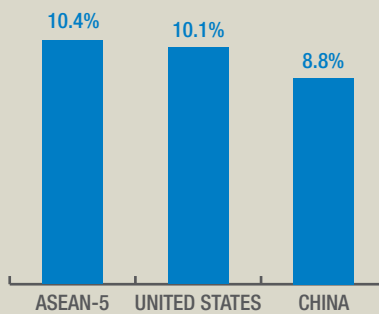
## ANALYSIS OF SINGAPORE'S EXTERNAL SOURCES OF FINAL DEMAND

As a small open economy, Singapore is dependent on external markets for demand.

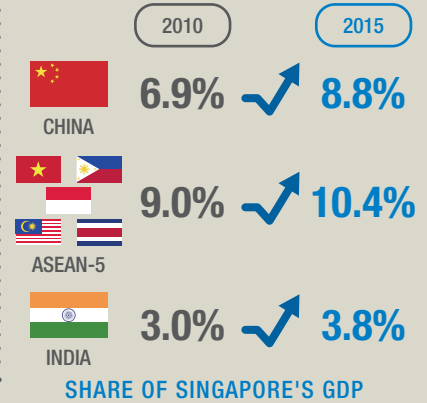
External final demand markets contributed two-thirds of Singapore's GDP in 2015



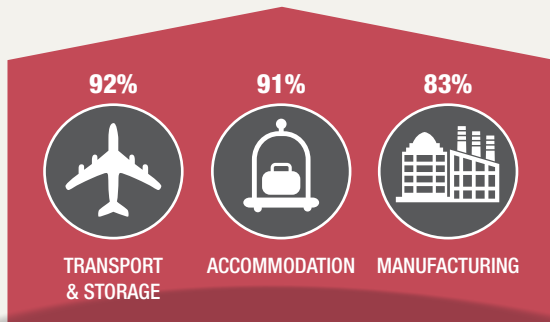
The most important final demand markets for Singapore were ASEAN-5, US and China



China, ASEAN-5 and India have risen in importance as final demand markets over the years

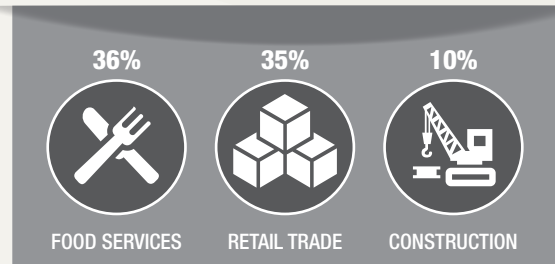


At the sectoral level, **manufacturing, transportation & storage and accommodation** are the most reliant on external demand, while **construction, retail and food services** are the least reliant.



**MOST RELIANT**

**LEAST RELIANT**



**EXTERNAL DEMAND SHARE OF SECTORS' VA, %**

Looking ahead, there is a need to closely monitor the changes in final demand drivers in key external markets as well as the shifts in global value chains, given their impact on our exports and hence GDP.

For instance, the shift towards consumption-driven growth in China and robust demand prospects in ASEAN-5 and India may present new opportunities for Singapore's goods and services exporters.



## EXECUTIVE SUMMARY

- This article examines the external sources of final demand for Singapore, derived based on data from the OECD Inter-Country Input-Output (ICIO) tables.
- At the overall economy level, external final demand contributed to two-thirds of Singapore's Gross Domestic Product (GDP) in 2015. The most important final demand markets for Singapore were ASEAN-5 (Malaysia, Indonesia, Philippines, Thailand and Vietnam), the United States (US) and China. While China, ASEAN-5 and India have risen in importance as final demand markets over the years, the advanced economies (e.g., the US, Eurozone and Japan) remain key final demand destinations for Singapore's exports of goods and services.
- At the sectoral level, the reliance on external final demand varies. The manufacturing, transportation & storage and accommodation<sup>1</sup> sectors were the most reliant on external final demand, while sectors such as construction, other services<sup>2</sup>, retail trade and food services catered predominantly to domestic final demand.
- Looking ahead, there is a need to continue to closely monitor the changes in final demand drivers in key external markets as well as the shifts in global value chains, given their impact on our exports and hence GDP. Doing so will also allow us to formulate strategies to ensure that we remain plugged into growth opportunities in key final demand markets either directly or via global value chains. For instance, even though the slowdown in investments and increased insourcing of intermediate inputs in China may weigh on Singapore's goods exports, the shift towards consumption-driven growth in China as well as robust demand prospects in ASEAN-5 and India may present new opportunities for Singapore's goods and services exporters.

