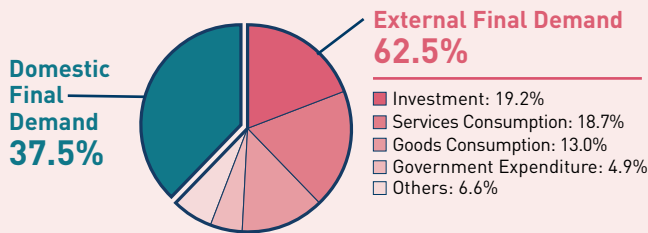


ANALYSIS OF EXTERNAL FINAL DEMAND DRIVERS OF SINGAPORE'S GDP

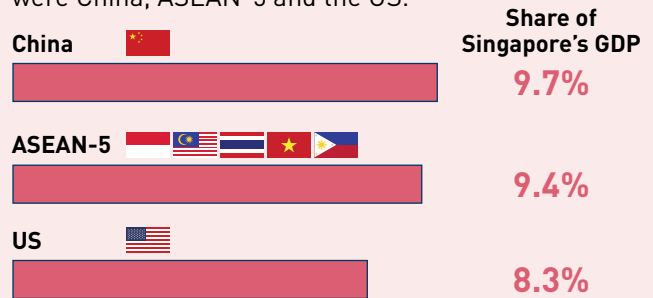
INTRODUCTION

As a small economy with a limited domestic market, Singapore is heavily dependent on external demand for growth.

External final demand accounted for 62.5 per cent of Singapore's GDP in 2018, led by investment demand, services consumption demand and goods consumption demand.



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



FINDINGS

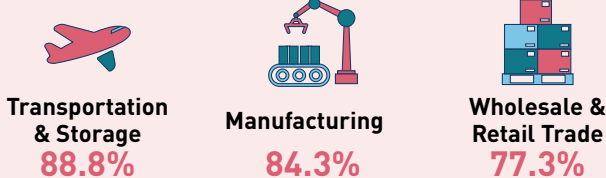
Finding 1

The transportation & storage, manufacturing and wholesale & retail trade sectors were the most reliant on external final demand. On the other hand, sectors such as construction, other services and real estate catered primarily to domestic final demand.

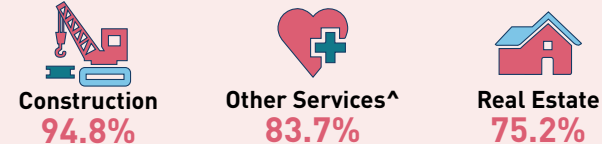
Finding 2

The manufacturing sector benefited more from investment demand and goods consumption demand in external final demand markets, whereas the transportation & storage and wholesale & retail trade served services consumption demand and investment demand.

EXTERNAL DEMAND SHARE OF SECTOR'S VALUE-ADDED



DOMESTIC DEMAND SHARE OF SECTOR'S VALUE-ADDED

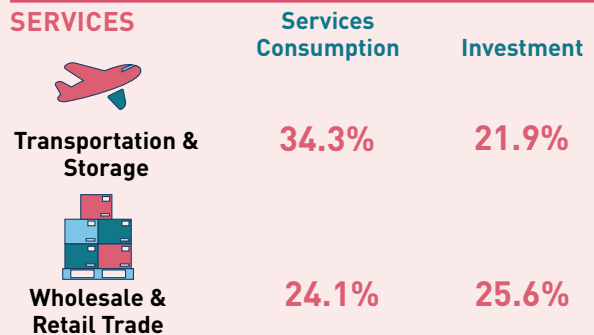


[^]Other Services include the "Education", "Health & Social Services", "Arts, Entertainment & Recreation", and "Other Service Activities" segments.

MANUFACTURING



SERVICES



POLICY TAKEAWAY

Looking ahead, there is a need for policymakers to closely monitor changes in the drivers of final demand in key external markets so as to be able to formulate strategies to tap on the growth opportunities in these markets. For instance, the rise of the middle class in the ASEAN-5 economies will lead to higher consumption demand for both goods and services, while sustained investment in infrastructure and other fixed assets in the region will provide opportunities for Singapore in the years to come.



