ECONOMIC

SURVEY

OF SINGAPORE

THIRD QUARTER 2018

CONTENTS

MAIN INDICATORS OF
THE SINGAPORE ECONOMY

OVERALL ECONOMY

	2Q18	3Q18
Real GDP (Year-on-Year Growth)	+4.1%	+2.2%
GDP at Current Market Prices	$114.8 billion	$116.2 billion

PRICES

	2Q18	3Q18
Consumer Price Index - All Items (Year-on-Year Growth)	+0.3%	+0.7%
Domestic Supply Price Index (Year-on-Year Growth)	+7.6%	+12.8%

LABOUR MARKET

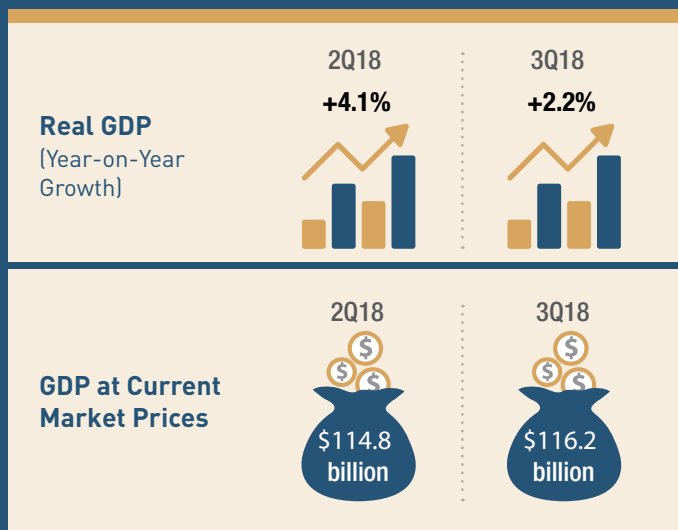|	2Q18	3Q18
Change in Employment (Quarter-on-Quarter)	+6.5 thousand	+17.7 thousand
Overall Unemployment Rate	2.0%	2.1%
Value-added per Worker (Year-on-Year Growth)	+3.6%	+1.2%

COSTS

	2Q18	3Q18
Unit Labour Cost of Overall Economy (Year-on-Year Growth)	+0.6%	+1.6%
Unit Business Cost of Manufacturing (Year-on-Year Growth)	-4.4%	-0.6%
Unit Labour Cost of Manufacturing (Year-on-Year Growth)	-7.4%	-1.0%

MERCHANDISE TRADE

Merchandise Exports

2Q18	3Q18
$138,546 million	$144,609 million
+9.3% Year-on-Year Growth	+12.7% Year-on-Year Growth

Merchandise Imports

2Q18	3Q18
$122,326 million	$130,214 million
+11.1% Year-on-Year Growth	+17.0% Year-on-Year Growth

SERVICES TRADE

Services Exports

2Q18	3Q18
$58,907 million	$59,345 million
+3.2% Year-on-Year Growth	+3.3% Year-on-Year Growth

Services Imports

2Q18	3Q18
$60,338 million	$60,847 million
+2.6% Year-on-Year Growth	+2.7% Year-on-Year Growth

THE SINGAPORE ECONOMY
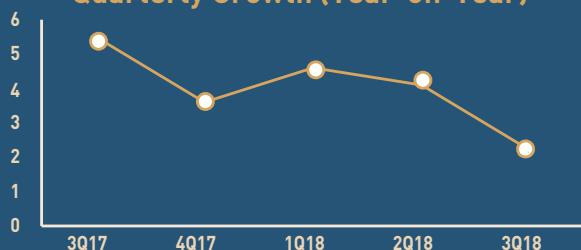
CHAPTER 1
THE SINGAPORE ECONOMY

ECONOMIC PERFORMANCE

Real GDP grew by

2.2% in 3Q18

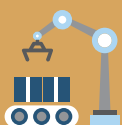### Quarterly Growth (Year-on-Year)

Main Drivers of Growth in 3Q18

Finance & Insurance

0.7%-point contribution

Manufacturing

0.7%-point contribution

These sectors accounted for

65% of GDP growth

LABOUR MARKET

Resident Unemployment Rate

2.9% in 3Q18

Employment (Q-O-Q Change)

+17,700 employed

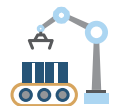### Sectors with the Highest Employment Growth in 3Q18

+5,200 employed

Other Services Industries

+3,500 employed

Manufacturing

+2,700 employed

Information & Communications

PRODUCTIVITY

Value-added per Worker grew by

1.2% in 3Q18

Sectors with the highest Value-added per Worker Growth in 3Q18

4.1%

Manufacturing

3.5%

Accommodation & Food Services

COSTS

Overall Unit Labour Cost increased by
1.6% in 3Q18

Within the manufacturing sector

-0.6%
Unit Business Cost

-1.0%
Unit Labour Cost

PRICES

The Consumer Price Index (CPI) rose by
0.7% in 3Q18

Categories with Price Increases

2.6%
Education

2.3%
Clothing & Footwear

2.0%
Health Care

Quarterly Growth (Year-on-Year)

INTERNATIONAL TRADE

Total Merchandise Exports rose by
12.7% in 3Q18

28.9%
Oil Domestic Exports

11.1%
Re-exports

8.0%
Non-Oil Domestic Exports

Total Services Exports rose by
3.3% in 3Q18

Main Drivers of Services Export Growth were...

28.9%
Charges for the use of Intellectual Property

2.3%
Other Business Services

3.5%
Financial Services

OVERVIEW

In the third quarter of 2018,

- The economy expanded by 2.2 per cent on a year-on-year basis. The sectors that contributed the most to GDP growth were the finance & insurance and manufacturing sectors.

- Total employment rose by 17,700 on a quarter-on-quarter basis, more than double the 6,500 increase in the second quarter. Excluding foreign domestic workers (FDWs), employment increased by 15,200.

- The seasonally-adjusted overall unemployment rate rose slightly in September 2018 as compared to June 2018, while that for residents and citizens remained unchanged. Retrenchments were lower than the previous quarter and the same period a year ago.

- The Consumer Price Index (CPI) rose by 0.7 per cent on a year-on-year basis, faster than the 0.3 per cent increase in the previous quarter.

OVERALL PERFORMANCE

The economy grew by 2.2 per cent on a year-on-year basis in the third quarter, slower than the 4.1 per cent growth in the previous quarter (Exhibit 1.1). On a quarter-on-quarter seasonally-adjusted annualised basis, the economy expanded by 3.0 per cent, faster than the 1.0 per cent growth in the preceding quarter.

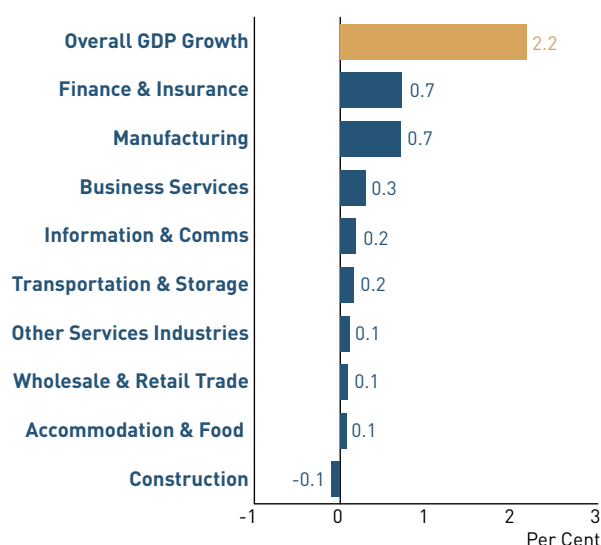*Exhibit 1.1: GDP and Sectoral Growth Rates in 3Q 2018*
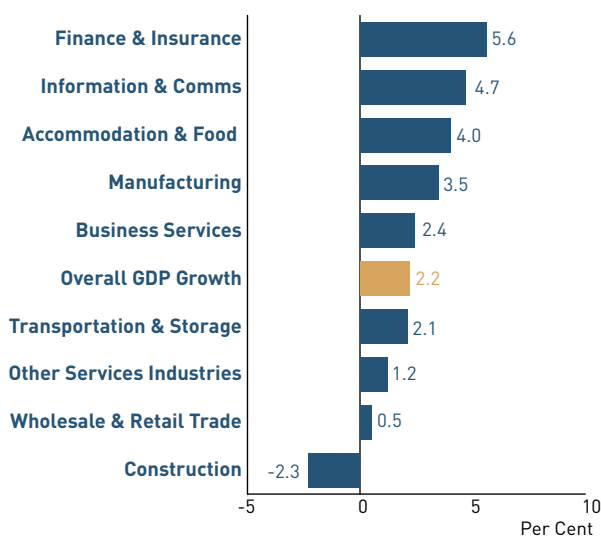
The manufacturing sector grew by 3.5 per cent year-on-year in the third quarter, moderating from the 11 per cent growth in the previous quarter. Growth during the quarter was broad-based, with all manufacturing clusters recording output expansions, except for the general manufacturing cluster.

The services producing industries expanded by 2.4 per cent year-on-year, easing from the 2.8 per cent growth in the preceding quarter. The finance & insurance sector posted the fastest pace of growth (5.6 per cent), followed by the information & communications (4.7 per cent) and accommodation & food services (4.0 per cent) sectors. The business services, transportation & storage, other services and wholesale & retail trade sectors also recorded positive growth rates of 2.4 per cent, 2.1 per cent, 1.2 per cent and 0.5 per cent respectively.

By contrast, the construction sector shrank by 2.3 per cent year-on-year, extending the 4.2 per cent decline in the previous quarter. The contraction was due to weakness in public sector construction activities.

The sectors that contributed the most to GDP growth in the third quarter were the finance & insurance and manufacturing sectors (Exhibit 1.2). Collectively, they accounted for 65 per cent of GDP growth during the quarter.

Exhibit 1.2: Percentage-Point Contribution to Growth in Real GDP in 3Q 2018 (By Industry)

Exhibit 1.3: Changes in Total Demand*

	2017		2018		
	III	IV	I	II	III
Total Demand	5.5	4.9	3.9	4.4	**4.3**
External Demand	4.4	4.2	4.1	4.8	**4.6**
Total Domestic Demand	8.5	6.6	3.4	3.1	**3.2**
Consumption Expenditure	5.7	4.4	4.5	3.4	**3.3**
Public	7.1	0.5	8.4	2.5	**2.6**
Private	5.3	5.5	3.2	3.7	**3.4**
Gross Fixed Capital Formation	-2.7	2.2	-0.9	3.1	**-1.4**
Changes in Inventories	4.1	2.4	0.6	0.0	**1.2**

*   *For inventories, this refers instead to change as a percentage of GDP in the previous year.*

SOURCES OF GROWTH

Total demand rose by 4.3 per cent year-on-year in the third quarter, extending the 4.4 per cent growth in the previous quarter (Exhibit 1.3). The increase in total demand was supported by both external and domestic demand.

External demand expanded by 4.6 per cent, easing from the 4.8 per cent growth in the previous quarter. Domestic demand rose at a slightly faster pace of 3.2 per cent compared to 3.1 per cent in the previous quarter. This was due to a larger build-up of inventories and a faster pace of increase in public consumption expenditure.

Consumption expenditure increased by 3.3 per cent, slightly lower than the 3.4 per cent growth in the previous quarter. Consumption expenditure growth in the third quarter was supported by both public and private consumption, with the former rising by 2.6 per cent and the latter increasing by 3.4 per cent.

Meanwhile, gross fixed capital formation (GFCF) declined by 1.4 per cent, a reversal from the 3.1 per cent growth in the previous quarter. The contraction came on the back of a 2.4 per cent reduction in private GFCF, which was in turn due to reduced investment spending on transport equipment and residential buildings. On the other hand, public GFCF rose by 3.0 per cent, supported by higher investment spending on transport equipment and machinery & equipment.
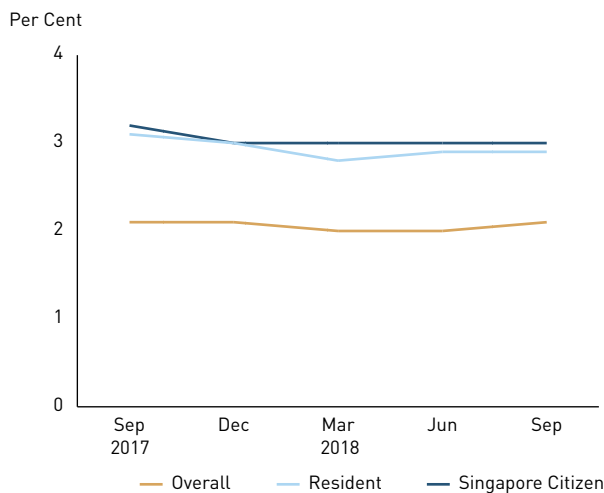
LABOUR MARKET

▸ Unemployment and Retrenchment[1]

Between June and September 2018, the seasonally-adjusted unemployment rate at the overall level rose slightly (from 2.0 per cent to 2.1 per cent), while that for residents (2.9 per cent) and citizens (3.0 per cent) remained unchanged (Exhibit 1.4). These levels remained slightly elevated compared to the lows observed in March 2018, reflecting the continued inflow of job seekers into the labour market.
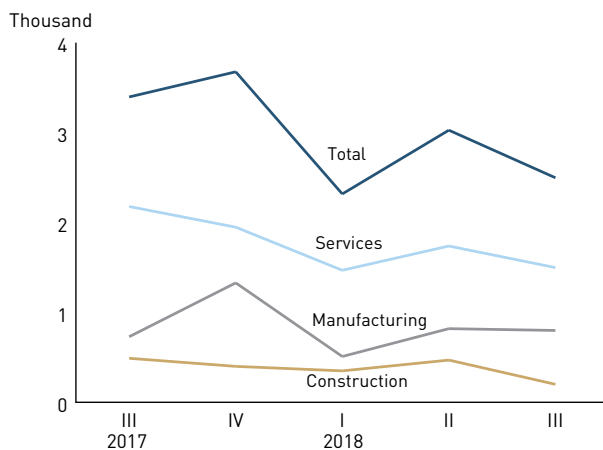
In September 2018, an estimated 67,000 residents were unemployed, higher than the 66,600 in June 2018. On the other hand, the number of citizens who were unemployed remained broadly similar in June and September 2018, at 59,000 and 59,100 respectively.[2]

1   *Figures pertain to private sector establishments with at least 25 employees and the public sector.*
2   *Based on seasonally-adjusted data on the number of unemployed persons.*

Exhibit 1.4: Unemployment Rate (Seasonally-Adjusted)

EMPLOYMENT[3]

Total employment rose by 17,700 on a quarter-on-quarter basis in the third quarter, more than double the 6,500 increase in the preceding quarter and a reversal from the 2,300 decline recorded in the same quarter a year ago (Exhibit 1.6). The increase in total employment came on the back of employment growth in both the manufacturing and services sectors, while the pace of employment decline in the construction sector moderated. Excluding FDWs, employment rose by 15,200 in the third quarter.

By broad sectors, employment in the manufacturing sector rose by 3,500 on a quarter-on-quarter basis in the third quarter, after fifteen consecutive quarters of decline (Exhibit 1.7). Employment in the services producing industries rose by 14,800 (12,300 excluding FDWs) over the same period, with the other services (5,200), information & communications (2,700) and finance & insurance (2,500) sectors contributing the most to the increase.

Total retrenchments came in at around 2,500 in the third quarter. This was lower than the 3,030 recorded in the previous quarter and the 3,400 registered in the same period a year ago (Exhibit 1.5). Retrenchments fell across all broad sectors between the second and third quarters – from 820 to 800 in the manufacturing sector, 470 to 200 in the construction sector, and 1,740 to 1,500 in the services sector.
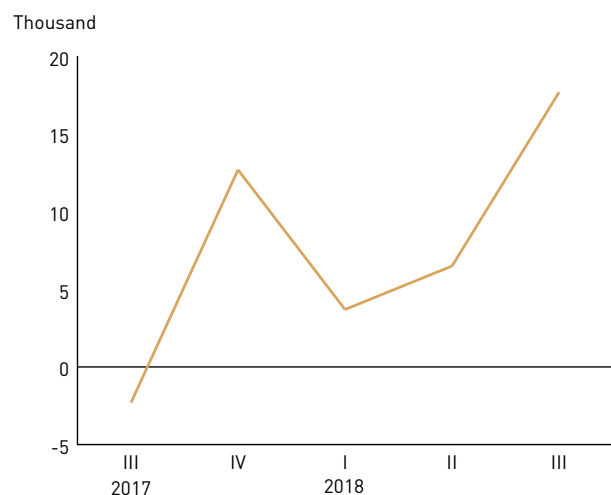
By contrast, construction employment fell by 400 in the third quarter, registering the tenth consecutive quarter of decline. This reflected the weakness in construction activities. However, the pace of decline was slower than that of previous quarters.