*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.<sup>3</sup>*

## INTRODUCTION

As a small open economy, Singapore is heavily dependent on external markets for the goods and services that it produces. There are two ways to measure the importance of different external markets to Singapore's Gross Domestic Product (GDP). The first is based on the value-added (VA) from direct exports to a market, while the second is based on the VA from meeting the final demand in that market.<sup>4</sup>

Given the rising prominence of global supply and value chains, the two measures offer different insights on the relative importance of various external markets to Singapore's GDP. In particular, a significant share of Singapore's exports are intermediates used by industries overseas to produce goods and services intended for export to another destination, either as final products or as further intermediate inputs. Using the first measure (i.e., direct exports to a market) therefore has the potential effect of overstating our reliance on our direct trading partners, and understating our reliance on countries which purchase the final goods and services produced at the end of the value chain.

<sup>1</sup> This refers primarily to the hotels industry.

<sup>2</sup> Other services include the "Health & Social Services", "Education", "Arts, Entertainment & Recreation" and "Other Community" segments.

<sup>3</sup> We would like to thank Ms Yong Yik Wei for her useful suggestions and comments. All remaining errors belong to the authors.

<sup>4</sup> We measure the VA derived from the exports of goods and services rather than the gross value of the exports, as the former more accurately measures the value that accrues to Singapore from exports since it removes the cost of imports required to produce the exports.

The second measure, which accounts for these global value chain effects, offers a more accurate assessment of the relative importance of different final demand markets to Singapore's GDP. Our study uses data from the OECD Inter-Country Input-Output (ICIO) tables to trace the external sources of final demand for Singapore. Doing so allows us to gain a better understanding of how changing patterns of final demand (e.g., consumption by consumers and investments by businesses) in end-markets affect Singapore's GDP.

## LITERATURE REVIEW

A number of previous studies had estimated the importance of various external markets to the Singapore economy using the first measure, i.e. the share of GDP attributable to Singapore's direct export destinations. Using the 2005 input-output tables published by the Singapore Department of Statistics, Jayaram and Neo (2010) found that the G3 economies (US, EU-27 and Japan) were collectively the largest contributor to Singapore's export VA in 2005, summing to 20 per cent of GDP. Chan et al. (2012) updated the analysis and found that while the G3 economies still accounted for most of the VA from Singapore's exports in 2010, an increasing share of the VA was derived from exports to China and other Northeast Asian economies.

Due to data limitations then, these studies could only inform us of Singapore's reliance on our direct trading partners and did not account for global value chain linkages.

## METHODOLOGY AND DATA

Our study extends the previous studies in a few ways. First, we used new data from the OECD ICIO tables to establish the sources of final demand for Singapore's exports of goods and services. Second, we updated the analysis to 2015, and examined the changes in the relative importance of our final demand markets over the last five years. Third, we estimated the VA shares of our final demand markets at the sectoral level, to uncover the differences in exposure to various markets across sectors.

The OECD ICIO tables track the inter-country, inter-industry flows of intermediate and final goods and services for 61 countries (including Singapore), 34 industries and 3 sources of final demand (consumption by consumers, investments by businesses, and expenditure by government).<sup>5</sup> As the OECD ICIO tables are currently only available up to 2011, we used the RAS methodology to update the tables to 2015 data.<sup>6</sup> We then used standard open input-output multipliers to calculate the share of Singapore's GDP and sectoral VA attributable to each final demand market. Please refer to the Annex for more details of the methodology.