EXECUTIVE SUMMARY

- ▶ This article examines the external final demand drivers of Singapore's Gross Domestic Product (GDP), using data from OECD's Inter-Country Inter-Output (ICIO) tables.
- ▶ At the overall economy level, external final demand accounted for 62.5 per cent of Singapore's GDP in 2018. The most important final demand markets for Singapore were China, ASEAN-5 (i.e., Indonesia, Malaysia, Thailand, Vietnam and the Philippines) and the US. Even as China and India grew in importance as final demand markets for Singapore from 2015 to 2018, the advanced economies (i.e., the US, Eurozone and Japan) remained key sources of final demand for Singapore.
- ▶ By final demand type, investment demand was the largest external final demand driver for Singapore, followed by consumption demand for services and then goods. Notably, ASEAN-5 was a major source of final demand for all three types of demand in 2018.
- ▶ At the sectoral level, the different sectors in Singapore had varying degrees of exposure to external final demand. The transportation & storage, manufacturing and wholesale & retail trade sectors were the most reliant on external final demand. On the other hand, sectors such as construction, other services¹ and real estate catered primarily to domestic final demand.
- ▶ The relative importance of the different types of external final demand also varied across the sectors in Singapore. For example, the manufacturing sector benefited more from investment demand and goods consumption demand in external final demand markets, whereas the transportation & storage and wholesale & retail trade sectors primarily served services consumption demand and investment demand in these markets.
- ▶ As Singapore is a small economy that is heavily reliant on external demand, there is a need for policymakers to closely monitor changes in the drivers of final demand in key external markets so as to be able to formulate strategies to tap on the growth opportunities in these markets. For instance, the rise of the middle class in the ASEAN-5 economies will lead to higher consumption demand for both goods and services, which will present new opportunities for Singapore's manufacturing and outward-oriented services sectors. Similarly, sustained investment in infrastructure and other fixed assets in the region will provide opportunities for a range of sectors in Singapore, including the information & communications, manufacturing and professional services sectors.

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.²

INTRODUCTION

As a small economy with a limited domestic market, Singapore is heavily dependent on external demand for the goods and services that it produces. In this article, we measure the relative importance of the various external markets to Singapore's Gross Domestic Product (GDP) by examining the value-added (VA) attributable to final demand in those markets using data from OECD's Inter-Country Input-Output (ICIO) tables. We also study changes in the relative importance of Singapore's external final demand markets over time, as well as the drivers of external final demand by demand type (e.g., consumption by households or investments by businesses) at the overall economy level and by sectors. Doing so will allow policymakers to distinguish between the different types of final demand opportunities across our external markets, and assess how Singapore can better seize these opportunities.

¹ Other Services include the "Education", "Health & Social Services", "Arts, Entertainment & Recreation", and "Other Service Activities" segments.

² We would like to thank Ms Yong Yik Wei, Mr Kuhan Harichandra, Dr Andy Feng and Mr Lau Zheng Yi for their useful suggestions and comments. All errors belong to the authors.