Exhibit 1.5: Retrenchments

Exhibit 1.6: Change in Total Employment, Quarter-on-Quarter

---

3   *Based on preliminary estimates.*

Exhibit 1.7: Changes in Employment by Industry in 3Q 2018
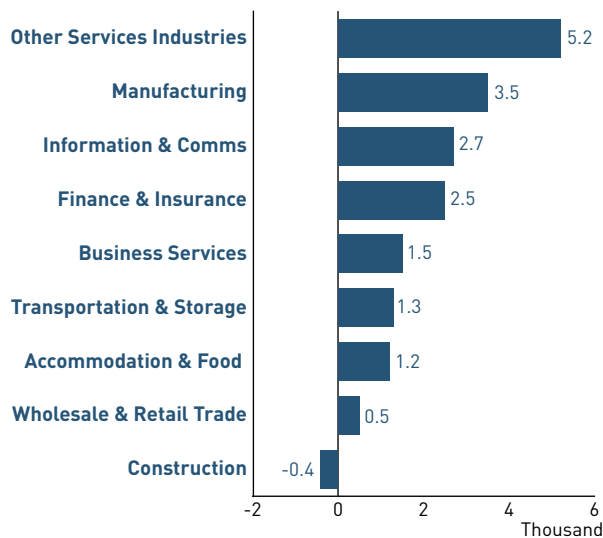
HIRING EXPECTATIONS

According to EDB's Business Expectations Survey for the Manufacturing Sector, a net weighted balance of 1 per cent of manufacturers expected to hire fewer workers in the fourth quarter of 2018 as compared to the third quarter. Firms in the machinery & systems segment of the precision engineering cluster and the printing segment of the general manufacturing cluster had the weakest hiring sentiments, with a net weighted balance of 14 per cent and 11 per cent of firms in the respective segments expecting lower levels of hiring in the fourth quarter. By contrast, firms in the computer peripherals segment of the electronics cluster and the medical technology segment of the biomedical manufacturing cluster were the most optimistic, with a net weighted balance of 21 per cent and 16 per cent of firms in the respective segments expecting to increase hiring in the fourth quarter.

Hiring expectations for firms in the services sector were positive. According to DOS' Business Expectations Survey for the Services Sector, a net weighted balance of 10 per cent of services firms expected to increase hiring in the fourth quarter of 2018 as compared to the third quarter. In particular, a net weighted balance of 35 per cent of firms in the retail trade segment and 17 per cent of firms in the food & beverage services segment expected to hire more workers in the fourth quarter, partly because of the year-end festivities.

COMPETITIVENESS

‣ Productivity

Overall labour productivity, as measured by real value-added per worker[4], increased by 1.2 per cent in the third quarter compared to the same period a year ago (Exhibit 1.8). This was slower than the 3.6 per cent increase recorded in the second quarter. The slowdown in productivity growth can be attributed to the moderation in GDP growth and pickup in employment during the third quarter.

The manufacturing (4.1 per cent), accommodation & food services (3.5 per cent) and finance & insurance (3.2 per cent) sectors saw the highest productivity growth rates in the third quarter. By contrast, the transportation & storage (-1.5 per cent) and other services (-0.9 per cent) sectors experienced declines in productivity.

Outward-oriented sectors as a whole continued to achieve stronger productivity growth than domestically-oriented sectors. Compared to the same period last year, the productivity of outward-oriented sectors rose by 1.2 per cent in the third quarter, slower than the 4.4 per cent growth in the previous quarter.[5] For domestically-oriented sectors, productivity rose by 0.9 per cent, an improvement from the 0.4 per cent increase in the preceding quarter.

Exhibit 1.8: Changes in Value-added per Worker for the Overall Economy and Sectors in 3Q 2018

4   Real value-added per actual hour worked is currently only available on an annual basis.
5   Based on MTI estimates. Outward-oriented sectors refer to manufacturing, wholesale trade, transportation & storage, accommodation, information & communications, finance & insurance and professional services. Domestically-oriented sectors refer to construction, retail trade, food & beverage services, other business services and other services industries.

▸ Unit Labour Cost and Unit Business Cost

Overall unit labour cost (ULC) for the economy rose by 1.6 per cent on a year-on-year basis in the third quarter, higher than the 0.6 per cent increase in the previous quarter (Exhibit 1.9). The rise in the overall ULC was due to increases in total labour cost per worker that exceeded the gains in labour productivity.

*Exhibit 1.9: Changes in Unit Labour Cost in 3Q 2018*
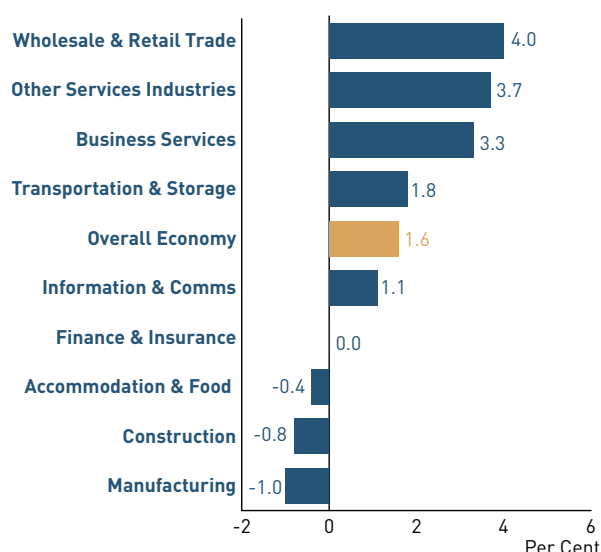
By sectors, the ULC for the manufacturing sector fell by 1.0 per cent year-on-year, the eleventh consecutive quarter of decline, on the back of strong productivity gains in the sector.

On the other hand, the ULC for services producing industries rose by 2.6 per cent, a moderation from the 3.0 per cent increase in the previous quarter. Most services sectors saw increases in their ULCs, with the exception of the accommodation & food services sector where productivity gains outweighed the rise in total labour cost per worker.

Meanwhile, construction ULC fell by 0.8 per cent, a reversal from the 0.8 per cent increase in the preceding quarter, as productivity growth outpaced the rise in total labour cost per worker in the sector.

Unit business cost (UBC) for the manufacturing sector fell by 0.6 per cent year-on-year in the third quarter, extending the 4.4 per cent decline in the previous quarter (Exhibit 1.10). The decline came on the back of decreases in both the manufacturing ULC (-1.0 per cent) and the unit services cost (-0.4 per cent). On the other hand, unit non-labour production taxes rose (2.3 per cent).

*Exhibit 1.10: Changes in Unit Business Cost for Manufacturing*
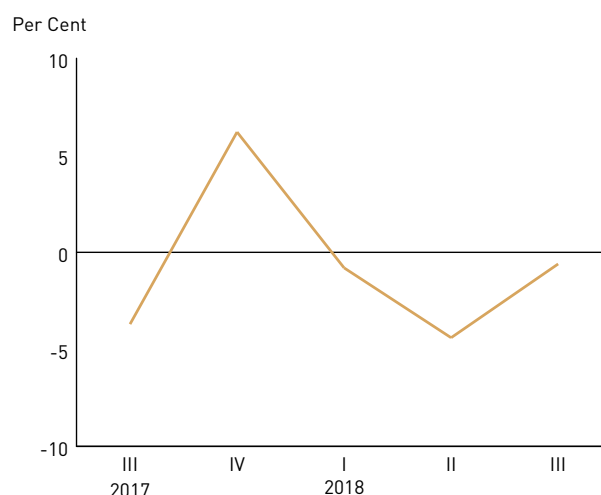
▸ Investment Commitments

Investment commitments in terms of Fixed Asset Investments (FAI) and Total Business Expenditure (TBE) amounted to $1.5 billion and $1.1 billion respectively in the third quarter (Exhibit 1.11 and Exhibit 1.12).

In terms of FAI, the largest contribution came from the services clusters, which garnered $1.1 billion in commitments, mainly from the engineering & environmental services cluster. Within manufacturing, the electronics cluster attracted the highest amount of commitments, at $110 million. Investors from Europe were the largest contributor to total FAI commitments, with $854 million of FAI commitments (57 per cent). They were followed by investors from Asia Pacific (ex-Japan), who contributed about $270 million of FAI commitments (18 per cent).

Exhibit 1.11: Fixed Asset Investments by Industry Cluster in 3Q 2018
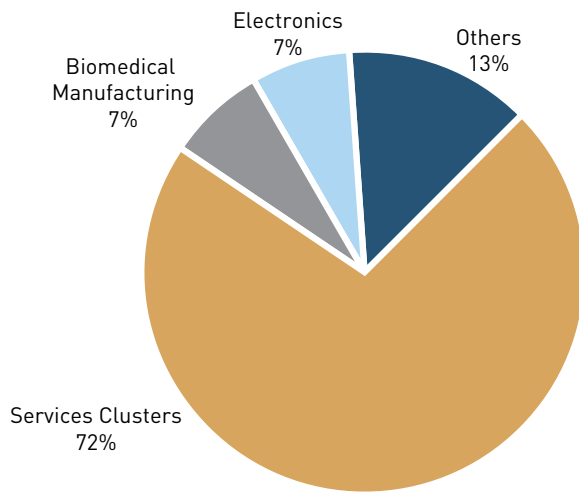
In terms of TBE, the engineering & environmental services cluster attracted the highest amount of commitments, at $476 million, followed by the research & development cluster with $173 million. Investors from Asia Pacific (ex-Japan) contributed the most to total TBE, at $546 million (51 per cent), followed by investors from the United States at $214 million (20 per cent).

*Exhibit 1.12: Total Business Expenditure by Industry Cluster in 3Q 2018*
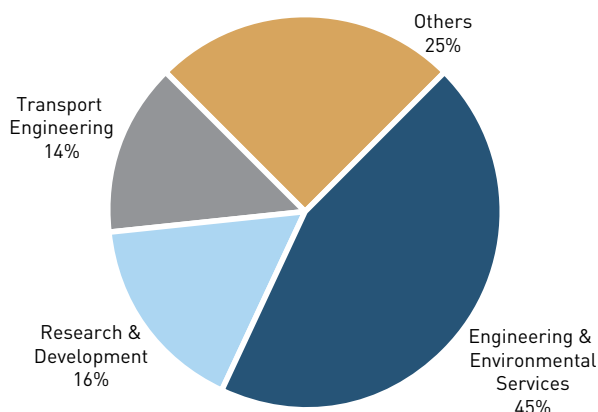
When fully realised, these commitments are expected to generate value-added of $2.4 billion and more than 3,900 jobs.

PRICES

‣ Consumer Price Index

The Consumer Price Index-All Items (CPI-All Items) rose by 0.7 per cent on a year-on-year basis in the third quarter, faster than the 0.3 per cent increase in the preceding quarter (Exhibit 1.13). On a quarter-on-quarter seasonally-adjusted basis, the CPI-All Items increased by 0.3 per cent, slightly higher than the 0.2 per cent increase in the second quarter.

Exhibit 1.13: Changes in CPI-All Items
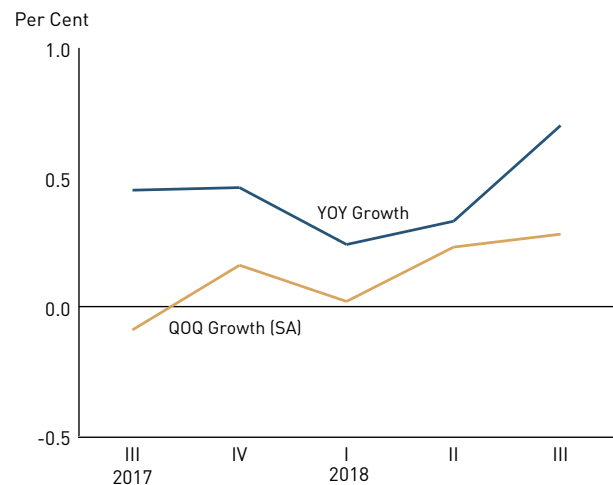
Among the CPI categories, food was the largest positive contributor to CPI-All Items inflation in the third quarter, with prices rising by 1.6 per cent on a year-on-year basis on the back of price increases for food servicing services like hawker food and restaurant meals, as well as non-cooked food items such as fruits, fish & seafood and bread & cereals (Exhibit 1.14). Meanwhile, education costs rose by 2.6 per cent on account of higher fees at kindergartens & childcare centres, commercial institutions, universities and polytechnics.

Healthcare costs increased by 2.0 per cent due to more expensive hospital services and outpatient services. Recreation & culture costs climbed by 1.5 per cent on the back of a rise in the cost of holiday travel. Prices of miscellaneous goods & services picked up by 1.1 per cent as the result of an increase in cigarette prices. The costs of household durables & services rose by 0.7 per cent as an increase in the salaries of foreign maids outweighed a dip in the prices of household durables. Clothing & footwear costs went up by 2.3 per cent due to more expensive ready-made garments and footwear.

Exhibit 1.14: Percentage Changes in CPI over Corresponding Quarter of Previous Year

Per Cent

	2017		2018		
	III	**IV**	**I**	**II**	**III**
All items	0.4	0.5	0.2	0.3	**0.7**
Food	1.3	1.4	1.3	1.4	**1.6**
Clothing & Footwear	1.6	0.4	1.0	1.0	**2.3**
Housing & Utilities	-2.4	-2.4	-2.6	-2.0	**-0.7**
Household Durables & Services	1.0	1.0	0.9	0.8	**0.7**
Health Care	2.6	2.0	2.3	2.2	**2.0**
Transport	1.5	1.7	0.3	-0.1	**-0.2**
Communication	0.6	1.0	-0.1	-0.7	**-1.0**
Recreation & Culture	0.2	0.6	1.0	1.1	**1.5**
Education	2.7	2.6	2.9	2.9	**2.6**
Miscellaneous Goods & Services	0.4	0.2	0.6	0.9	**1.1**

The price gains in these CPI categories were partially offset by price declines in other categories. Housing & utilities costs posed the largest drag on CPI-All Items inflation, declining by 0.7 per cent as a fall in accommodation costs more than offset higher electricity tariffs and water prices, as well as higher housing maintenance charges. Likewise, communication costs fell by 1.0 per cent due to a drop in the cost of telecommunication services and equipment. Transport costs edged down by 0.2 per cent as lower car prices and bus & train fares outweighed higher petrol prices.

INTERNATIONAL TRADE

▸ Merchandise Trade

Singapore's total merchandise trade expanded by 15 per cent year-on-year in the third quarter, following the 10 per cent growth in the preceding quarter (Exhibit 1.15). The increase was supported by both oil and non-oil trade. Oil trade rose by 28 per cent in nominal terms on the back of higher oil prices compared to a year ago, while non-oil trade expanded by 12 per cent.

Exhibit 1.15: Growth Rates of Total Merchandise Trade, Merchandise Exports and Merchandise Imports (In Nominal Terms)

Per Cent

	2017			2018		
	III	**IV**	**Ann**	**I**	**II**	**III**
Merchandise Trade	11.6	7.8	11.1	2.5	10.2	**14.7**
Merchandise Exports	10.1	6.6	10.3	2.3	9.3	**12.7**
Domestic Exports	11.0	15.3	15.8	3.5	12.9	**14.5**
Oil	19.3	26.1	33.4	8.6	20.4	**28.9**
Non-Oil	7.6	10.4	8.8	1.1	9.3	**8.0**
Re-Exports	9.3	-1.3	5.2	0.9	5.7	**11.1**
Merchandise Imports	13.4	9.1	12.1	2.8	11.1	**17.0**
Oil	26.3	30.5	41.6	3.7	26.3	**30.9**
Non-Oil	10.4	4.0	5.8	2.6	6.9	**13.4**

Total merchandise exports grew by 13 per cent in the third quarter, faster than the 9.3 per cent increase in the preceding quarter. This also marked the eighth consecutive quarter of growth, and was supported by increases in both domestic exports (15 per cent) and re-exports (11 per cent).

In turn, the increase in domestic exports was due to an expansion in both oil and non-oil domestic exports. In particular, oil domestic exports rose by 29 per cent on the back of higher oil prices compared to levels observed a year ago. In volume terms, oil domestic exports declined by 5.8 per cent.

Meanwhile, non-oil domestic exports (NODX) expanded by 8.0 per cent, following the 9.3 per cent increase in the previous quarter. Growth in NODX was driven by an increase in non-electronics NODX which outweighed the decline in electronics NODX.

Total merchandise imports increased by 17 per cent in the third quarter, after posting growth of 11 per cent in the previous quarter. Both oil and non-oil merchandise imports grew. Oil imports expanded by 31 per cent on the back of higher oil prices, while non-oil imports rose by 13 per cent, driven by an increase in both electronics and non-electronics imports.

▸ **Services Trade**

Total services trade expanded by 3.0 per cent year-on-year in the third quarter, extending the 2.9 per cent growth in the previous quarter (Exhibit 1.16). Services exports grew by 3.3 per cent, after recording growth of 3.2 per cent in the second quarter. The increase in services exports was largely attributable to the rise in receipts from charges for the use of intellectual property, as well as higher exports of other business services and financial services. Meanwhile, services imports rose by 2.7 per cent, a slight increase from the 2.6 per cent growth in the preceding quarter. The rise in services imports was mainly due to higher imports of other business services and insurance services.