## EMPIRICAL RESULTS

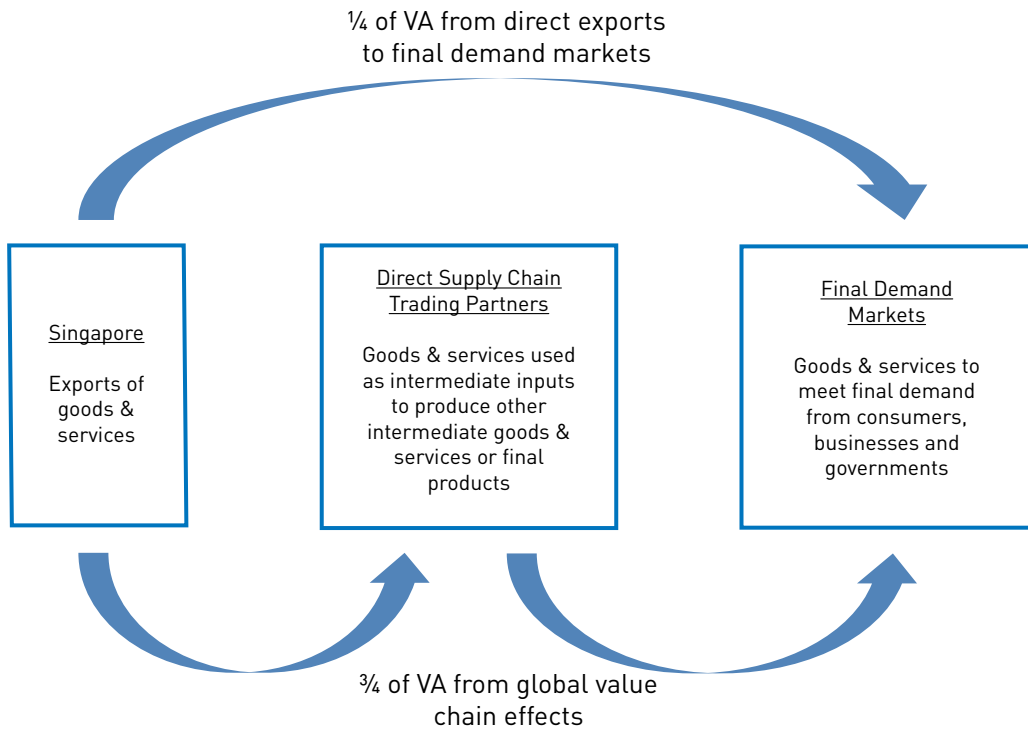
### (i) External Sources of Final Demand at the Overall Economy Level

At the overall economy level, external final demand accounted for around 66 per cent of Singapore's GDP in 2015, while domestic final demand accounted for the remaining share. Of the VA derived from external final demand, only one-quarter was attributable to the direct exports of goods and services to final demand markets. The remaining three-quarters of the VA from external final demand were generated through global value chain effects (Exhibit 1).

<sup>5</sup> OECD ICIO tables cover the global flows of goods and services as one of the 61 countries in the tables is the "rest of the world" grouping.

<sup>6</sup> The RAS methodology is commonly used to update an input-output matrix to a more recent time period, when only partial information about its row and column sums is known for the more recent time period. For details of the RAS method, refer to *Singapore Supply and Use, and Input Output Tables 2010*, Department of Statistics (2014).

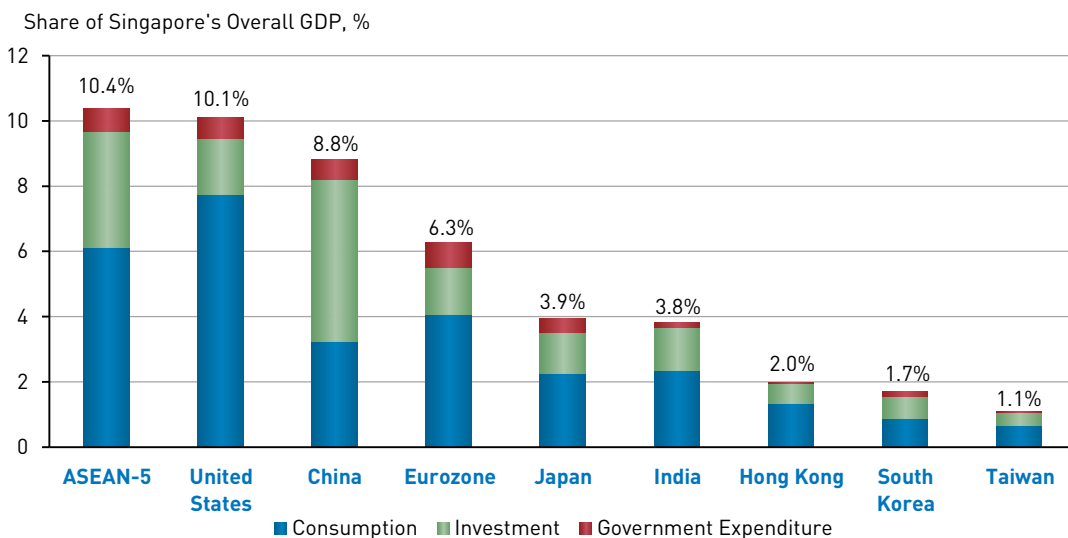
**Exhibit 1: Direct Exports to Final Demand Markets and Global Value Chain Effects**