LITERATURE REVIEW

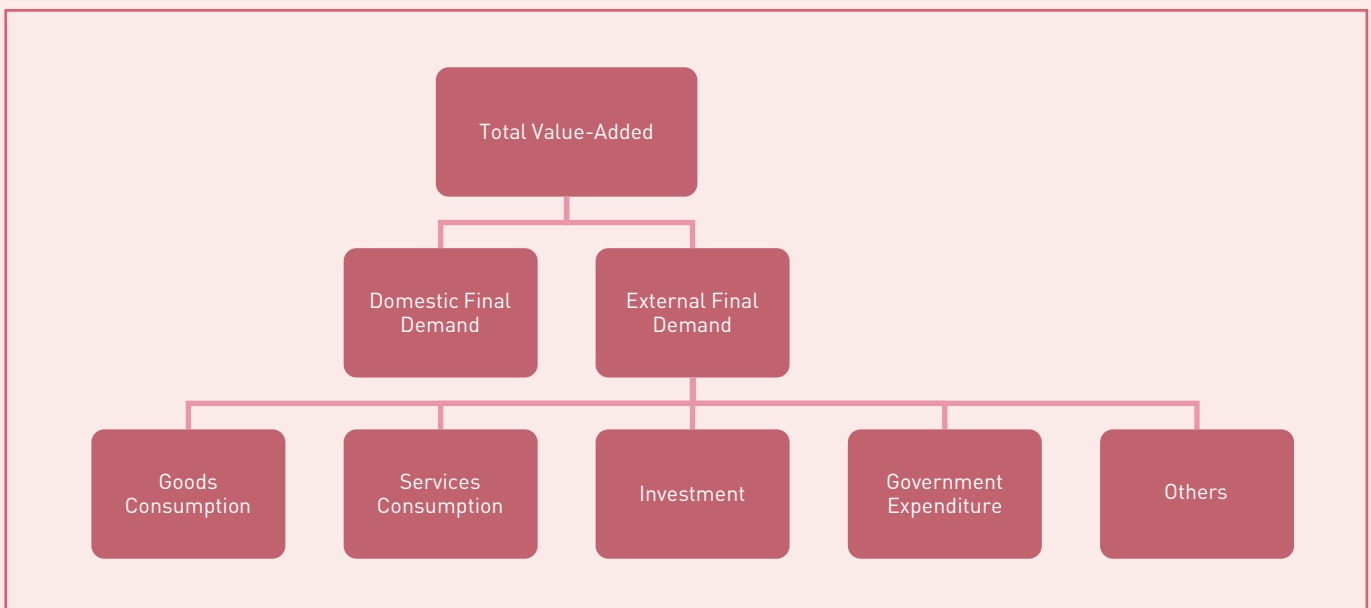
Several studies had previously analysed the contribution of external final demand to Singapore's GDP. Using 2011 OECD ICIO tables that were updated to 2015 data using the RAS method, Lim and Zhou (2016) estimated that external final demand accounted for around two-thirds of Singapore's GDP, and that the most important final demand markets for Singapore were ASEAN-5³, the US and China. Meanwhile, Chiang (2019) found that Singapore became more reliant on final demand from China and ASEAN-5 between 2005 and 2015, even as its reliance on final demand from the Eurozone and the US fell over the same period.

DATA AND METHODOLOGY

Our study extends previous studies by updating estimates on the sources of final demand for Singapore's goods and services using the latest edition of the OECD ICIO tables. It also estimates the VA attributable to the different types of final demand (i.e., household consumption of goods and services, business investment and government expenditure) in Singapore's external final demand markets at both the overall economy and sectoral levels [Exhibit 1].

Our study uses data from the OECD ICIO tables released in November 2021, covering the period of 1995 to 2018. The tables track inter-country, inter-industry flows of both intermediate and final goods and services across 66 economies (including Singapore) and the "Rest of the World", as well as 45 industries. Input-output methods are employed to compute the share of Singapore's GDP and sectoral VA attributable to each external final demand market and final demand type. Please refer to the Annex for more details on the methodology.

Exhibit 1: Components of Singapore's Total Value-Added at Overall Economy Level and By Sectors



Notes:

[1] Consumption refers to Household Final Consumption Expenditure and Non-Profit Institutions Serving Households. Goods consumption comprises sectors 01T03 to 36T39 of the OECD ICIO tables, while Services consumption comprises sectors 41T43 to 97T98 of the OECD ICIO tables.