Exhibit 1.16: Growth Rates of Total Services Trade, Services Exports and Services Imports (In Nominal Terms)

Per Cent

	2017			2018		
	III	IV	Ann	I	II	III
Total Services Trade	6.6	4.1	4.7	4.5	2.9	**3.0**
Services Exports	5.3	3.2	4.2	5.5	3.2	**3.3**
Services Imports	7.9	5.0	5.1	3.7	2.6	**2.7**

BALANCE OF PAYMENTS

The overall balance of payments recorded a smaller surplus of $6.2 billion in the third quarter, compared to the $7.8 billion surplus in the second quarter (Exhibit 1.17). This occurred as net outflows from the capital and financial account increased, even as the current account surplus was broadly unchanged.

Exhibit 1.17: Balance of Payments[6]
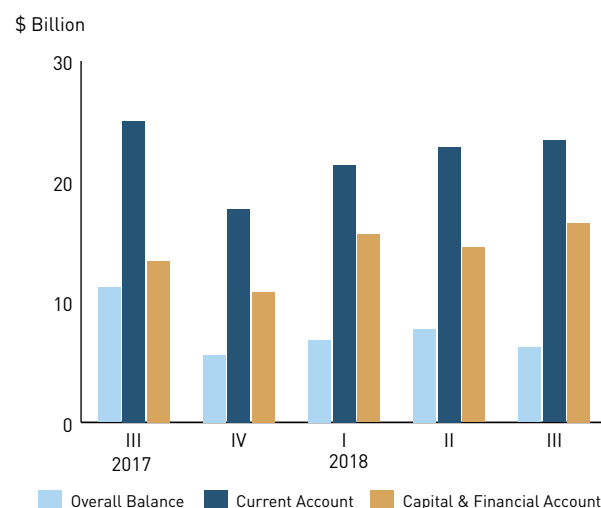
▸ **Current Account**

The current account surplus was stable at $23 billion in the third quarter. Although the goods account surplus rose, it was mostly offset by a larger primary income deficit. Meanwhile, the deficits in the services and secondary income balances were almost unchanged.

The surplus in the goods balance increased by $1.0 billion to $32 billion in the third quarter, as goods exports rose more than imports.

The deficit in the services balance widened slightly from $1.4 billion in the second quarter to $1.5 billion in the third quarter. Although net payments for travel services fell and net receipts of maintenance & repair services rose, their impact was more than offset by higher net payments for telecommunications, computer & information services and other business services, as well as the reversal of transport services from net receipts to net payments.

The deficit in the primary income balance widened to $5.0 billion in the third quarter from $4.5 billion in the second quarter, as primary income payments rose faster than receipts.

6   *Net inflows in net balances are indicated by a minus (-) sign. For more details regarding the change in sign convention to the financial account, please refer to DOS's information paper on "Singapore's International Accounts: Methodological Updates and Recent Developments".*

▸ Capital and Financial Account

Net outflows from the capital and financial account increased to $17 billion in the third quarter, from $15 billion in the previous quarter. This was due to a rise in the net outflows of other investment, which outweighed higher net inflows of direct investment and lower net outflows of portfolio investment.

Net inflows of direct investment reached $21 billion, up from $8.3 billion in the second quarter. This primarily reflected an increase in foreign direct investment into Singapore.

Meanwhile, net outflows of portfolio investment declined by $1.8 billion to $8.0 billion in the third quarter. The net sales of foreign securities by domestic deposit-taking corporations increased, exceeding the higher net acquisition of overseas securities by both the non-bank and official sectors.

By contrast, net outflows from the "other investment" account rose by $16 billion to $29 billion in the third quarter. This was mainly due to a reversal of the non-bank private sector from a net inflow to net outflow position, which more than offset the switch from a net outflow to net inflow position for domestic deposit-taking corporations.

At the same time, financial derivatives turned to a small net outflow position in the third quarter, following net inflows of $0.1 billion in the second quarter.

Estimating Singapore's Value-Added in Gross Exports and Foreign Exports

INTRODUCTION

As a small open economy, Singapore is highly dependent on trade. There are two complementary ways to measure the importance of exports to the Singapore economy. The first is to measure the value-added (VA) generated from Singapore's gross exports of goods and services to other countries, where gross exports refer to the total exports to a country regardless of whether they are meant to meet final or intermediate demand.

The second is to measure Singapore's VA embodied in foreign exports.[1] Specifically, Singapore's VA would be embodied in foreign exports if Singapore was involved in the supply of intermediate goods or services further up the value chain in the production of these exports. For example, when Malaysia exports an electronics product to China, some of Singapore's VA would be embodied in Malaysia's exports because our sectors had provided intermediate goods and services to Malaysia's electronics sector which produced the exported product.

As a significant share of Singapore's goods and services exports are intermediates used by sectors overseas to produce the goods and services intended for export to another economy, it is pertinent to examine the second measure, alongside the first, to have a clearer understanding of how different export flows contribute to the Singapore economy.[2]

LITERATURE REVIEW

A number of previous studies had analysed the importance of exports to Singapore's Gross Domestic Product (GDP). For example, using the 2005 Singapore Input-Output (IO) tables published by the Department of Statistics, Jayaram and Neo (2011) found that the VA from Singapore's gross exports of goods and services accounted for 54 per cent of Singapore's GDP in 2005, with Singapore's exports to the G3 economies (the US, EU and Japan) collectively accounting for 20 per cent of Singapore's GDP. An update of the analysis by Chan et al. (2012) found that while the G3 economies still accounted for most of the VA from Singapore's gross exports in 2010, Singapore was deriving an increasing share of its VA from gross exports to China and other Asian economies.

METHODOLOGY AND DATA

Our study extends the previous studies in two ways. First, it updates the earlier estimates on the VA generated by Singapore's gross exports of goods and services using the OECD Inter-Country Input-Output (ICIO) tables. Using the OECD ICIO tables rather than Singapore's IO tables has the advantage of accounting for linkages between foreign economies outside of Singapore. Second, it explicitly examines the importance of foreign export flows (i.e., export flows between foreign countries) to the Singapore economy. Doing so enables us to quantify the relative importance of different foreign export flows to the Singapore economy arising from our role in global value chains.

---

1   *Foreign exports are defined as goods or services exported by an economy other than Singapore.*
2   *A related measure is the contribution of external sources of final demand to Singapore's GDP. Final demand refers to the consumption of final goods and services by consumers, the government and businesses in a particular country. Our current study focuses on Singapore's gross exports and foreign export flows as these better reflect global value chain linkages. However, there have been past studies that examined the contribution of external final demand to the Singapore economy. For instance, Lim and Zhou (2016) found that external final demand contributed to two-thirds of Singapore's GDP in 2015, with ASEAN-5, the US and China being the most important final demand markets. Similarly, a study by MAS (2018) found that final demand from Asia contributed to 21.9 per cent of Singapore's GDP in 2016, showing the importance of Asian final demand to Singapore's GDP.*

Our analysis uses the OECD Trade in Value-Added (TiVA) database which tracks the inter-country, inter-industry flows of goods and services trade and VA for 64 economies (viz. 63 economies, including Singapore, and the Rest of the World) across 34 industries. As the data in the OECD TiVA database is currently only up to 2011, we employ the RAS methodology to update the underlying ICIO tables to 2017 data.[3] We then use input-output methods to compute the contribution of our gross exports to Singapore's GDP, as well as Singapore's VA embodied in various foreign export flows. Refer to the Annex for more details of the methodology.

FINDINGS

Trends in Singapore's VA Generated from Gross Exports

First, we estimate the VA generated by Singapore's gross exports of goods and services to various countries. We find that Singapore's exports to the ASEAN-5 economies (comprising Malaysia, Indonesia, Thailand, Philippines and Vietnam) and China contributed the most to Singapore's GDP in 2017, at 13.44 per cent and 9.47 per cent of GDP respectively (Exhibit 1). These were followed by Singapore's exports to EU-28 (7.55 per cent), the US (6.70 per cent) and India (4.13 per cent).

We also observe a shift in the drivers of Singapore's VA from gross exports towards the ASEAN-5 economies as a whole as well as China in recent years. Specifically, between 2011 and 2017, Singapore's VA from our gross exports to the ASEAN-5 economies rose from 12.45 per cent of GDP to 13.44 per cent of GDP, while the VA from our gross exports to China grew from 7.77 per cent of GDP to 9.47 per cent of GDP. Meanwhile, even though the share of Singapore's GDP arising from our gross exports to the EU-28 and US has fallen, they remain important contributors to Singapore's GDP at 7.55 per cent and 6.70 per cent respectively in 2017.

Exhibit 1: Singapore's VA Generated by Singapore's Gross Exports

Singapore's VA Generated by Singapore's Gross Exports   *Singapore's VA Generated by Gross Exports to ASEAN-5 Countries*
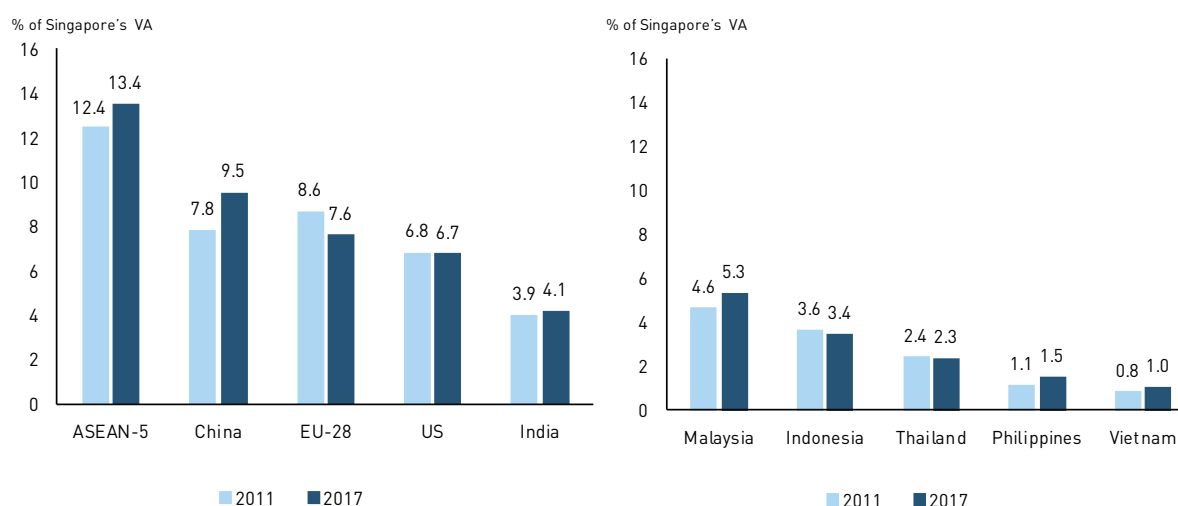
Source: OECD ICIO (2011), MTI-ECD estimates

---

3   *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 on the RAS method, refer to Singapore Supply and Use, and Input Output Tables 2010, Department of Statistics (2014).*

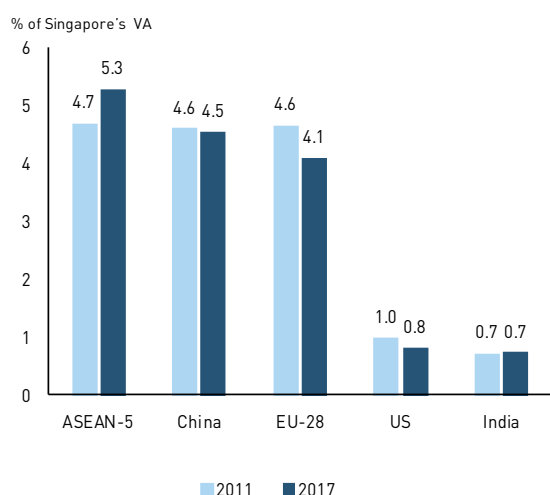Trends in Singapore's VA Embodied in Foreign Exports

Next, we examine the trends in Singapore's VA embodied in foreign export flows. To recap, this measures Singapore's VA that is embodied within the exports of goods and services by a foreign country, because of our role in the supply of intermediate inputs used in the production of these goods and services.

Among all the foreign export flows, Singapore's VA embodied in the exports of the ASEAN-5 economies and China accounted for the largest shares of Singapore's GDP in 2017, at 5.25 per cent and 4.51 per cent respectively (Exhibit 2). These were followed by the exports of EU-28 (4.06 per cent), the US (0.79 per cent) and India (0.71 per cent).
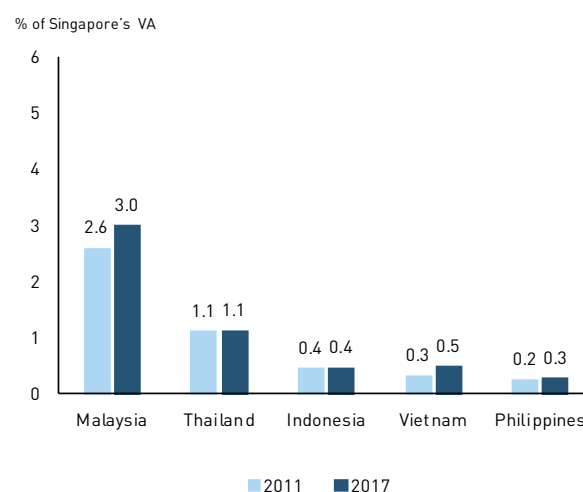
Over the period of 2011 to 2017, the share of Singapore's GDP embodied in ASEAN-5's exports increased from 4.66 per cent of GDP to 5.25 per cent of GDP. On the other hand, the share of Singapore's GDP embodied in the exports of China, EU-28 and the US declined slightly over the same period.

Exhibit 2: Singapore's VA Embodied in Foreign Gross Exports

*Singapore's VA Embodied in Foreign Gross Exports*

Singapore's VA Embodied in Gross Exports of ASEAN-5 Countries

Source: OECD ICIO (2011), MTI-ECD estimates

Delving deeper into foreign export flows by country-pairs, we find that the bilateral flow that accounted for the largest share of Singapore's GDP was Malaysia's exports to China, at 1.23 per cent of Singapore's GDP in 2017 (Exhibit 3). This was followed by China's exports to the US, which accounted for 1.20 per cent of Singapore's GDP in 2017.

Over the period of 2011 to 2017, the share of Singapore's GDP embodied in Malaysia's exports to the US increased from 0.89 per cent of GDP to 1.23 per cent of GDP, leading it to overtake China's exports to the US as the bilateral foreign export flow that accounted for the highest share of Singapore's GDP. While the share of Singapore's GDP embodied in China's exports to the US has fallen, this trade flow remains important for Singapore's GDP, as do other bilateral foreign trade flows such as South Korea's exports to China, China's exports to Japan, and Malaysia's exports to the US.

Exhibit 3: Singapore's VA Embodied in Foreign Export Flows (Top 5 Flows)

% of Singapore's VA

Source: OECD ICIO (2011), MTI-ECD estimates
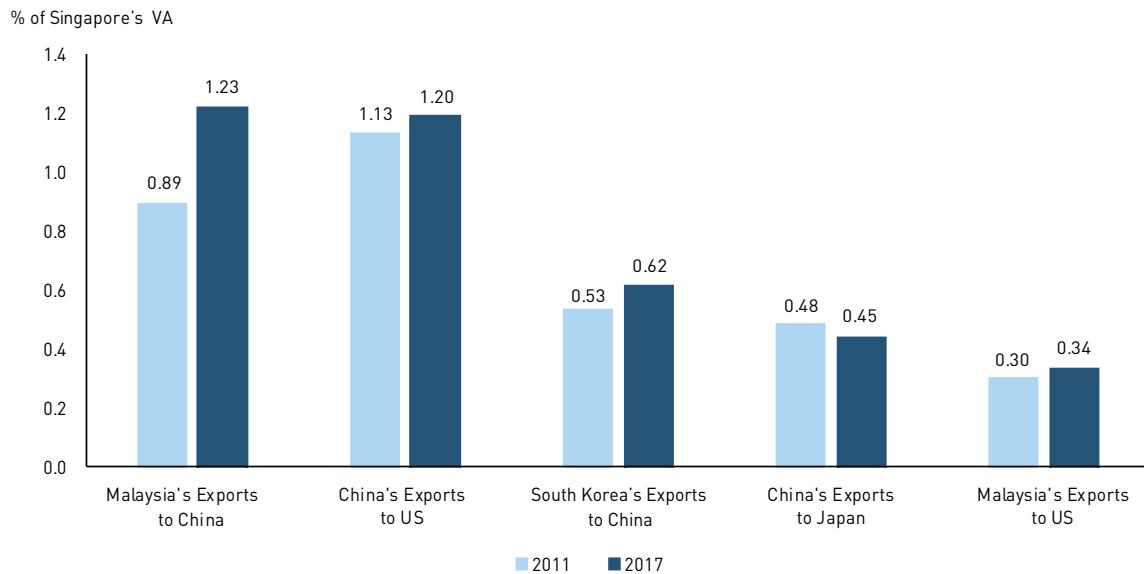
INSET 1: Singapore's VA Embodied in US-China's Bilateral Exports

In this inset, we examine in greater detail Singapore's VA that is embodied in export flows between the US and China. This is of interest given concerns about the potential impact of the on-going trade conflict between the US and China on the Singapore economy.[4]

Our analysis shows that Singapore's VA embodied in China's exports of goods and services to the US accounted for 1.20 per cent of our GDP in 2017, while the VA embodied in the US' exports of goods and services to China accounted for a smaller 0.09 per cent of our GDP in 2017 (Exhibit 4). As such, in total, Singapore's VA embodied in the exports of goods and services between the US and China accounted for 1.29 per cent of our GDP in 2017, higher than the 1.2 per cent in 2011.[5] By products, about three-quarters of our VA embodied in China's exports to the US arose from China's exports of Computer, Electronic & Optical Equipment to the US.