Among Singapore’s external final demand markets, ASEAN-5, US and China were the most important, contributing to 10.4 per cent, 10.1 per cent and 8.8 per cent of Singapore’s GDP respectively in 2015 (Exhibit 2). These were followed by the Eurozone (6.3 per cent), Japan (3.9 per cent) and India (3.8 per cent).

A further decomposition of the contributions of our key markets by final demand type (i.e., consumption, investment and government expenditure) reveals that the largest final demand drivers for Singapore’s GDP in 2015 were consumption in the US (7.7 per cent) and ASEAN-5 (6.1 per cent), followed by investments in China (5.0 per cent). This finding suggests that Singapore is well-positioned to benefit from the rising consumption of the middle class in the ASEAN-5 economies, but is also likely to be adversely affected by the slowdown in investments in China as it rebalances towards consumption-driven growth.

**Exhibit 2: Share of Singapore’s Overall GDP by Final Demand Market and Type (2015)**



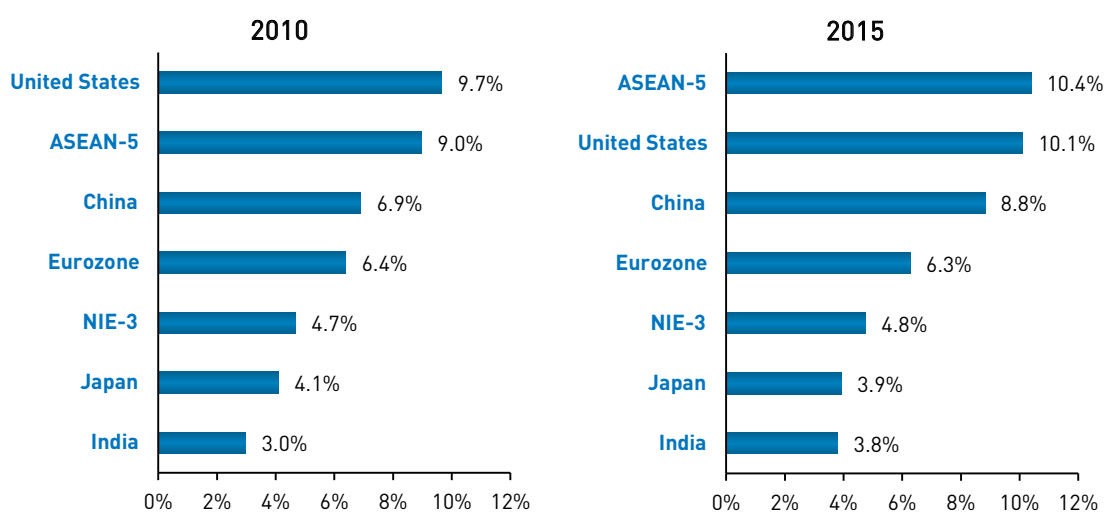
Source: MTI-ECD Estimates

Note: ASEAN-5 refers to Malaysia, Indonesia, Thailand, Philippines and Vietnam

Next, we examined the changes in the relative importance of our final demand markets over the last five years. Our results showed that China, ASEAN-5 and India have risen in importance as final demand markets for Singapore between 2010 and 2015. In particular, the share of Singapore's GDP attributable to final demand from ASEAN-5 increased from 9.0 per cent in 2010 to 10.4 per cent in 2015, overtaking that of the US (Exhibit 3). The emergence of ASEAN-5 as Singapore's largest final demand market was due to robust consumption and investment growth in the region, particularly in Indonesia and Malaysia, as well as the ability of Singapore's exporters to tap on demand opportunities in the region (Exhibit 4).