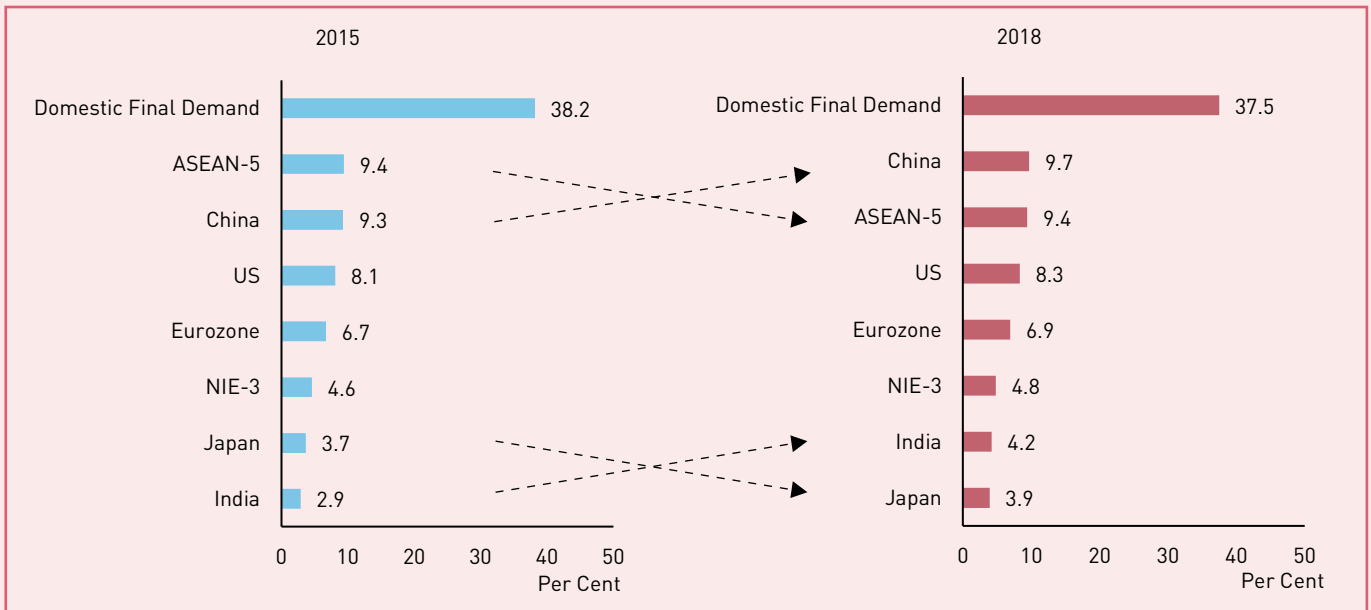
[2] Others refers to Changes in Inventories and Direct Purchases Abroad.

RESULTS

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

At the overall economy level, external final demand accounted for 62.5 per cent of Singapore's GDP in 2018, while domestic final demand accounted for the remaining share (37.5 per cent). The former was slightly higher than the 61.8 per cent in 2015, indicating an increase in our reliance on external final demand over time [Exhibit 2].

³ ASEAN-5 comprises Indonesia, Malaysia, Thailand, Vietnam and the Philippines.

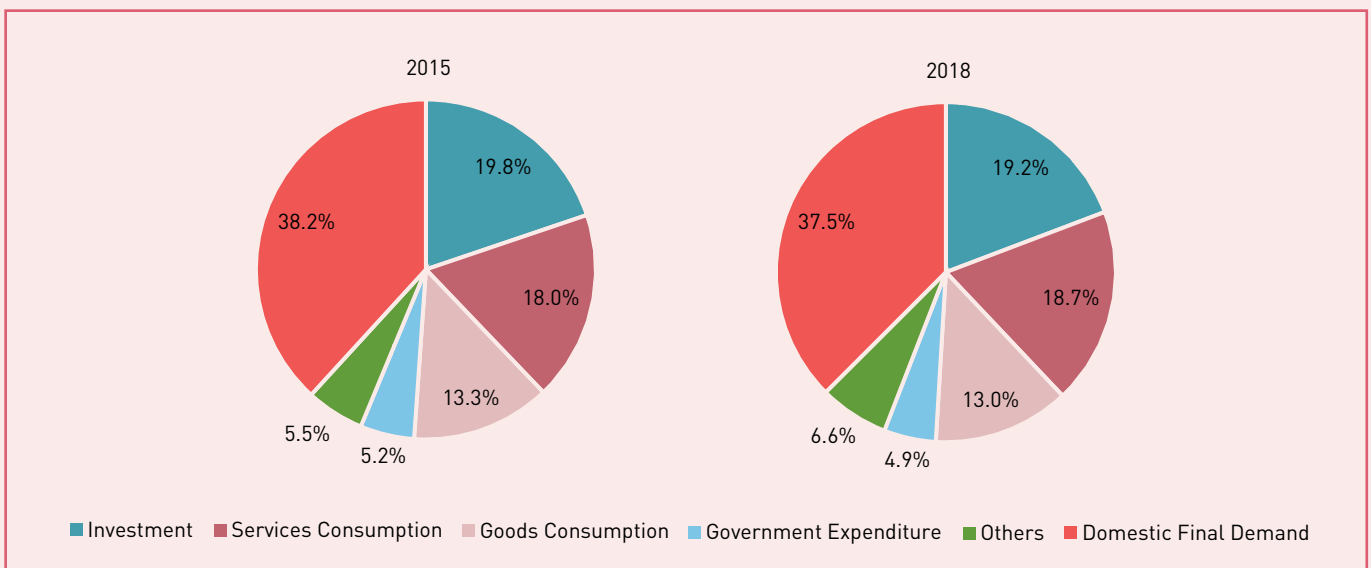
Exhibit 2: Share of Singapore's GDP by Final Demand Markets (2015 and 2018)