While the estimate of 1.29 per cent of GDP represents Singapore's indirect exposure to US-China bilateral export flows, the actual impact of the on-going US-China trade conflict on the Singapore economy would likely be smaller for two reasons. <u>First</u>, only a portion of the bilateral goods exports between the US and China has been subjected to tariffs, whereas the estimate of 1.29 per cent of GDP represents Singapore's VA embodied in the bilateral exports of <u>all goods and services</u> between the US and China. <u>Second</u>, while the imposition of tariffs could lower the exports of the covered products between the US and China, it is not likely that the exports would fall to zero.[6]

A key caveat to the above analysis is that it does not take into account the adverse impact that could arise should there be an escalation of the US-China trade conflict that, in turn, triggers a sharp fall in global confidence or a tightening of global liquidity conditions. In such a scenario, global consumption and investment, and hence global growth, would decline, thereby causing a drop in the global demand for Singapore's exports. The negative impact on the Singapore economy would likely be larger in this case.

---

4   Since July 2018, the US has imposed tariffs on around US$250 billion worth of imports from China, while China has imposed retaliatory tariffs on around US$110 billion worth of imports from the US.
5   Specifically, in 2011, China's exports to the US accounted for 1.1 per cent of Singapore's GDP, while US' exports to China accounted for 0.08 per cent of Singapore's GDP.
6   For example, if we assume unit elasticity, a 10 per cent tariff will only lead exports of the covered products to fall by 10 per cent.

Exhibit 4: Singapore's VA Embodied in US-China Bilateral Export Flows

% of Singapore's VA

■ China's Exports to US   ■ US' Exports to China
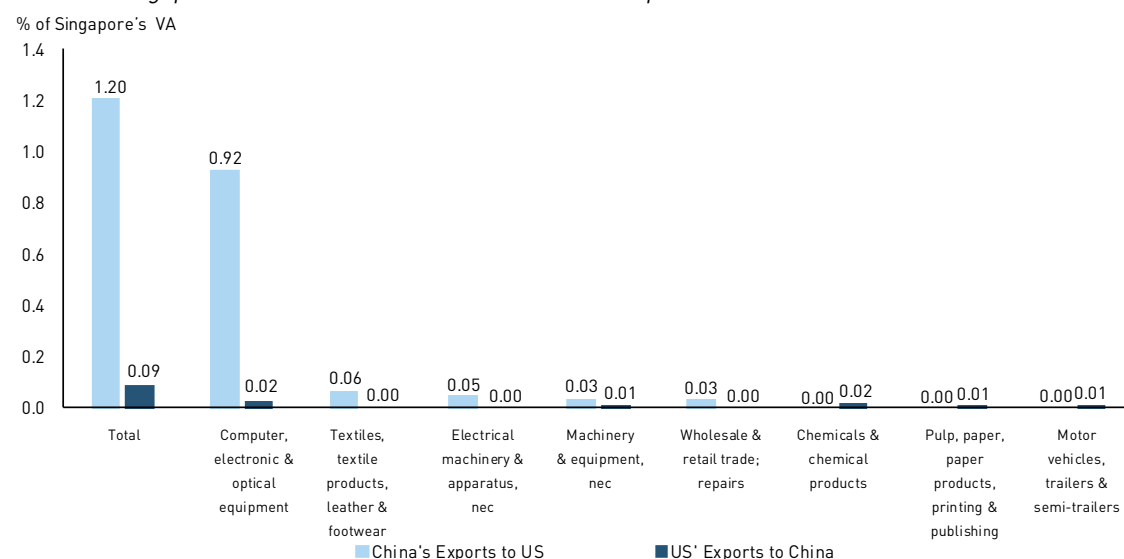
Source: OECD ICIO (2011), MTI-ECD estimates

CONCLUSION

In this article, we analyse Singapore's VA generated from our gross exports of goods and services, as well as Singapore's VA embodied in foreign export flows. Our key findings are as follows. First, over the period of 2011 to 2017, the share of Singapore's GDP generated from our gross exports of goods and services to the ASEAN-5 economies and China has increased, although our gross exports to other key trading partners such as EU-28, US and India remain important for the Singapore economy. Second, the share of Singapore's GDP embodied in the goods and services exports of the ASEAN-5 economies has similarly increased over the same period. Third, Malaysia's exports to China accounted for the largest share of Singapore's GDP embodied in bilateral exports between foreign countries in 2017, with China's exports to the US accounting for the second largest share.

Over the years, sustained efforts to bolster our linkages with other economies, such as through bilateral and multilateral trading agreements, have increased the economic value of our trading links with many economies around the world, including the ASEAN economies and China. This is manifested in the VA that we derive from our gross exports of goods and services to these economies, as well as the VA embodied in the exports originating from these economies. Going forward, Singapore will continue to diversify and build up our linkages with various economies around the world, especially those with high-growth potential. This will help to position the Singapore economy for growth over the longer term.

Contributed by:

Mr Nicholas Chiang, Economist
Mr Tek Yong Jian, Economist
Economics Division
Ministry of Trade and Industry

REFERENCES

Chan, Ying Jie, Lim Yin, Lee Meng Chung and Chen Yixiu. 2012. "Feature Article: Update on Value-Added from Singapore's Exports." *Economic Survey of Singapore 2012*: 14-21.

Jayaram, Shruthi and Neo Lay Hoon. 2011. "Feature Article: Estimating the Value-Added from Singapore's Exports to Key Markets." *Economic Survey of Singapore 2010*: 61-69.

Lim, Xin Yu and Eugene Zhou. 2016. "Feature Article: Analysis of Singapore's External Sources of Final Demand." *Economic Survey of Singapore 2016*: 42-49.

Monetary Authority of Singapore. 2018. "Shifts in Asia's Demand and Production Structure: A Value-Added Approach." *Macroeconomic Review*, October 2018: 70-77.

OECD. 2016. *Input-Output Tables*. www.oecd.org/trade/input-outputtables.htm (accessed November 4, 2018).

OECD. 2016. *Trade in Value Added (TiVA)*. http://stats.oecd.org/index.aspx?queryid=75537 (accessed November 4, 2018).

OECD. 2017. *TiVA 2016 Indicators – Definitions*. www.oecd.org/sti/ind/tiva/TIVASaM_2016_Indicator_Definitions.pdf (accessed November 4, 2018).

ANNEX: METHODOLOGY

We used an input-output (IO) multiplier framework to calculate the VA generated by Singapore's gross exports, as well as Singapore's VA embodied in foreign exports by other economies.[7] To illustrate, we will use Singapore's gross exports to the US and China's gross exports to the US as examples.

The matrix equation for computing Singapore's VA generated by Singapore's gross exports to the US can be written as:

$$VA_{SG,SG,US} = \widehat{V_{SG}} \, B_{SG,SG} \, \widehat{X_{SG,US}}$$

where $\widehat{V_{SG}}$ is the 34 x 34 diagonal matrix of VA coefficients for Singapore

$B_{SG,SG}$ is the Singapore submatrix of the world's matrix of total requirement coefficients (also known as the Leontief inverse)[8], specifically the 34 x 34 matrix where the rows and columns correspond to Singapore's industries

$\widehat{X_{SG,US}}$ is the diagonal matrix derived by diagonalising the 34 x 1 vector of gross exports from each of Singapore's industries to the US

$VA_{SG,SG,US}$ is the 34 x 34 matrix where the each element in row i and column j shows the amount of VA generated by Singapore industry i from Singapore industry j's gross exports to the US

Similarly, the matrix equation for computing Singapore's VA embodied in China's gross exports to the US can be written as:

$$VA_{SG,CN,US} = \widehat{V_{SG}} \, B_{SG,CN} \, \widehat{X_{CN,US}}$$

where $\widehat{V_{SG}}$ is the 34 x 34 diagonal matrix of VA coefficients for Singapore

$B_{SG,CN}$ is a submatrix of the world's matrix of total requirement coefficients (also known as the Leontief inverse), specifically the 34 x 34 matrix where the rows correspond to Singapore's industries, and the columns correspond to China's industries

$\widehat{X_{CN,US}}$ is the diagonal matrix derived by diagonalising the 34 x 1 vector of gross exports from each of China's industries to the US

$VA_{SG,CN,US}$ is the 34 x 34 matrix where the each element in row i and column j shows the amount of VA from Singapore industry i embodied in China industry j's gross exports to the US

The matrix equation for computing Singapore's total VA embodied in China's exports to the US can be written as:

$$SGVA = v^{T} VA_{SG,CN,US} v$$

where v is a 34 x 1 vector of 1's.

---

7   For more details on computing value added from gross export flows, please refer to OECD (2017).
8   The world's Leontief inverse matrix is the 34N x 34N matrix, where N is the total number of economies (N=64 in the OECD ICIO).
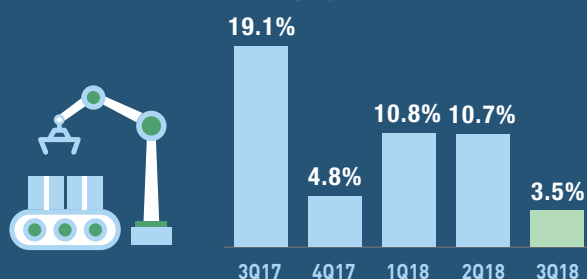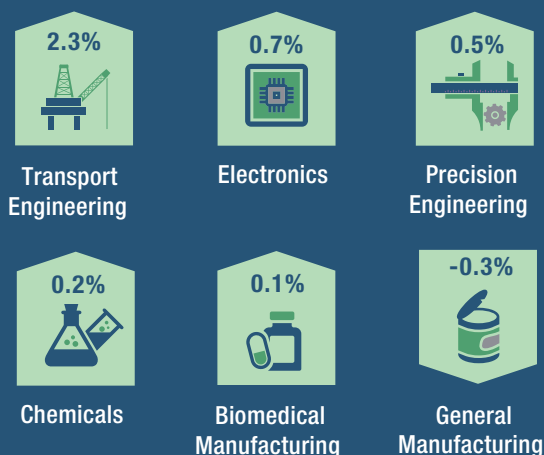
SECTORAL PERFORMANCE
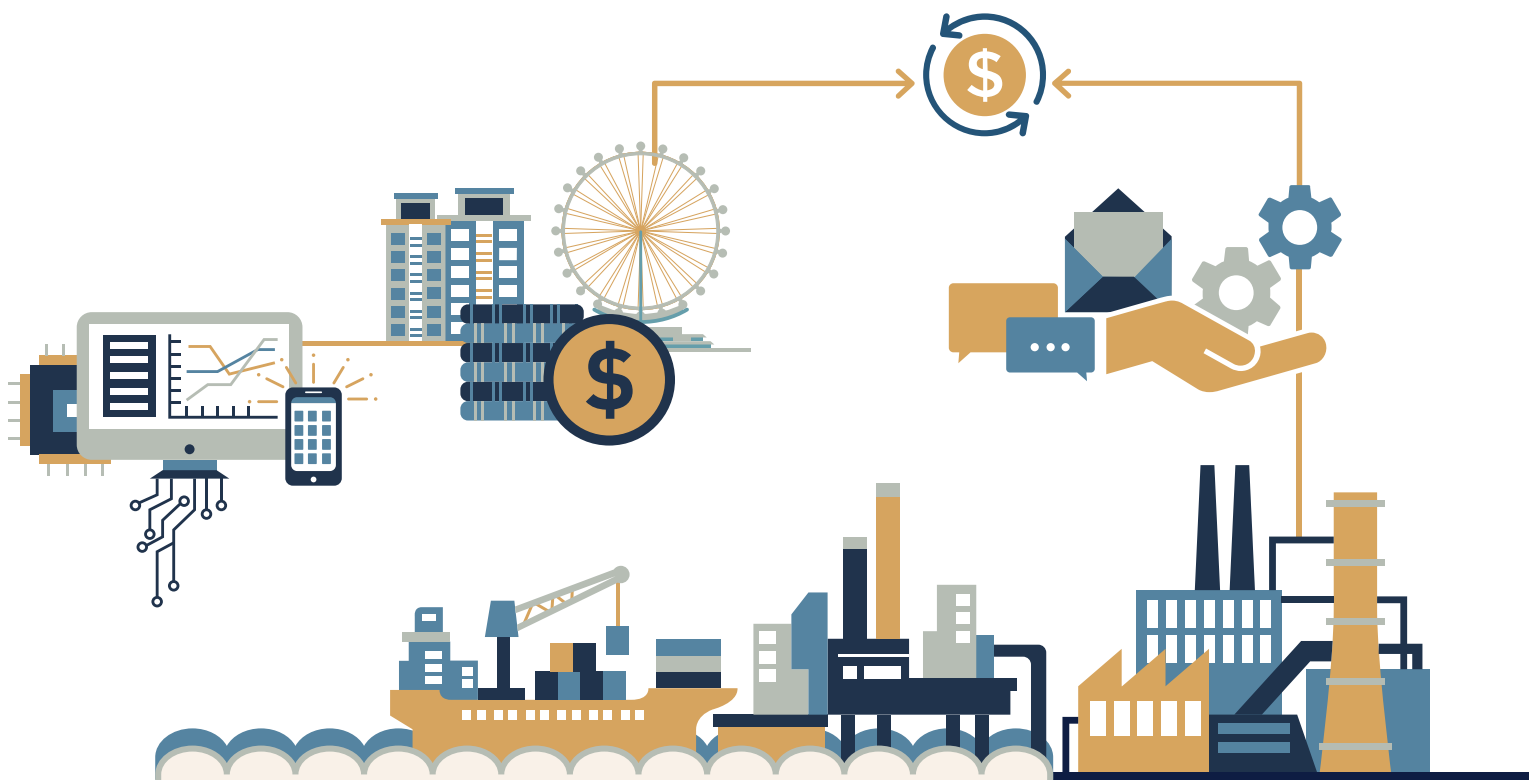
CHAPTER 2
SECTORAL PERFORMANCE
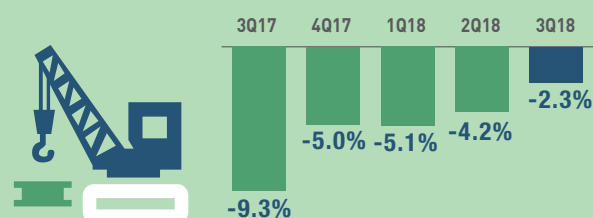
MANUFACTURING

REAL GROWTH

3Q17	4Q17	1Q18	2Q18	3Q18
19.1%	4.8%	10.8%	10.7%	3.5%

CLUSTERS IN MANUFACTURING SECTOR
%-POINT CONTRIBUTION IN 3Q18

2.3%	0.7%	0.5%
Transport Engineering	Electronics	Precision Engineering

0.2%	0.1%	-0.3%
Chemicals	Biomedical Manufacturing	General Manufacturing

CONSTRUCTION

REAL GROWTH

3Q17	4Q17	1Q18	2Q18	3Q18
-9.3%	-5.0%	-5.1%	-4.2%	-2.3%

CERTIFIED PAYMENTS IN 3Q18

50.7% Public

49.3% Private
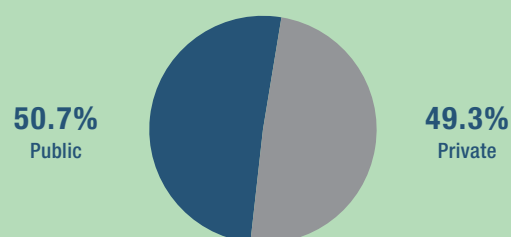
CONTRACTS AWARDED IN 3Q18

111.2%	104.0%	54.0%	-47.4%	-70.2%
Institutional & Others	Industrial	Residential	Commercial	Civil Engineering

WHOLESALE & RETAIL TRADE

REAL GROWTH

3Q17	3.3%
4Q17	3.0%
1Q18	2.6%
2Q18	1.5%
3Q18	0.5%
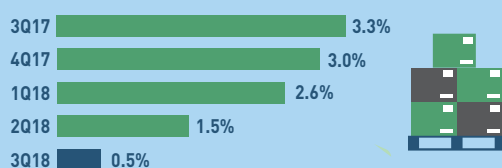
WHOLESALE TRADE