The share of Singapore's GDP that could be attributed to final demand from China also rose significantly, from 6.9 per cent in 2010 to 8.8 per cent in 2015. This reflects China's rising dominance as an end-market for consumer and capital goods, apart from its traditional role as a processing centre for intermediate goods. Meanwhile, India's share increased by 0.8 percentage-points over the same period to around 4.0 per cent in 2015 on the back of strong final demand growth in the country.

**Exhibit 3: Share of Singapore's Overall GDP by Final Demand Markets (2010 and 2015)**



Source: MTI-ECD Estimates

Note: NIE-3 refers to Hong Kong, South Korea and Taiwan

**Exhibit 4: Historical Growth of Final Demand in Key External Economies, and Change in Share of Singapore's GDP Attributable to Final Demand in these External Economies from 2010 to 2015**

Final Demand Country	Real Growth in Final Demand (CAGR 2010-15), %			Change in Share of Singapore's GDP from External Final Demand between 2010 to 2015 (%-pt)
	Consumption	Investment	Government Expenditure	
<b>China</b>	9.0	7.0	8.7	1.9
<b>ASEAN-5</b>	-	-	-	1.4
Indonesia	5.2	6.5	4.7	0.7
Malaysia	7.0	7.2	6.7	0.5
Philippines	5.9	8.8	6.6	0.1
Thailand	2.4	3.3	3.4	0.1
Vietnam	6.0	3.6	7.1	0.1
<b>India<sup>^</sup></b>	5.8	3.7	4.4	0.8
<b>G3</b>	-	-	-	0.1
US	2.2	6.1	-1.6	0.4
Eurozone	0.1	0.0	0.4	-0.1
Japan	0.4	2.2	1.2	-0.2

Source: MTI-ECD Estimates, OECD ICIO Tables, Respective National Statistics Bureaus

<sup>^</sup> Due to data limitations, the CAGR of India's final demand is calculated from 2012 to 2015.

Notwithstanding the rising importance of China, ASEAN-5 and India as final demand markets, the advanced economies continue to remain key final demand destinations for Singapore's exports. Collectively, the contribution of final demand from the US, Eurozone and Japan to Singapore's GDP remained stable, at around 20 per cent, over the last five years.

### (iii) External Sources of Final Demand at the Sectoral Level

At the sectoral level, the exposure to external final demand varies across sectors. In 2015, the share of VA attributable to external final demand ranged from 10 per cent in the construction sector to 92 per cent in the transportation & storage sector (Exhibit 5).

For the manufacturing sector as a whole, external final demand accounted for 83 per cent of its VA in 2015, reflecting its externally-oriented nature. Within the sector, the chemicals and biomedical manufacturing clusters had the highest external reliance, with 93 per cent of their respective VA attributable to external final demand. However, their exposure varied across markets. Specifically, the chemicals cluster had the highest exposure to ASEAN-5 (26 per cent of total VA) and China (14 per cent), while the biomedical manufacturing cluster's largest exposure was to the US (32 per cent) followed by Eurozone (13 per cent).

Among the externally-oriented services sectors, the share of VA attributable to external final demand was the highest for the transportation & storage (92 per cent) and accommodation (91 per cent) sectors. In the case of the transportation & storage sector, close to half of the sector's VA from external final demand came from the water transport segment, where the bulk of its VA was in turn derived from ASEAN-5 and China. As for the accommodation sector, its key external markets were the Asian economies (India, ASEAN-5, NIE-3 and China), which collectively accounted for more than three-quarters of Singapore's total visitor arrivals in 2015.

**Exhibit 5: Share of Singapore Sectors' Total VA by Final Demand Markets, 2015 (%)**

Sectors	Key External Final Demand Markets							Total External Final Demand	Total Domestic Final Demand
	ASEAN-5	US	China	Euro-zone	NIE-3	Japan	India		
Manufacturing	13	15	12	7	6	4	3	83	17
Electronics	9	16	19	7	9	5	2	83	17
Precision Engineering	19	8	15	5	8	4	3	79	21
Chemicals	26	8	14	7	4	5	4	93	7
Biomedical Manufacturing	9	32	9	13	7	3	2	93	7
Transport Engineering	14	3	6	4	2	2	2	72	28
General Manufacturing	15	6	10	4	5	4	3	70	30
Transportation & Storage	15	7	14	5	7	8	7	92	8
Accommodation	12	7	10	4	11	1	14	91	9
Wholesale Trade	14	11	11	6	6	5	4	77	23
Finance & Insurance	14	17	11	5	4	4	5	73	27
Business Services	7	8	6	11	4	3	4	68	32
Information & Communications	6	7	6	9	5	6	5	62	38
Food Services	5	5	4	4	2	2	2	36	64
Retail Trade	6	5	5	3	3	2	2	35	65
Other Services <sup>^</sup>	2	2	2	3	1	1	1	16	84
Construction	1	1	1	1	1	1	1	10	90