Source: OECD ICIO, MTI-ECD estimates

Among Singapore's external final demand markets, China, ASEAN-5 and the US were the most important markets, accounting for 9.7 per cent, 9.4 per cent and 8.3 per cent of Singapore's GDP respectively in 2018. They were followed by the Eurozone (6.9 per cent), NIE-3 (i.e., Hong Kong, South Korea and Taiwan) (4.8 per cent), and India (4.2 per cent). Notably, between 2015 and 2018, China overtook ASEAN-5 as Singapore's largest external final demand market, while India overtook Japan to become the 6th largest.

(ii) External Sources of Final Demand by Demand Type

A decomposition of Singapore's GDP by final demand type showed that investment (19.2 per cent) was the largest type of external final demand served by Singapore in 2018, followed by services consumption (18.7 per cent) and goods consumption (13.0 per cent) [Exhibit 3].

Exhibit 3: Share of Singapore's GDP by Final Demand Type

Source: OECD ICIO, MTI-ECD estimates

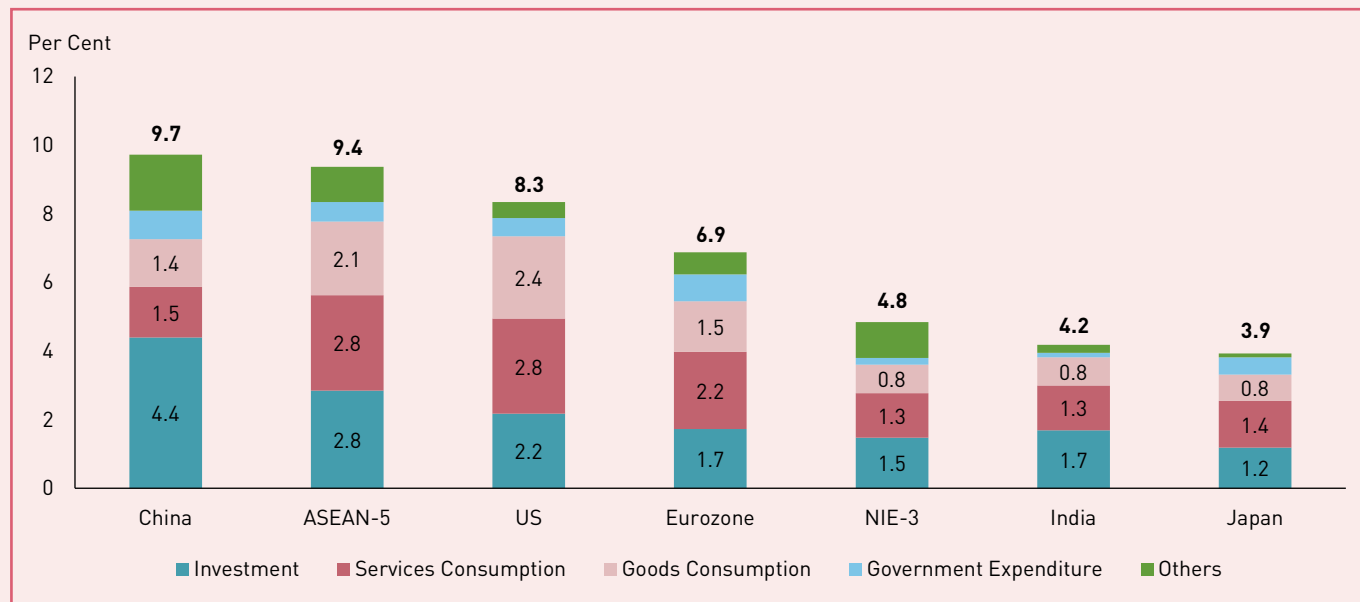
Notes:

[1] Consumption refers to Household Final Consumption Expenditure and Non-Profit Institutions Serving Households. Goods consumption comprises sectors 01T03 to 36T39 of the OECD ICIO tables, while Services consumption comprises sectors 41T43 to 97T98 of the OECD ICIO tables.

[2] Others refers to Changes in Inventories and Direct Purchases Abroad.