Domestic Wholesale Trade Index Growth **2.6%** Domestic WTI
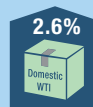
Foreign Wholesale Trade Index Growth **-0.4%** Foreign WTI

RETAIL TRADE

Retail Sales Index Growth (Non-Motor Vehicles) **0.8%**

Retail Sales Index Growth (Motor Vehicles) **-8.6%**

ACCOMMODATION & FOOD SERVICES

REAL GROWTH

3Q17	4Q17	1Q18	2Q18	3Q18
1.3%	2.9%	2.0%	3.9%	4.0%
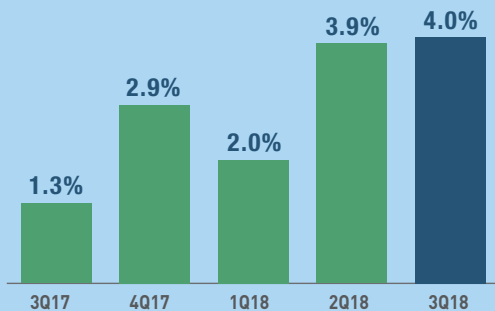
ACCOMMODATION

Occupancy Rates of Hotels
(Y-O-Y Change)

Luxury
7.1%-pt

Upscale
0.3%-pt

Mid-tier
0.8%-pt

Economy
1.6%-pt

FOOD SERVICES

F&B Sales Index Growth
(Y-O-Y Change)

Fast Food
5.5%

Restaurants
0.9%

Others
-1.2%

Food Caterers
-4.5%

TRANSPORTATION & STORAGE

REAL GROWTH

3Q17	5.2%
4Q17	5.3%
1Q18	2.7%
2Q18	1.2%
3Q18	2.1%
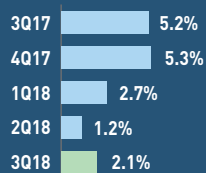
Total Sea Cargo Handled Growth
1.0%

Motor Vehicle Population Growth
0.1%

Air Passengers Handled Growth
6.4%

BUSINESS SERVICES

REAL GROWTH

3Q17	0.5%
4Q17	0.4%
1Q18	2.6%
2Q18	2.3%
3Q18	2.4%
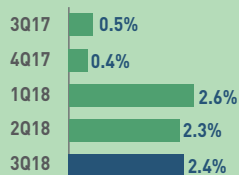
PRIVATE RESIDENTIAL REAL ESTATE

-13.9%
Units Transacted
(Y-O-Y Change)

0.5%
Price Index
(Q-O-Q Change)

FINANCE & INSURANCE

REAL GROWTH

3Q17	4Q17	1Q18	2Q18	3Q18
7.1%	6.3%	9.4%	6.8%	5.6%

GROWTH OF BANK LOANS & ADVANCES TO NON-BANK CUSTOMERS IN 3Q18

Loans to Businesses
5.3%

Consumer Loans
3.3%
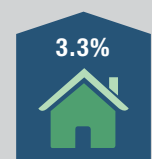
OVERVIEW

In the third quarter of 2018,

- The manufacturing sector expanded by 3.5 per cent, moderating from the 11 per cent growth in the previous quarter. All clusters recorded positive growth, except for the general manufacturing cluster, which recorded a decline in output.

- The construction sector contracted by 2.3 per cent, improving from the 4.2 per cent contraction in the preceding quarter. The decline in construction output was due to the weakness in public sector construction activities.

- The wholesale & retail trade sector grew by 0.5 per cent, slowing from the 1.5 per cent growth in the second quarter. Growth was supported by the wholesale trade segment.

- The transportation & storage sector expanded by 2.1 per cent, extending the 1.2 per cent expansion in the previous quarter. The air transport and water transport segments contributed the most to the sector's growth.

- Growth in the accommodation & food services sector came in at 4.0 per cent, slightly faster than the 3.9 per cent recorded in the preceding quarter. Growth during the quarter was mainly driven by the accommodation segment.

- The finance & insurance sector grew by 5.6 per cent, a moderation from the 6.8 per cent growth in the previous quarter. Growth was driven by the healthy performance of the insurance segment as well as digital-related activities.

- The business services sector posted growth of 2.4 per cent, similar to the 2.3 per cent achieved in the second quarter, on the back of expansions in the "others" and professional services segments.

MANUFACTURING

Manufacturing output rose by 3.5 per cent year-on-year in the third quarter, moderating from the 11 per cent increase in the previous quarter (Exhibit 2.1). Growth during the quarter was supported by an increase in output across all manufacturing clusters, with the exception of the general manufacturing cluster, which registered a decline in output (Exhibit 2.2).
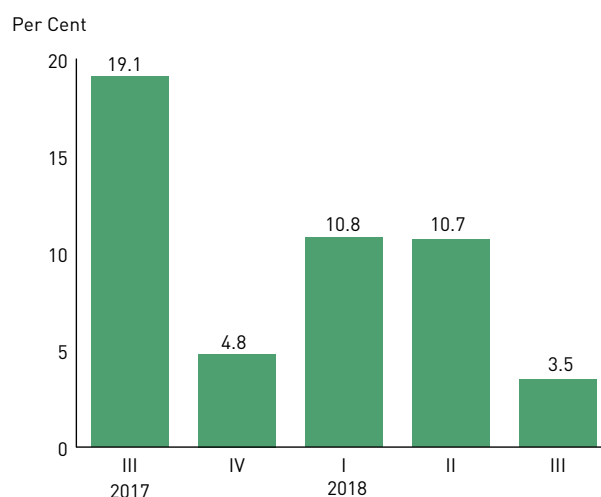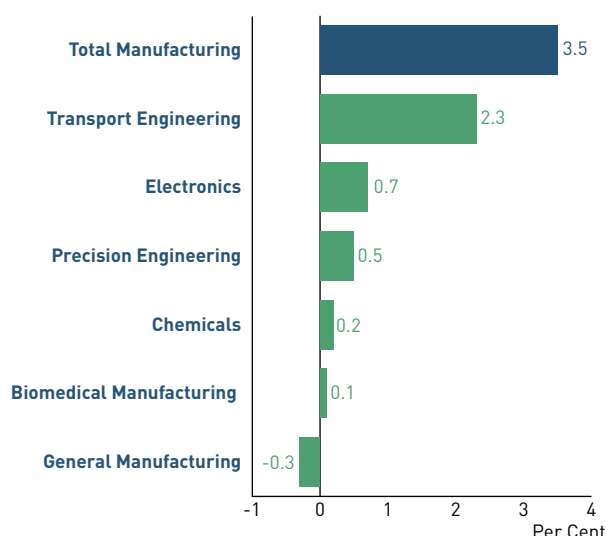
Exhibit 2.1: Manufacturing Sector's Growth Rate

Exhibit 2.2: Percentage-Point Contribution to Manufacturing Sector's Growth in 3Q 2018

The transport engineering cluster's output increased by 21 per cent in the third quarter. In particular, the marine & offshore engineering segment saw its output expand by 36 per cent on account of a higher level of work done in offshore projects, as well as a low base in the third quarter of last year. At the same time, the aerospace segment grew by 15 per cent on the back of a higher volume of engine repair and maintenance work from commercial airlines. On the other hand, the land transport segment's output declined by 15 per cent.

Output of the electronics cluster rose by 1.8 per cent in the third quarter, largely driven by the semiconductors segment, which grew by 4.5 per cent. The resilient performance of the semiconductors segment came on the back of a continued expansion in global semiconductor demand, which was in turn supported by key end markets such as the server, industrial and automotive markets. The other electronic modules & components and infocomms & consumer electronics segments also recorded positive growth of 8.0 per cent and 3.9 per cent respectively. By contrast, the computer peripherals and data storage segments weighed on the performance of the sector as their output contracted by 26 per cent and 8.5 per cent respectively.

The precision engineering cluster expanded by 4.0 per cent in the third quarter, driven by both the precision modules & components (PMC) and machinery & systems (M&S) segments, which grew by 9.6 per cent and 0.5 per cent respectively. In particular, the PMC segment was supported by a higher level of output of optical instruments.

The output of the chemicals cluster rose by 2.0 per cent in the third quarter, driven mainly by the specialties segment, which expanded by 8.0 per cent on account of a pickup in the production of industrial gases and mineral oil additives. Meanwhile, the output of the other chemicals segment edged up by 0.2 per cent due to an increase in the production of fragrances. However, the petrochemicals and petroleum segments contracted due to scheduled plant maintenance shutdowns.

The biomedical manufacturing cluster's output grew by 0.6 per cent in the third quarter, underpinned by output expansions in the pharmaceuticals segment. In particular, pharmaceuticals output rose by 2.8 per cent as more active pharmaceutical ingredients and biological products were produced. By contrast, the medical technology segment declined by 5.4 per cent.

Output of the general manufacturing cluster fell by 2.7 per cent in the third quarter, weighed down by the printing and miscellaneous industries segments. Specifically, the former recorded a 11 per cent decline in output on account of a fall in demand for print products, while the latter contracted by 3.8 per cent due to a drop in the production of wooden furniture & fixtures and insulation products.
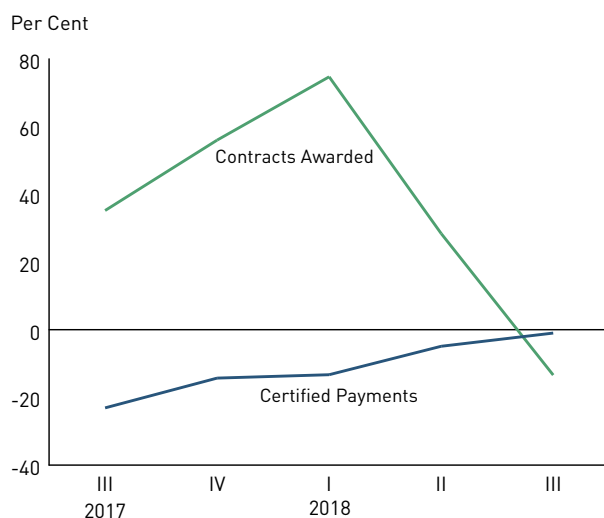
CONSTRUCTION

The construction sector contracted by 2.3 per cent year-on-year in the third quarter, an improvement from the 4.2 per cent decline recorded in the previous quarter. The contraction in the third quarter was due to a fall in public sector construction output.

In the third quarter, nominal certified progress payments (a proxy for construction output) shrank by 1.0 per cent, a more gradual pace of contraction as compared to the 4.9 per cent decline in the second quarter (Exhibit 2.3). The decline in construction output was due to a fall in public certified progress payments (-4.6 per cent), which was in turn weighed down by weakness in public institutional & other building works (-27 per cent). On the other hand, private certified progress payments provided some support to overall output growth, rising by 3.0 per cent on the back of a pickup in private industrial building works (14 per cent) and private commercial building works (20 per cent).

Meanwhile, construction demand in terms of contracts awarded declined by 13 per cent in the third quarter, a reversal from the 28 per cent increase in the previous quarter (Exhibit 2.3). This was due to a fall in public sector construction demand (-44 per cent) on the back of a decline in the demand for public civil engineering works (-71 per cent) and public residential building works (-41 per cent). By contrast, private sector construction demand expanded by 62 per cent, accelerating from the 2.8 per cent increase in the previous quarter. The increase was mainly due to an uptick in contracts awarded for private residential building works (199 per cent), such as contracts awarded for collective sales sites, and private industrial building works (114 per cent).

Exhibit 2.3: Changes in Contracts Awarded and Certified Payments

Per Cent

WHOLESALE & RETAIL TRADE

The wholesale & retail trade sector grew by 0.5 per cent year-on-year in the third quarter, moderating from the 1.5 per cent growth in the previous quarter. Growth during the quarter was driven by the wholesale trade segment.

The wholesale trade segment was supported by an expansion in domestic wholesale trade sales volume (Exhibit 2.4). In particular, domestic wholesale trade sales volume rose by 2.6 per cent in the third quarter, reversing the decline of 5.5 per cent in the previous quarter. This came on the back of an increase in the sales volumes of petroleum & petroleum-related products (7.8 per cent), telecommunications & computers (14 per cent) and electronic components (5.4 per cent).

Exhibit 2.4: Changes in Wholesale Trade Index at Constant Prices
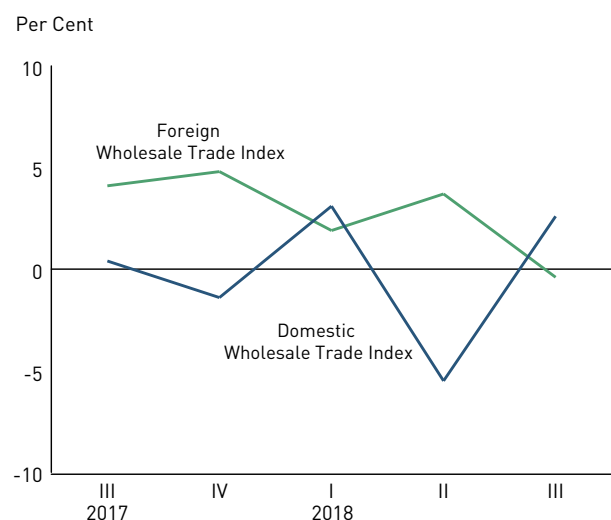
Per Cent

Meanwhile, the foreign wholesale trade index declined by 0.4 per cent in the third quarter, a pullback from the 3.7 per cent growth in the second quarter. This was largely due to declines in the sales volumes of metals, timber & construction materials (18 per cent) and "other wholesale trade" (6.2 per cent)[1]. Nevertheless, these declines were partially offset by robust expansions in the sales volumes of industrial & construction machinery (16 per cent) and telecommunications & computers (23 per cent).

---

1   The "other wholesale trade" segment consists of a diverse range of products that includes agricultural raw materials and live animals, tropical produce, personal effects and medicinal and pharmaceutical products, among others.

For the retail trade segment, the overall retail sales volume shrank by 0.9 per cent in the third quarter, reversing the 0.5 per cent growth in the previous quarter. Retail sales volume was largely dragged down by motor vehicle sales, which fell by 8.6 per cent in the third quarter (Exhibit 2.5). By contrast, retail sales volume (excluding motor vehicles) rose by 0.8 per cent, led by a rise in the sales of goods such as watches & jewellery (8.5 per cent), medical goods & toiletries (3.4 per cent) and wearing apparel & footwear (1.7 per cent).

*Exhibit 2.5: Changes in Retail Sales Index at Constant Prices*
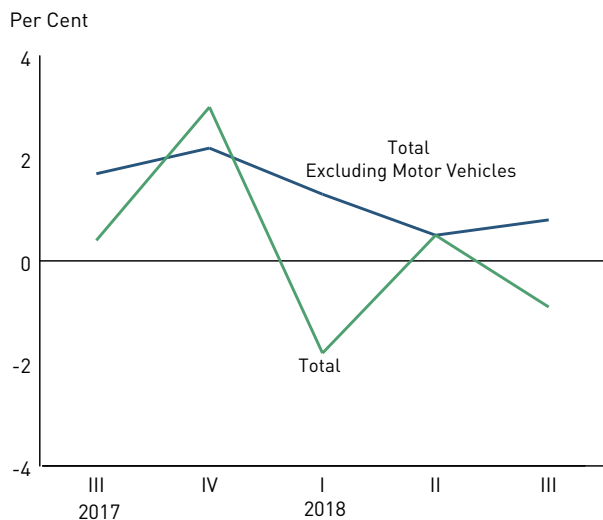

TRANSPORTATION & STORAGE

The transportation & storage sector grew by 2.1 per cent year-on-year in the third quarter, extending the growth of 1.2 per cent in the previous quarter. Growth was mainly supported by the water transport and air transport segments.

The water transport segment expanded, supported by a 1.0 per cent increase in the volume of sea cargo handled in the third quarter, which was in turn a reversal of the 0.5 per cent decline recorded in the previous quarter (Exhibit 2.6). The higher volume of sea cargo handled came on the back of a 7.6 per cent expansion in container throughput handled at Singapore's ports, in tandem with the sustained growth in global container trade flows.

Exhibit 2.6: Changes in Container Throughput and Sea Cargo Handled
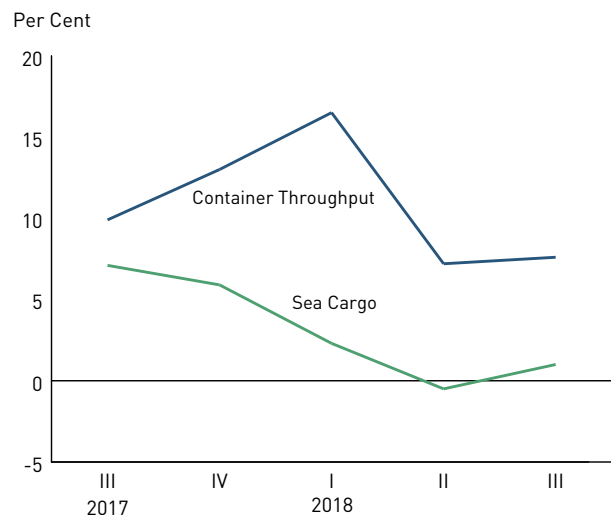
The air transport segment also grew, bolstered by an increase in both air passenger traffic and air cargo volume handled at Changi Airport. Specifically, the volume of air passenger traffic passing through Changi Airport rose by 6.4 per cent in the third quarter, extending the 5.7 per cent increase in the previous quarter (Exhibit 2.7). The increase in air passenger traffic volume continued to be underpinned by robust growth on the Singapore-India and Singapore-China routes. Meanwhile, in line with the growth in Singapore's non-oil export volumes, total air cargo shipments handled at Changi Airport expanded by 1.5 per cent in the third quarter, extending the 1.8 per cent increase in the preceding quarter. In addition, the number of aircraft landings rose by 3.0 per cent in the third quarter to reach 48,484, following the 3.8 per cent increase in the previous quarter.