Source: MTI-ECD Estimates

<sup>^</sup>Other Services include the "Health & Social Services", "Education", "Arts, Entertainment & Recreation" and "Other Community" segments.



On the other end of the scale, sectors such as construction, other services, retail and food services catered predominantly to domestic final demand in Singapore, implying that they would be less sensitive to developments in external markets.

## CONCLUSION AND IMPLICATIONS

This study analyses the external sources of final demand that contribute to Singapore's GDP. Our key observations are as follows. First, two-thirds of Singapore's GDP are derived from external final demand, while one-third is accounted for by domestic final demand. Second, the advanced economies remain key final demand destinations for Singapore's exports, even though China, ASEAN-5 and India have risen in importance as final demand markets over the years. Third, there is substantial heterogeneity in exposure to external final demand markets at the sectoral level, with external final demand accounting for 83 per cent of the VA in the manufacturing sector but only 10 per cent in the construction sector. Furthermore, sectors had varying exposure to different final demand markets. For example, the ASEAN-5 economies accounted for a quarter of the chemicals cluster's total VA, while the US and Eurozone accounted for close to half of total VA in the biomedical manufacturing cluster.

Looking ahead, it is important for us to closely monitor the changes in final demand drivers in key external markets as well as the shifts in global value chains, given their impact on our exports and hence GDP. Doing so will also allow us to formulate strategies to ensure that we remain plugged into growth opportunities in key final demand markets either directly or via global value chains.

For instance, recent trends that may weigh on Singapore's exports in the short term include sluggish final demand in the advanced economies, including weak investment demand in economies like the US. Over the medium- to longer-term, the continued slowdown in investment growth in China and the increasing trend of insourcing in its manufacturing sector may also pose a drag on Singapore's sectors with higher exposure to China's import demand for goods. Nonetheless, the shift in China's demand drivers towards consumption could bring about new opportunities for sectors that are able to cater to its consumption needs directly or via global value chains. Similarly, there is scope for Singapore's goods and services exporters to ride the wave of increasing final demand in ASEAN-5 and India, which is in turn expected to be supported by significant infrastructure investments and a rising middle class.

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## ANNEX: METHODOLOGY

We used a standard open input-output (IO) multiplier framework to calculate the share of Singapore's GDP and sectoral VA attributed to each of our key external final demand markets.<sup>7</sup>

The system of equations in the open IO model can be expressed as:

$$X = AX + F$$

where  $A$  is the  $2074 \times 2074$  matrix of direct requirement coefficients<sup>8</sup>

$X$  is the  $2074 \times 1$  vector of output

$F$  is the  $2074 \times 1$  vector of final demand

The solution for  $X$  can be expressed as:

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

where  $B$  is the  $2074 \times 2074$  matrix of total requirement coefficients, also known as the Leontief inverse.

To derive the output generated to satisfy the final demand in economy  $j$ , we replace the final demand vector  $F$  with the final demand of economy  $j$ ,  $F_j$ :

$$X_j = BF_j$$

The corresponding VA generated to satisfy the final demand in economy  $j$  can be calculated as follows:

$$VA_j = v \cdot BF_j$$

where  $v$  is the  $2074 \times 1$  vector of VA coefficients.

Finally, extracting the rows in  $VA_j$  which correspond to Singapore's industries will give us the sectoral VA attributed to the final demand of economy  $j$ .<sup>9</sup>

<sup>7</sup> For more details on the open IO model, please refer to Singapore Department of Statistics (2014).

<sup>8</sup> There are 2074 direct requirement coefficients as the IO tables have 61 countries and 34 industries in each country.

<sup>9</sup> As the OECD ICIO tables comprise data on the VA of industries, as well as net taxes on products, we are also able to derive the GDP generated at the overall economy level to satisfy the final demand of our key markets.