Disaggregating the contribution to Singapore's GDP by both external final demand markets and final demand types, we find that the investment demand served by Singapore was mainly driven by China (4.4 per cent) and ASEAN-5 (2.8 per cent). On the other hand, the services consumption demand served by Singapore was led by ASEAN-5 (2.8 per cent) and the US (2.8 per cent), whereas the goods consumption demand met by Singapore came primarily from the US (2.4 per cent) and ASEAN-5 (2.1 per cent) [Exhibit 4].

Exhibit 4: Share of Singapore's Overall GDP by Final Demand Market and Type (2018)



Source: OECD ICIO, MTI-ECD estimates

Notes:

[1] Consumption refers to Household Final Consumption Expenditure and Non-Profit Institutions Serving Households. Goods consumption comprises sectors 01T03 to 36T39 of the OECD ICIO tables, while Services consumption comprises sectors 41T43 to 97T98 of the OECD ICIO tables.

[2] Others refers to Changes in Inventories and Direct Purchases Abroad.

(iii) External Sources of Final Demand by Sector

The degree of exposure to external final demand varied across the sectors in Singapore. In 2018, the transportation & storage, manufacturing and wholesale & retail trade sectors were the most reliant on external final demand, whereas sectors such as construction, other services⁴ and real estate primarily served domestic final demand [Exhibit 5].

For the manufacturing sector, external final demand accounted for 84.3 per cent of its VA in 2018, reflecting its outward-oriented nature. Within the sector, the chemicals, electronics and biomedical manufacturing clusters had the highest external reliance, with 93.2 per cent, 88.8 per cent and 85.2 per cent of their VA attributable to external final demand, respectively. However, their exposure across final demand markets varied. Specifically, the chemicals cluster had the highest exposure to final demand from ASEAN-5 (19.4 per cent of its VA) and China (17.3 per cent), while the electronics cluster's largest exposure was to NIE-3 (15.7 per cent), followed by China (14.7 per cent), the US (12.3 per cent) and ASEAN-5 (12.0 per cent). Meanwhile, the biomedical manufacturing cluster was heavily reliant on final demand from the US (47.7 per cent), followed by the Eurozone (11.7 per cent).

Among the services sectors, the transportation & storage (88.8 per cent of its VA), wholesale & retail trade (77.3 per cent) and information & communications (76.9 per cent) sectors had the highest external reliance. The key external final demand markets for all three sectors were China and ASEAN-5. In particular, final demand from China and ASEAN-5 accounted for 14.9 per cent and 13.5 per cent respectively of the VA of the transportation & storage sector, and 16.5 per cent and 10.6 per cent respectively of the VA of the information & communications sector. As for the wholesale & retail trade sector, ASEAN-5 was a larger final demand market compared to China, with the former accounting for 13.9 per cent of its VA and the latter accounting for 11.2 per cent.

⁴ Other Services include the "Education", "Health & Social Services", "Arts, Entertainment & Recreation", and "Other Service Activities" segments.

Exhibit 5: Share of Singapore Sectors' Total VA by Final Demand Market (2018)

Sectors	Key External Final Demand Markets (%)							Total External Final Demand (%)	Total Domestic Final Demand (%)
	China	ASEAN-5	US	Eurozone	NIE-3	India	Japan		
Manufacturing	12.3	13.4	14.6	7.8	8.5	6.1	4.8	84.3	15.7
Electronics	14.7	12.0	12.3	7.1	15.7	6.8	4.9	88.8	11.2
Chemicals	17.3	19.4	9.8	9.2	6.1	7.0	4.0	93.2	6.8
Biomedical Manufacturing	2.6	2.3	47.7	11.7	2.3	0.6	5.8	85.2	14.8
Precision Engineering	11.9	13.2	8.9	4.7	9.6	7.1	6.7	76.8	23.2
Transport Engineering	5.9	10.9	18.4	9.2	7.2	7.4	3.2	81.4	18.6
General Manufacturing	7.1	10.1	13.6	5.7	4.4	4.6	5.1	65.5	34.5
Construction	0.8	0.8	0.7	0.5	0.4	0.3	0.4	5.2	94.8
Wholesale & Retail Trade	11.2	13.9	9.6	7.5	7.1	5.2	5.1	77.3	22.7
Transportation & Storage	14.9	13.5	8.6	8.3	5.2	7.6	3.7	88.8	11.2
Accommodation & Food Services	15.5	12.0	5.3	3.0	3.3	2.3	1.9	55.3	44.7
Information & Communications	16.5	10.6	8.3	9.3	4.2	5.1	6.3	76.9	23.1
Finance & Insurance	8.4	6.9	8.0	12.6	3.8	4.1	4.5	71.1	28.9
Real Estate	4.1	4.2	3.1	2.5	1.8	1.4	1.5	24.8	75.2
Professional Services	10.3	9.2	12.5	8.3	4.3	3.9	6.4	72.6	27.4
Administrative & Support Services	11.1	9.2	9.2	9.9	5.5	4.6	6.3	75.1	24.9
Other Services^	5.9	2.4	1.6	1.1	1.0	0.7	0.8	16.3	83.7