Exhibit 2.7: Changes in Air Transport
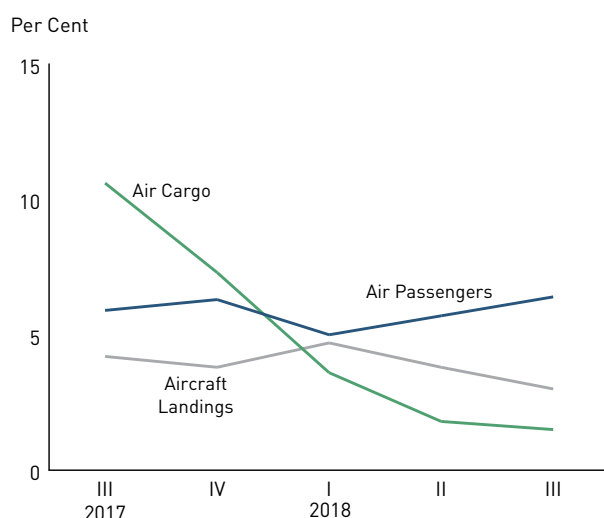
As of September 2018, the total number of motor vehicles registered with the Land Transport Authority was 955,956, representing a 0.1 per cent increase from a year ago (Exhibit 2.8). These comprised 550,423 private and company cars, 66,410 rental cars, 21,279 taxis, 19,290 buses, 137,224 motorcycles and scooters, and 161,330 goods vehicles & other vehicle types.

Exhibit 2.8: Motor Vehicles Registered
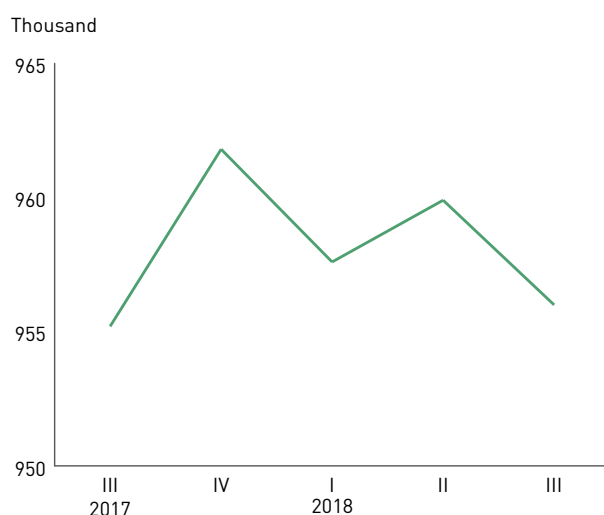

ACCOMMODATION & FOOD SERVICES

The accommodation & food services sector grew by 4.0 per cent year-on-year in the third quarter, extending the 3.9 per cent growth in the second quarter. The sector's performance was bolstered by the accommodation segment, which was in turn supported by the healthy growth in visitor arrivals.

Exhibit 2.9: Visitor Arrivals

Total visitor arrivals rose by 7.1 per cent in the third quarter, following the 8.0 per cent increase in the previous quarter (Exhibit 2.9). The strong performance came on the back of buoyant travel demand from the Chinese, Malaysian, and Indian source markets. Specifically, Chinese, Malaysian and Indian arrivals increased by 5.0 per cent, 13 per cent and 10 per cent respectively in the third quarter.

In tandem with the robust growth in visitor arrivals, gross lettings at gazetted hotels rose by 7.5 per cent in the third quarter, improving from the 7.3 per cent increase posted in the previous quarter (Exhibit 2.10). As the rise in gross lettings outstripped a 5.3 per cent increase in available room-nights over the same period, the average occupancy rate of gazetted hotels increased by 1.9 percentage-points on a year-on-year basis to reach 89.7 per cent in the third quarter.

Exhibit 2.10: Gross Lettings at Gazetted Hotels
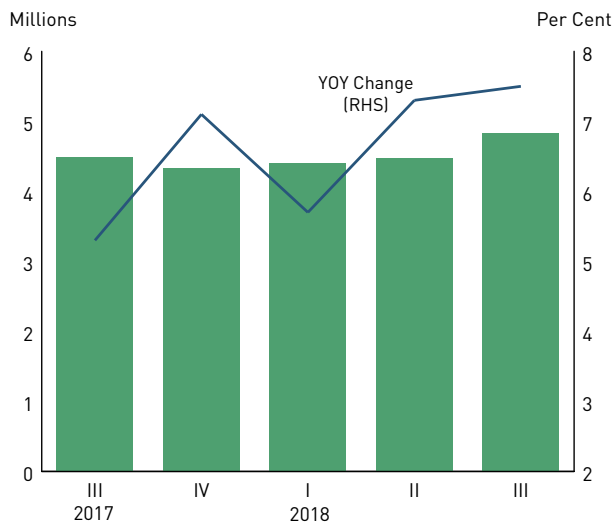
On the other hand, the food services segment remained subdued in the third quarter. The overall volume of food & beverage sales rose marginally by 0.1 per cent during the quarter, easing from the 0.3 per cent expansion in the second quarter (Exhibit 2.11). The weak performance of food caterers and other eating places weighed on the segment's growth over the period. Specifically, the sales volumes of food caterers and other eating places fell by 4.5 per cent and 1.2 per cent respectively in the third quarter. By contrast, the sales volumes of fast food outlets (5.5 per cent) and restaurants (0.9 per cent) rose.

Exhibit 2.11: Changes in Food & Beverage Services Index at Constant Prices
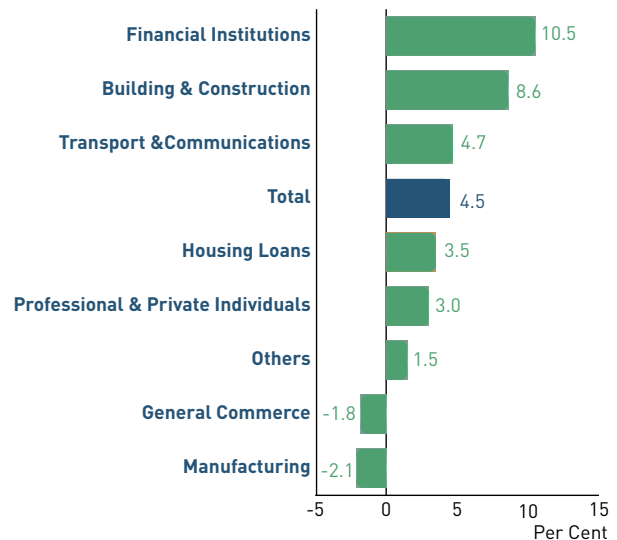

FINANCE & INSURANCE

The finance & insurance sector grew by 5.6 per cent year-on-year in the third quarter, easing from the 6.8 per cent growth in the preceding quarter. Growth was supported by the insurance segment and digital-related activities such as those by payment network players. At the same time, financial intermediation and fund management activities registered slower expansions compared to the previous quarter.

In the financial intermediation segment, Asian Currency Unit (ACU) non-bank lending ceded some momentum, growing by 10 per cent year-on-year in the third quarter compared to the 17 per cent average in the first half of 2018, as loan demand from East Asia and the Americas moderated. Similarly, Domestic Banking Unit (DBU) non-bank lending grew by a slower 4.5 per cent in the third quarter, compared to the 5.6 per cent average in the first half of 2018 (Exhibit 2.12). Notably, loans to the general commerce and manufacturing sectors contracted amidst global trade and political concerns.

Exhibit 2.12: Growth of DBU Loans & Advances to Non-Bank Customers by Industry in 3Q 2018

Growth in the insurance segment was driven by strong demand for both life and general insurance products and services, including reinsurance. Separately, increasing technological adoption has benefited activities such as digital payments. In particular, payment network players have expanded strongly in recent quarters as cashless transactions gain currency. Meanwhile, the fund management segment was weighed down by heightened global financial uncertainty.

BUSINESS SERVICES

The business services sector grew by 2.4 per cent year-on-year in the third quarter, similar to the 2.3 per cent growth in the preceding quarter.

Growth of the sector was driven primarily by the "others"[2] and professional services segments, which expanded on the back of sustained growth in economic activities domestically and in the region.

On the other hand, the real estate segment continued to contract, as the sales transactions of private residential units eased during the quarter on the back of the introduction of property cooling measures. Specifically, the sales transactions of private residential units deteriorated by 14 per cent year-on-year in the third quarter, a reversal from the 4.1 per cent growth in the previous quarter (Exhibit 2.13). This also marked the first decline after twelve consecutive quarters of increases. At the same time, the pickup in private residential property prices moderated to 0.5 per cent on a quarter-on-quarter basis in the third quarter, from 3.4 per cent in the previous quarter.

Exhibit 2.13: Total Sales Transactions for Private Residential Units and Private Residential Property Price Index
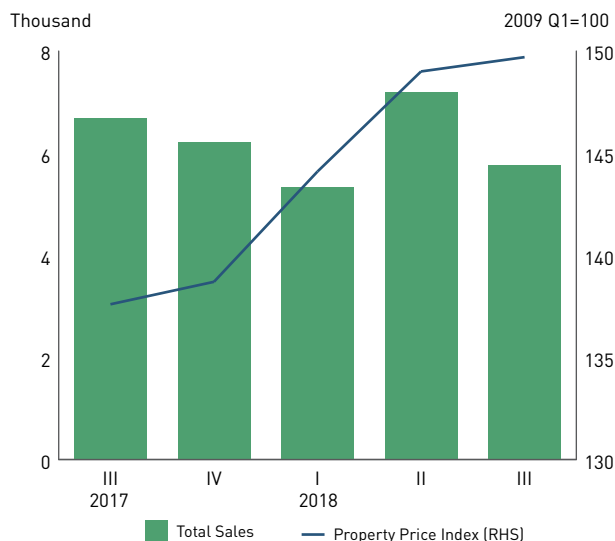
For the private retail space segment, rentals dropped by 1.2 per cent on a quarter-on-quarter basis in the third quarter, similar to the 1.1 per cent decline in the previous quarter (Exhibit 2.14). However, the average occupancy rate of private retail space remained at 92 per cent, unchanged from the preceding quarter.

By contrast, the rentals for private office space remained robust, rising by 2.5 per cent on a quarter-on-quarter basis in the third quarter, marking the fifth consecutive quarter of increase. Reflecting the healthy demand for office space, the average occupancy rate of private office space stayed at 87 per cent despite the injection of new supply into the market.

Exhibit 2.14: Changes in Rentals of Private Sector Office and Retail Spaces
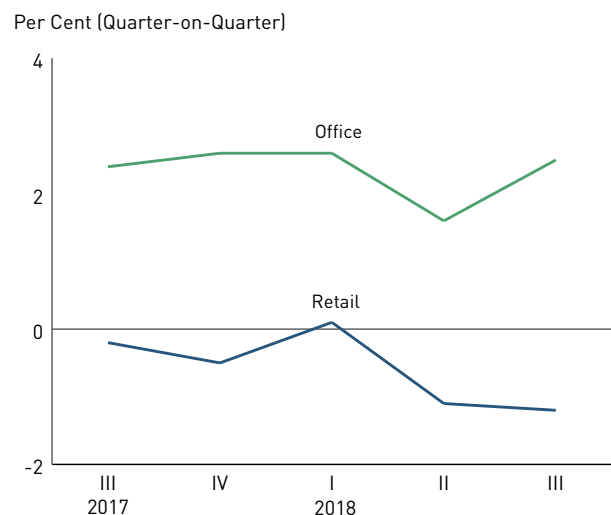
As for the private industrial space market, overall rentals fell marginally by 0.1 per cent on a quarter-on-quarter basis in the third quarter, the same pace of decline seen in the previous quarter (Exhibit 2.15). The occupancy rates for private sector multiple-user factory space and private sector warehouse space stood at 86 per cent and 89 per cent respectively in the third quarter, both of which were similar to the previous quarter's rates.

---

2   The "others" segment consists of (i) rental & leasing, (ii) other professional, scientific & technical services, and (iii) other administrative & support services. Rental & leasing activities include rental & leasing of motor vehicles, rental & leasing of other machinery, equipment and tangible goods and the leasing of non-financial intangible assets.

Exhibit 2.15: Occupancy Rate and Rental Growth of Private Sector Industrial Space

Per Cent   Per Cent (Quarter-on-Quarter)

- Multiple-User Factory Space Occupancy
- Warehouse Space Occupancy
- Rental Growth (RHS)
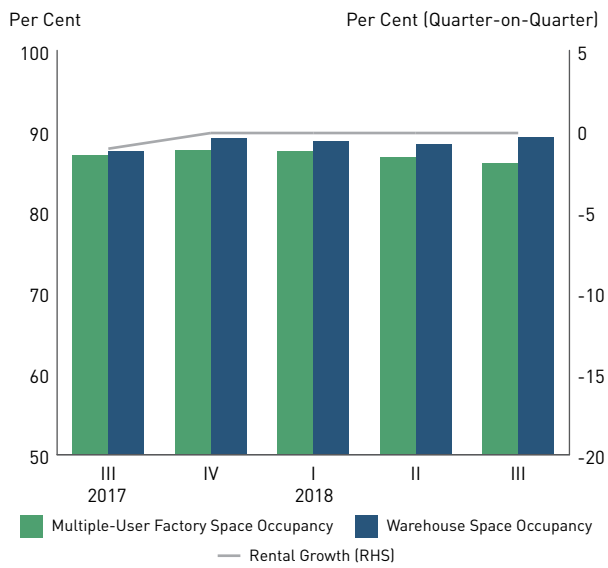
ECONOMIC OUTLOOK

CHAPTER 3
ECONOMIC OUTLOOK

LEADING INDICATORS

On a quarter-on-quarter basis, the composite leading index (CLI) edged down by 0.1 per cent in the third quarter, extending the 0.4 per cent decline in the previous quarter (Exhibit 3.1).

Of the nine components in the CLI, five of them increased on a quarter-on-quarter basis, namely money supply, stock of finished goods, non-oil retained imports, non-oil sea cargo handled and the US Purchasing Managers' Index. By contrast, wholesale trade, stock price and domestic liquidity declined compared to a quarter ago. There was no change in the number of new companies formed.

Exhibit 3.1: Composite Leading Index Levels and Growth Rate
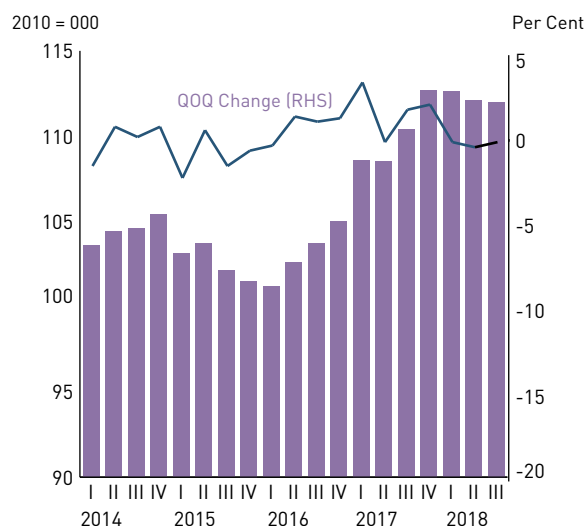
OUTLOOK FOR 2018

At the last Economic Survey of Singapore update in August, MTI maintained the GDP growth forecast for the Singapore economy in 2018 at "2.5 to 3.5 per cent". Underpinning the forecast was the expectation that GDP growth in the second half of 2018 would moderate from that in the first half, given the projected slowdown in growth in Singapore's key final demand markets such as the US and China.

Since then, growth in Singapore's key final demand markets has evolved largely as expected. While the IMF has downgraded the global growth forecast for 2018, this was mainly on account of poorer growth prospects in some emerging market and developing economies such as Latin America. On the other hand, the growth outlook for 2018 for many of Singapore's key external demand markets, including the US, China and ASEAN-5 economies, has remained as earlier projected.

Against this backdrop, the Singapore economy performed broadly in line with expectations in the third quarter, with growth primarily supported by the finance & insurance, manufacturing and business services sectors. Taking into account Singapore's GDP performance in the third quarter, GDP growth in the first three quarters of the year came in at 3.6 per cent on a year-on-year basis.

For the remaining quarter of the year, Singapore's GDP growth is expected to moderate but remain firm. In particular, outward-oriented sectors such as the manufacturing and finance & insurance sectors are expected to continue to expand, albeit at a more moderate pace, and support GDP growth for the rest of the year.

Taking these factors into consideration, the 2018 GDP growth forecast for Singapore is narrowed upwards to **"3.0 to 3.5 per cent"**, from "2.5 to 3.5 per cent".

OUTLOOK FOR 2019

For 2019, the pace of economic expansion across most of the major advanced and regional economies is expected to ease from 2018's levels, in part due to the impact of the ongoing trade conflicts between the US and its key trading partners.

Growth in the US economy is projected to moderate in 2019, as the effect of the fiscal stimulus implemented earlier this year starts to fade and monetary policy tightens further. However, private consumption is expected to continue to support growth on the back of strong labour market conditions and healthy wage growth. Meanwhile, the Eurozone economy's growth is likely to ease slightly in 2019. Growth is expected to be supported by firm domestic demand on the back of an improving labour market, healthy business and consumer sentiments, as well as favourable financing conditions.

In Asia, China's growth is also projected to moderate in 2019 on account of a continued moderation in credit growth and softer external demand, although accommodative macroeconomic policies and stable domestic demand are likely to provide some support to growth. Similarly, growth in the key ASEAN economies is expected to ease or remain unchanged in 2019, supported by resilient domestic demand even as growth in merchandise exports moderates.

On balance, MTI's assessment is that the external demand outlook for the Singapore economy in 2019 is slightly weaker as compared to 2018. At the same time, risks in the global economy are tilted to the downside. First, there is the risk of a further escalation of the ongoing trade conflicts between the US and its key trading partners, which could trigger a sharp fall in global business and consumer confidence. Should this happen, global investment and consumption spending would decline, with adverse impact on economic growth. Second, a faster-than-expected tightening of global financial conditions could lead to disorderly capital outflows from emerging markets, including economies in the region. This could cause financial vulnerabilities to surface in some of these economies, particularly those with elevated debt levels. If this occurs, there could be some pullback in investment and consumption growth, with spillover effects on the rest of the region.

Against this external backdrop, the pace of growth in the Singapore economy is expected to moderate in 2019 as compared to 2018. In particular, the manufacturing sector is likely to see a more modest pace of expansion. Within the sector, the electronics and precision engineering clusters are expected to face external headwinds due to weaker demand conditions in the global semiconductor and semiconductor equipment markets with the fading of the global electronics cycle. Similarly, growth in outward-oriented services sectors such as wholesale trade, transportation & storage and finance & insurance is projected to ease in tandem with the moderation in growth in key advanced and regional economies.

On the other hand, other services sectors such as information & communications and education, health & social services are expected to remain resilient, supported by firms' robust demand for IT and digital solutions and the ramp-up of operations in healthcare facilities respectively. Meanwhile, the performance of the construction sector is projected to improve in 2019, as the pickup in contracts awarded since the second half of 2017 is expected to translate into construction activities in the quarters ahead.

Taking into account the global and domestic economic environment, and barring the full materialisation of downside risks, the Singapore economy is expected to grow by **"1.5 to 3.5 per cent"** in 2019.

FEATURE ARTICLE

APPLICATION MISMATCHES IN THE LABOUR MARKET IN SINGAPORE: ESTIMATES AND EFFECTS

INTRODUCTION

This study examines the effect of mismatches between jobseekers and the jobs that they applied for at the point of application. Using data from MyCareersFuture.sg, we study the effect of application mismatches in the labour market along six dimensions, namely – (i) industry, (ii) occupation, (iii) education, (iv) experience, (v) salary, and (vi) skills mismatches. The key factors driving application mismatch are identified, and machine learning techniques are used to estimate the effects of mismatch on long term unemployment, as well as the probability of unemployed jobseekers securing employment.

FINDINGS

▶ **FINDING 1**

Of the six dimensions of mismatch identified, skills mismatch is the primary driver of application outcomes.

▶ **FINDING 2**

A lower skills mismatch translates to higher application quality, and is thus associated with better application outcomes.

▶ **FINDING 3**

Higher application quantity and lower duration between applications are associated with better application outcomes.

▶ **FINDING 4**

Higher employer activity is associated with better application outcomes.

POLICY TAKEAWAY

The effects of skills mismatch, as well as jobseekers' application behaviour and employers' activity on labour market outcomes, suggest that there is scope to reduce information asymmetry and hence "search frictions". In particular, providing transparent and direct information on skills as well as job roles on MyCareersFuture.sg may help to improve job matching between employers and jobseekers.

EXECUTIVE SUMMARY

With job search activities increasingly migrating online, researchers now have new avenues to study the labour market, especially the job matching process, at an unprecedented level of detail. Using data from MyCareersFuture.sg, we study the different dimensions of mismatches between jobseekers and the jobs they applied for at the point of application, and find that skills mismatch is the most significant mismatch dimension. Segmenting skills mismatch into generic and non-generic skills mismatch, we find that non-generic skills mismatch is a more significant factor than generic skills mismatch.

Next, we apply machine learning approaches to identify the factors that have the greatest effect on labour market application outcomes. The two outcomes examined are the likelihood of unemployed jobseekers securing a successful job match and the risk of unemployed jobseekers becoming long-term unemployed. Our findings again suggest that skills mismatch is an important driver of these outcomes. Apart from skills mismatch, other factors that have a significant impact on application outcomes include the job search effort on the part of the jobseeker.

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]

INTRODUCTION

There are many different forms of labour market mismatches. In this study, we focus narrowly on the mismatches between the jobseekers and the jobs that they applied for at the point of application. While this was difficult to quantify in the past due to a lack of data, we can now leverage on the growing popularity of online job platforms like MyCareersFuture.sg to study application mismatches in the labour market at a more granular level.

This study will offer insights into six dimensions of application mismatches, namely – (i) industry, (ii) occupation, (iii) education, (iv) experience, (v) salary, and (vi) skills mismatches. A key contribution of this analysis is to quantify these mismatches, and empirically determine which of them are the main drivers of application mismatches in the labour market in Singapore. We then extend the analysis by using machine learning techniques to identify the factors that affect the likelihood of a successful job match among unemployed jobseekers, as well as the risk of unemployed jobseekers becoming long-term unemployed (LTU).[2]

The rest of the article is organised as follows. We start by providing a brief introduction to the academic literature in this field. We then describe the data, before presenting our methodology and results. The last section concludes.

LITERATURE REVIEW

The importance of skills as a driver of labour market outcomes is well recognised in the literature. Earlier work in the skills-biased technical change literature (Katz & Murphy, 1992; Autor, Katz, & Krueger, 1998) examined the divergent effect of skills on wages arising from technological change. More recent work on skills finds evidence of a positive correlation between wages and the groups of skills demanded by firms, with the difference in skills requirements accounting for around 12 per cent of the variation in wages (Deming & Kahn, 2017). In a similar vein, this study aims to provide a more granular look at the role of skills by studying its impact on labour market outcomes during the job application phase.

---

1   We would like to thank Yong Yik Wei and Kuhan Harichandra for their useful suggestions and comments. We would also like to thank Workforce Singapore (WSG) for providing inputs related to MyCareersFuture.sg. All remaining errors belong to the authors.
2   For this study, an individual is defined as a LTU if he/she is actively searching for work and has been unemployed for six or more consecutive months.

With the increasing availability of micro data on the job matching process (e.g., through online job portals), studies overseas have applied machine learning techniques on these datasets to identify the factors that are good predictors of various labour market outcomes. For example, Matty et al. (2012) estimated the risk of an individual becoming LTU by applying predictive modelling on UK administrative data, and found that close to 60% of the variation in LTU statuses could be explained by the model. Likewise, Chalfin et al. (2016) applied machine learning techniques on job application and demographic data in order to identify the factors that would be good predictors of job fit for applicants applying to become police officers. In the same vein, for this study, we apply machine learning approaches on data from MyCareersFuture.sg to tease out the factors that affect various labour market application outcomes such as the likelihood of a successful job match.

DATA

Jobs Bank was launched in 2014 as part of the Singapore Government's effort to strengthen the Singaporean core in the workforce. As part of the Fair Consideration Framework -- which mandates that companies consider Singaporeans fairly for job opportunities through an open, merit-based and non-discriminatory recruitment process, companies that wish to hire foreign employees are legislatively required to advertise vacancies on the Jobs Bank before they can be granted Employment Passes. Since April 2018, the Jobs Bank has been replaced by MyCareersFuture.sg (MCF), which aims to provide jobseekers with a smarter job search service through a skills-based job search functionality.

Traditionally, macro-surveillance and research involving Singapore's labour market have relied on data from surveys and administrative sources. With job postings and job search increasingly moving online, the MCF offers a compelling supplementary data source that can be tapped on to provide insights on demand and supply flows in the labour market on a real-time basis.

This study uses anonymised data on jobseekers as well as data on job postings from MCF. The dataset is augmented with firm-level data from the Accounting & Corporate Regulatory Authority's (ACRA) business registry, as well as employment-related data from government agencies. The data covers the period of January to December 2016.[3]

METHODOLOGY AND RESULTS

We first quantify the various dimensions of labour market application mismatches, and then estimate the extent to which they contribute to overall application mismatch on the MCF. Next, we employ machine learning techniques to identify the factors (including the different mismatch dimensions) that have the greatest impact on (i) the likelihood of a successful job match among unemployed jobseekers, and (ii) the risk of unemployed jobseekers becoming LTU.

Quantify the Dimensions of Application Mismatch

We disaggregate the concept of labour market application mismatch into six dimensions – (i) industry, (ii) occupation, (iii) education, (iv) salary, (v) experience, and (vi) skills. Traditionally, the first three mismatch dimensions tend to be more widely studied using established taxonomies (i.e., SSIC, SSOC and SSEC[4] respectively). However, the richness of the data from MCF allows us to study three other dimensions of mismatch. First, as the MCF dataset provides information about each individual's last drawn salary and also a job's offered salary, the two can be put together to analyse the extent of salary expectations mismatch.[5] Second, as we are able to obtain an individual's prior work experience from his/her resume, the work experience can be compared against the requirements of the job that he/she has applied for in order to measure the extent of experience mismatch.[6]

---

3   *While the MCF presents a unique opportunity for us to study the labour market at a granular level, it should be noted that the dataset is largely based on self-reported information from both jobseekers (e.g., last drawn salary and skills possessed) and employers. In addition, although the MCF accounts for a sizeable portion of the online job market in Singapore, there is likely to be some degree of self-selection among jobseekers and employers who opt to use the platform.*
4   *SSIC, SSOC and SSEC refer to the Singapore Standard Industrial Classification, Singapore Standard Occupational Classification and Singapore Standard Educational Classification respectively.*
5   *Jobs posted without an offered salary were dropped from our dataset.*
6   *Experience mismatch is measured by taking the difference between the years of experience demanded by a job, and the years an individual had spent in a relevant industry.*

<u>Third</u>, as the job postings and jobseeker resumes on MCF contain free-text descriptions of the skills that are required in jobs and the skills possessed by jobseekers respectively, we are able to apply text and network analytics to the MCF data to identify these skills and quantify the mismatch in skills between the jobseekers and the jobs they applied for. Specifically, this entails the following steps:

(i)   <u>Build a Skills List</u>: We first train a natural language processing (NLP) algorithm to identify skills from free-text, and apply this to job descriptions in the job postings on MCF. This forms our base list of skills, which we then supplement with skills information provided by WSG and also from SkillsFuture Singapore's (SSG) Skills Frameworks for the various sectors.[7] By combining these sources of information, we are able to derive a consolidated list of approximately 1,000 skills.

(ii)   <u>Construct a Skills Network</u>: Using the skills list compiled, we construct a network to map all pairwise relationships between the skills based on their co-occurrences in job descriptions (i.e., a skill is said to co-occur with another skill if they are both cited together in a job description). This approach is similarly employed by Djumalieva and Sleeman (2018), who applied their network model to detect communities of skills. In our network, the skills are represented by nodes, and every pairwise skills relationship is represented by an edge. The weight of each edge is determined by the extent of co-occurrences of each skill pair throughout our sample of job descriptions. Skill pairs that co-occur frequently are closer to each other in the network, and could be deemed to be more complementary in nature. A visualisation of this network is provided in Exhibit 1:

Exhibit 1: Visualisation of the Skills Network

Edge lengths are determined by the strength of the link information. In particular, stronger link information (i.e. greater co-occurrences and hence complementarity in demand) translate into shorter distances within the network.
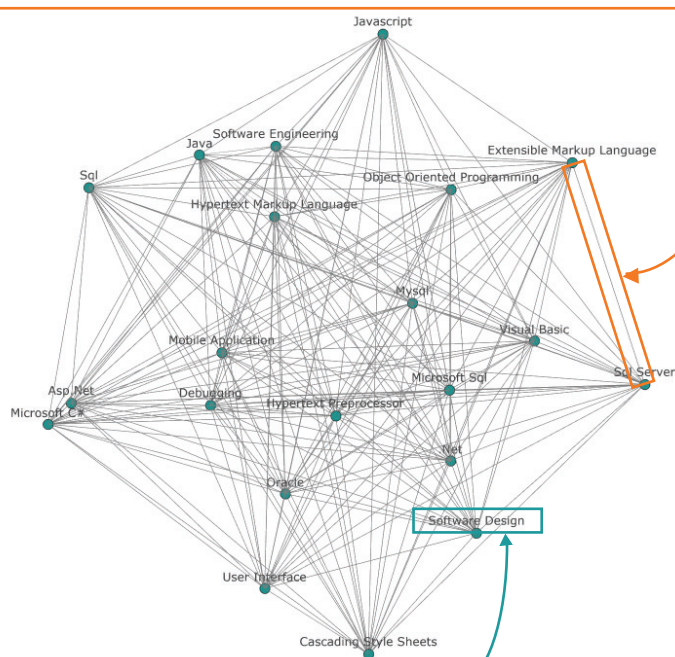
Each skill is represented by a node in the skills network

---

7   *At the point when the research was conducted, SSG had published skills frameworks for the following 13 sectors: Accountancy, Aerospace, Early Childhood Care and Education, Electronics, Energy and Chemicals, Food Services, Hotel and Accommodation Services, Infocomm Technology, Logistics, Marine and Offshore, Precision Engineering, Retail, and Sea Transport.*

(iii)   <u>Segment Generic/Non-Generic Skills</u>: Using the constructed skills network, we then compute the hub and entropy scores for each skill. Hub scores reflect the genericity of any given skill by measuring its propensity to be linked to all other skills in the network, while entropy scores measure how well each skill is spread out across the industries. We define a skill to be generic if it is well-connected to all other skills (i.e., high hub score) and also well spread out across industries (i.e., high entropy score). In particular, we apply a density-based clustering algorithm on the hub and entropy scores of all the skills in our network to select a set of skills with the most generic characteristics. Through this, we are able to classify the skills in our consolidated skills list into generic and non-generic skills. <u>Exhibit 2</u> provides an illustration of the generic and non-generic skills across a sample of industries.

Exhibit 2: Generic/Non-Generic Skills by Industry

	Generic	**Non-Generic**	
Information & Communications (I&C)	• Information Technology • Data Analysis	• Java • Python • C++ • Javascript	• Hadoop • Node.JS • Microsoft SQL
Finance & Insurance (F&I)	• Sales	• Tax • Insurance • Investment • Hyperion	• Business Development • Banking • Risk Management
Healthcare	• Communication • Interpersonal • Teamwork	• Nursing • Medicine	• Occupational Therapy • Physiotherapy
Accommodation & F&B	• Management • Communication • Microsoft Office	• Food Safety • Housekeeping	• Public Relations

(IV)   <u>Quantify Skills Mismatches</u>: Finally, based on the skills taxonomy created, we extract the skills from the resumes of individual jobseekers and compare them with the skills required in the jobs that they have applied for. This allows us to assess the extent to which individual jobseekers have the skills (both generic and non-generic) that are required in the jobs that they have applied for.

Assessing Application Mismatches

Having quantified the various dimensions of application mismatch, we apply an ordered-probit model to estimate each dimension's contribution to overall application mismatch on the MCF platform. Specifically, we run an ordered-probit model using the jobseeker's application status on MCF as our dependent variable.

The application status can take on the values of "Shortlisted", "Received" or "Unsuccessful".[8] We then estimate the impact of the various mismatch dimensions on the status of the application, and compute their average marginal effects on each of the application statuses:

---

8   *There are three broad application statuses in the MCF: (i) Shortlisted (i.e., "Successful" or "Under Review"), (ii) Received, and (iii) Unsuccessful. On an ordinal scale, jobseekers are considered matched when their application is "Shortlisted", and the level of mismatch increases when moving from the application status of "Received" to "Unsuccessful".*

$$\text{Prob}(Y_i = y) = \Phi (\alpha \cdot X_i + \beta_1 \cdot \text{IndustryMismatch}_i + \beta_2 \cdot \text{OccupationMismatch}_i \, \beta_3 \cdot \text{EducationMismatch}_i \qquad (1)$$
$$+ \beta_4 \cdot \text{SalaryExpectationMismatch}_i + \beta_5 \cdot \text{ExperienceMismatch}_{ii} + \beta_6 \cdot \text{GenericSkillMismatch}_i$$
$$+ \beta_7 \cdot \text{NongenericSkillMismatch}_i)$$

where X_i is a vector of control variables for applicant i,
and Y_i is an ordered categorical variable reflecting the application status for applicant i

The average marginal effects of the different mismatch dimensions <u>on the probability of an unsuccessful application</u> are shown in Exhibit 3. Of the mismatch dimensions, we observe that only the effects of occupation and skills mismatch are significant. We also observe that the magnitude of the estimated effects of the two types of skills mismatch (i.e., generic and non-generic) far outweigh any other dimension. Specifically, a one-unit increase in generic skills mismatch is, on average, associated with a 1.5 percentage-point (pp) increase in the probability of an unsuccessful application, while a similar increase in non-generic skills mismatch is associated with a 4.3pp increase in the probability of an unsuccessful application.