Source: OECD ICIO, MTI-ECD Estimates. Shares by external demand markets do not sum to total external final demand because only the seven key markets are tabulated. ^Other Services include the "Education", "Health & Social Services", "Arts, Entertainment & Recreation", and "Other Service Activities" segments.

(iv) Types of External Final Demand Served by Sector

At the sectoral level, the exposure to the different types of external final demand also varied [Exhibit 6]. In 2018, the manufacturing sector as a whole served primarily investment demand (31.8 per cent of its VA) and goods consumption demand (30.0 per cent) in the various external final demand markets. Within the sector, the precision engineering, electronics and transport engineering clusters had the highest exposure to external investment demand, at 45.6 per cent, 43.2 per cent and 42.8 per cent of their VA respectively, reflecting the capital goods-intensive nature of the goods that they produce. By contrast, the biomedical manufacturing and chemicals clusters had high exposure to external goods consumption demand, at 51.7 per cent and 39.6 per cent of their VA respectively.

Among the services sectors with a higher degree of exposure to external final demand, there was also heterogeneity in their exposure to the different types of final demand. The share of VA attributable to external investment demand was the highest for the information & communications and professional services sectors, at 32.4 per cent and 27.2 per cent, respectively. By contrast, the finance & insurance (40.0 per cent of its VA) and transportation & storage (34.3 per cent) sectors had the largest exposure to external services consumption demand. As for the wholesale & retail trade sector, the extent of its exposure to external investment and services consumption demand was similar, at 25.6 per cent and 24.1 per cent of its VA respectively. This was also the case for the administrative & support services sector, with the corresponding figures at 24.2 per cent and 23.1 per cent respectively.

Exhibit 6: Share of Total VA of Sectors in Singapore by Final Demand Type (2018)

Sectors	External Final Demand Type (%)					Domestic Final Demand
	Investment	Services Consumption	Goods Consumption	Government Expenditure	Others	
Manufacturing	31.8	10.9	30.0	6.3	5.4	15.7
Electronics	43.2	9.5	23.8	4.8	7.5	11.2
Chemicals	27.9	14.3	39.6	6.8	4.6	6.8
Biomedical Manufacturing	4.0	10.3	51.7	16.9	2.3	14.8
Precision Engineering	45.6	8.3	15.7	3.9	3.4	23.2
Transport Engineering	42.8	11.1	17.8	6.8	3.0	18.6
General Manufacturing	15.2	8.6	29.4	3.9	8.4	34.5
Construction	1.7	1.4	1.0	0.4	0.8	94.8
Wholesale & Retail Trade	25.6	24.1	16.1	5.6	5.9	22.7
Transportation & Storage	21.9	34.3	14.0	7.4	11.2	11.2
Accommodation & Food Services	4.7	5.9	2.7	1.4	40.8	44.7
Information & Communications	32.4	26.9	6.3	6.8	4.4	23.1
Finance & Insurance	12.3	40.0	8.0	6.2	4.6	28.9
Real Estate	6.3	7.0	3.5	1.7	6.2	75.2
Professional Services	27.2	22.6	10.8	7.6	4.4	27.4
Administrative & Support Services	24.2	23.1	13.6	7.3	6.9	24.9
Other Services [^]	2.6	2.4	1.1	0.7	9.5	83.7

Source: OECD ICIO, MTI-ECD Estimates

[^]Other Services include the "Education", "Health & Social Services", "Arts, Entertainment & Recreation", and "Other Service Activities" segments.

CONCLUSION

This study analyses the external sources of final demand that contribute to Singapore's GDP. Our key observations are as follows. First, 62.5 per cent of Singapore's GDP was derived from external final demand, while the remaining (37.5 per cent) was from domestic final demand. Second, China's and India's shares of Singapore's GDP rose over the period of 2015 to 2018 for China and India to become Singapore's largest and 6th largest final demand markets respectively in 2018. At the same time, the advanced economies (i.e., the US, Eurozone and Japan) remained key final demand markets for Singapore. Third, Singapore primarily served investment demand in its external final demand markets, followed by services consumption demand and then goods consumption demand. ASEAN-5 was a major source of final demand across all three demand types in 2018, suggesting that Singapore would benefit from growth in the ASEAN-5 economies through these final demand channels.

Fourth, there was substantial heterogeneity in the various sectors' exposure to external final demand. For instance, while external final demand accounted for 88.8 per cent of the VA of the transportation & storage sector, it only constituted 5.2 per cent of the VA of the construction sector. Furthermore, sectors had varying exposure to different final demand markets. For example, the chemicals cluster had the highest exposure to final demand from ASEAN-5 (19.4 per cent of its VA) and China (17.3 per cent), while the biomedical manufacturing cluster was heavily reliant on final demand from the US (47.7 per cent) and the Eurozone (11.7 per cent). Fifth, Singapore's manufacturing sector as a whole served primarily investment and goods consumption demand in its external final demand markets, whereas services sectors with a higher degree of exposure to external final demand such as transportation & storage and wholesale & retail trade largely served services consumption and investment demand in these markets.

As Singapore is a small economy that is heavily reliant on external demand, there is a need for policymakers to closely monitor changes in the drivers of final demand in key external markets so as to be able to formulate strategies to tap on the growth opportunities in these markets. For instance, the rise of the middle class in the ASEAN-5 economies will lead to higher consumption demand for both goods and services, which will present new opportunities for our manufacturing and outward-oriented services sectors in the years to come. Similarly, sustained investment in infrastructure and other fixed assets in the region will provide opportunities for a range of sectors in Singapore, including the information & communications, manufacturing and professional services sectors.

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ANNEX: METHODOLOGY

We use a standard open input-output (IO) multiplier framework to calculate the share of Singapore's GDP and sectoral VA attributable to each final demand type in each of our external final demand markets.⁵

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

$$X = AX + F$$

where A is the 3105×3105 matrix of direct requirement coefficients⁶

X is the 3105×1 vector of output

F is the 3105×1 aggregated vector of final demand, representing the row sum of \hat{F}

\hat{F} is the 3105×4 vector of final demand, where each column represents a final demand type (i.e., household consumption of goods and services, business investment, government expenditure, and others) [see Exhibit A-1]

Exhibit A-1: Components of \hat{F}

Consumption (Goods and Services)	Investment	Government Expenditure	Others
3105 rows	3105 rows	3105 rows	3105 rows

Notes:

[1] Consumption refers to Household Final Consumption Expenditure and Non-Profit Institutions Serving Households. Goods consumption comprises sectors 01T03 to 36T39 of the OECD ICIO tables, while Services consumption comprises sectors 41T43 to 97T98 of the OECD ICIO tables.

[2] Others refers to Changes in Inventories and Direct Purchases Abroad.

The solution for X can be expressed as:

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

where $(I - A)^{-1}$ is the 3105×3105 matrix of total requirement coefficients, known as the Leontief Inverse.

To derive the output generated to satisfy final demand type k in country j , we replace the final demand vector F with the final demand type k of country j , \hat{F}_{jk} :

$$X_j = (I - A)^{-1} \hat{F}_{jk}$$

The corresponding VA generated to satisfy final demand type k in country j can be calculated as follows:

$$VA_{jk} = v \cdot (I - A)^{-1} \hat{F}_{jk}$$

where v is the 3105×1 vector of VA coefficients.

Finally, extracting the rows in VA_{jk} which correspond to Singapore's sectors will give us the sectoral VA attributable to the final demand type k of country j .

⁵ For more details on the open IO model, please refer to Singapore Department of Statistics (2014).

⁶ There are 3105×3105 direct requirement coefficients as the OECD ICIO tables have 69 regions and 45 industries in each region. For the purpose of our main analysis, we aggregate the data to 66 economies (including Singapore) and the "Rest of the World".