Exhibit 3: Average Marginal Effects of Ordered Probit Model of an Unsuccessful Application

Variable	Marginal Effect (pp)
Industry Mismatch	0.116
Occupation Mismatch	0.408***
Education Mismatch	0.092
Salary Expectation Mismatch	0.000
Experience Mismatch	0.002
Generic Skill Mismatch	1.468***
Non-generic Skill Mismatch	4.345***

Note: *** p-value < 0.01

Utilising Machine Learning to Predict Labour Market Application Outcomes

Two labour market application outcomes are examined in this section: (i) likelihood of successful job match among unemployed jobseekers[9], and (ii) risk of an unemployed jobseeker becoming LTU. To study the factors that have the greatest impact on these outcomes, we employ a range of machine learning techniques from logistic regression to random forest. Apart from the six dimensions of mismatches identified earlier, we also include other individual-, job- and firm-level characteristics, as well as additional features such as application activity (e.g., the number of applications made by each jobseeker) and employer activity (i.e., the level of activity on MCF of each employer), in our models.

Based on the optimal model selected,[10] we identify the factors that are best able to predict each of the two labour market application outcomes, viz. successful job match and risk of LTU among unemployed jobseekers. Using Partial Dependence Plots (PDPs) to measure the average marginal effect of each of the factors on the outcomes, we identify three major factors:
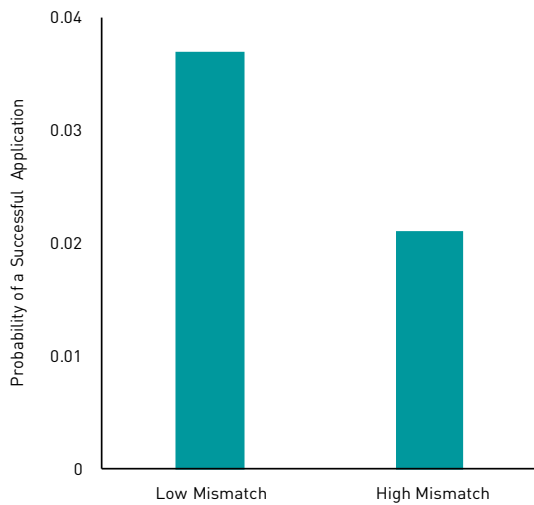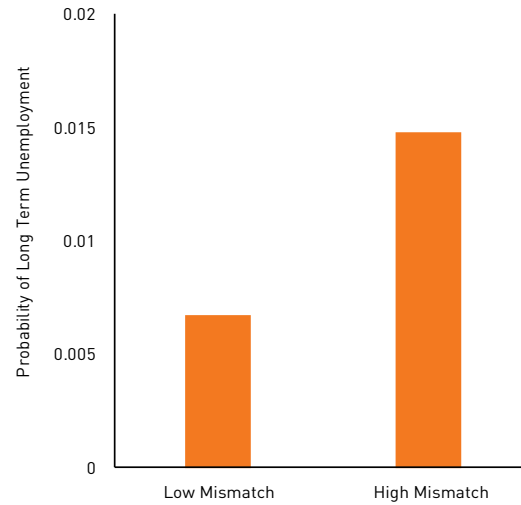
(i) Application Quality
    Consistent with the finding in the previous section, we find that skills mismatch is a key driver of labour market application outcomes. From the PDPs in Exhibit 4, we can see that on average, a higher skills mismatch score is associated with a lower probability of a successful job match among unemployed jobseekers (Exhibit 4a) and a higher risk of them becoming LTU (Exhibit 4b). This suggests that the quality of the application (i.e., whether jobseekers are applying for jobs that they have the skills for) is an important factor that affects the labour market application outcomes of jobseekers.

9   *Successful job matches refer to applications where the individual subsequently worked for the company he/she applied to. Successful job matches are identified through a combination of MCF data and administrative data.*
10 *Due to the heavily imbalanced dataset, we evaluate the models by examining their Area Under Curve (AUC) of the Receiver Operating Characteristic (ROC) and Precision-Recall (PR) curve respectively, and select the model with the highest AUC.*
11 *PDP shows the average marginal effect of each factor on the dependent variable within the dataset used. In other words, it plots how changes in the value of the factor (x-axis) changes the mean prediction of the dependent variable (y-axis), holding the rest constant.*
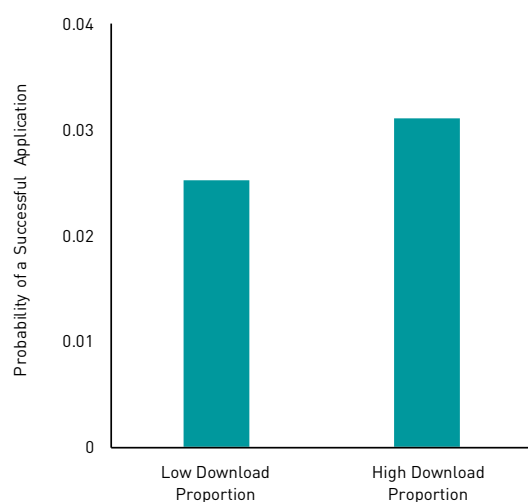
Exhibit 4a: Effect of Skills Mismatch on the Probability of a Successful Application

Exhibit 4b: Effect of Skills Mismatch on the Probability of Long Term Unemployment

(ii)   Application Quantity and Time Duration

We also find that number of applications made by unemployed jobseekers and the duration between applications matter for labour market application outcomes (Exhibit 5). More specifically, we find that the higher the number of applications made by an unemployed jobseeker – which is a proxy for job search effort, the lower the likelihood that the jobseeker would become LTU (Exhibit 5b). This is especially so if the application made is of sufficient quality, as seen from the previous finding. Furthermore, we find that the shorter the time duration between the latest application and the previous application, the higher the probability that the unemployed jobseeker would have a successful job match (Exhibit 5a).

Exhibit 5a: Effect of Application Duration on the Probability of a Successful Application
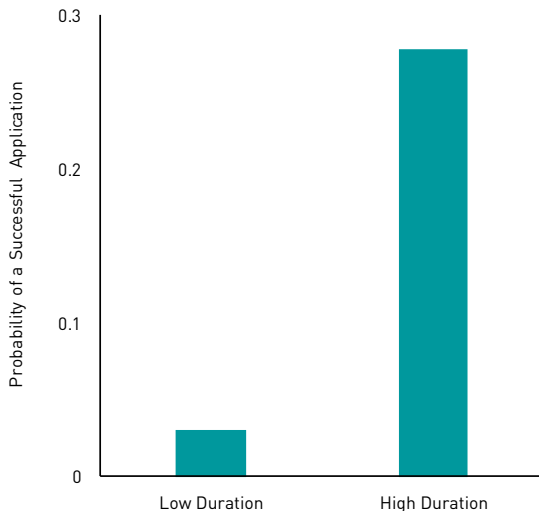
Exhibit 5b: Effect of Application Quantity on the Probability of Long Term Unemployment
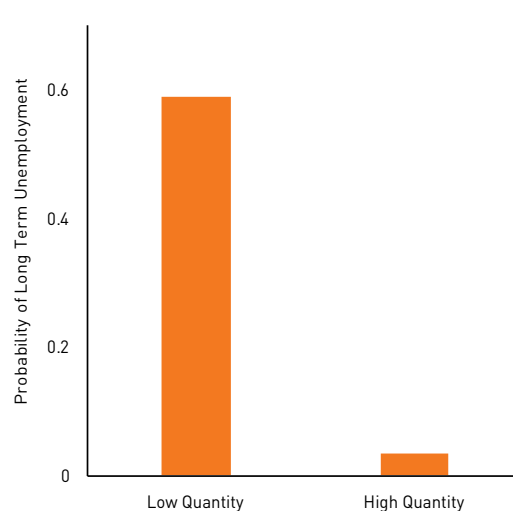
(iii)   Employer Activity

Lastly, we find that applying to jobs posted by employers that are active on the MCF platform also significantly improves labour market application outcomes (Exhibit 6).[12] For example, our results show that applying to employers who are active in reviewing applications on MCF raises the likelihood of a successful job match for the unemployed jobseeker and also reduces his/her risk of becoming LTU.

---

12 An employer's activity level is defined by the proportion of job applications to the employer that is under review by the employer.

Exhibit 6a: Effect of Employer Activity on the Probability of a Successful Application

Exhibit 6b: Effect of Employer Activity on the Probability of Long Term Unemployment
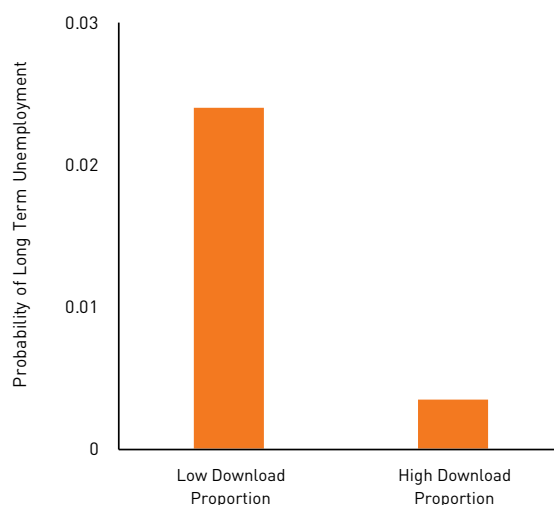
SUMMARY AND CONCLUDING REMARKS

This study finds that skills mismatch is a key driver of labour market application outcomes. For instance, when jobseekers apply for jobs that they lack the skills for, which translates to applications of lower quality, they face a lower probability of a successful job match and a higher risk of becoming LTU. This finding suggests that it would be beneficial for jobseekers to be mindful of the skills requirements of the jobs that they are applying for, and to actively acquire these skills in order to improve their chances of success. To the extent that skills have been found to matter for application outcomes, this finding also suggests that WSG's efforts in encouraging employers to focus on skills to improve job fit may be seeing early signs of success.[13]

We also find evidence that the quantity of applications made by unemployed jobseekers and the time duration between applications for each jobseeker can be good predictors of application outcomes. In particular, unemployed jobseekers who make more applications appear to be at a lower risk of being LTU. Similarly, unemployed jobseekers with a shorter duration between their applications have a better chance of finding a successful job match. These findings suggest that there might be value in considering deliberate nudging of jobseeker behaviour on the MCF platform in order to improve application outcomes.

Lastly, we find that unemployed jobseekers who apply to employers that are more active on the MCF platform tend to enjoy better application outcomes. This finding has two broad implications. First, for jobseekers, it suggests that apart from understanding the requirements of the jobs that they are applying for, it is also pertinent for them to consider the hiring behaviour of employers. Second, for employers, it suggests that there is scope for those that are hitherto less active on MCF to become more active in order to improve their ability to find the right candidates via the platform.

More broadly, our study suggests that a greater availability of information on jobs (e.g., skills required for jobs) would be useful to reduce information asymmetry and hence "search frictions" for jobseekers, thereby improving application outcomes. In this regard, WSG's efforts to reduce information asymmetry on MCF, such as through more transparent and direct information on skills as well as job roles, can be seen as a positive step. We will continue to work with WSG to monitor the effectiveness of these initiatives in reducing search frictions, and find ways to continually improve job matching services on MCF.
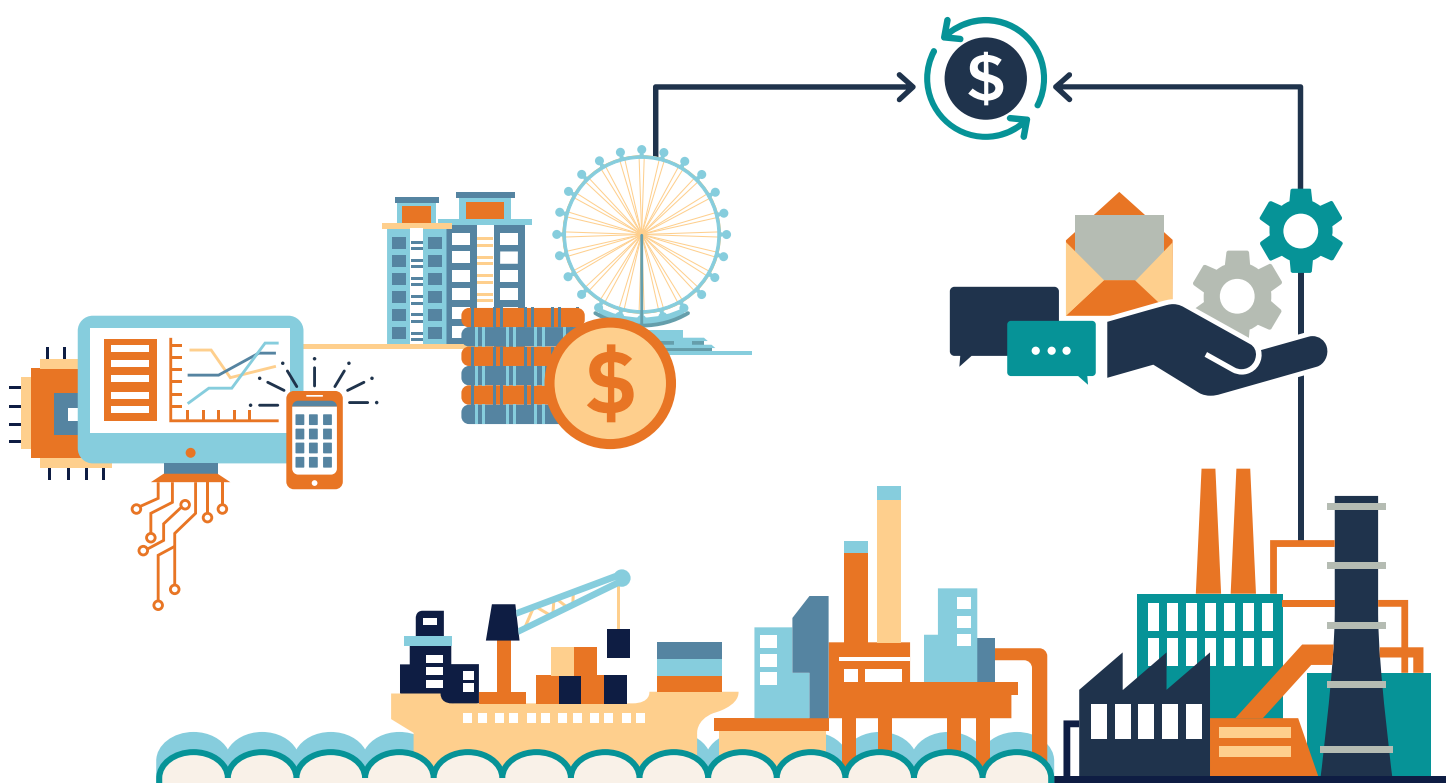
Contributed by:

Mr Tek Yong Jian, Economist
Ms Jessica Foo, Economist
Economics Division
Ministry of Trade and Industry

---

13 *These efforts include encouraging employers to take part in programmes like the Adapt and Grow Professional Conversion Programmes and through the introduction of a job search functionality based on skills on MCF.*

REFERENCES

Autor, D., Katz, L., & Krueger, A. (1998). Computing Inequality: Have Computers Changed the Labor Market? *Quarterly Journal of Economics*, 1169-1241.

Chalfin, A., Danieli, O., Hillis, A., Jelveh, Z., Luca, M., Ludwig, J., & Mullainathan, S. (2016). Productivity and Selection of Human Capital with Machine Learning. *American Economic Review*, 124-127.

Deming, D., & Kahn, L. B. (2017). Skill Requirements across Frism and Labor Markets: Evidence from Job Postings for Professionals. *NBER Working Paper No. 23328*.

Djumalieva, J., & Sleeman, C. (2018). *Linking skills to occupations: Using big data to build a new occupational taxonomy for the UK. Nesta*.

Katz, L. F., & Murphy, K. M. (1992). Changes in Relative Wages, 1963-1987. *The Quarterly Journal of Econmoics*, 35-78.

Matty, S., Hart, A., Pinto, D., & Williamson, J. (2013). *Predicting likelihood of long term unemployment: the development of a UK jobseekers' classification instrument*. London: Department of Work and Pensions.