



ECONOMIC SURVEY^{OF} SINGAPORE

THIRD QUARTER 2023

November 2023

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Republic of Singapore

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MAIN INDICATORS OF THE SINGAPORE ECONOMY

OVERALL ECONOMY

Real Gross Domestic Product
(YoY Growth)



Period	YoY Growth
2023	+0.5%
3Q23	+1.1%

Gross Domestic Product
at Current Market Prices



Period	Value (billion)
2023	\$163.2
3Q23	\$164.9

PRICES

Consumer Price Index — All Items
(YoY Growth)



Period	YoY Growth
2023	+5.1%
3Q23	+4.1%

Domestic Supply Price Index
(YoY Growth)



Period	YoY Growth
2023	-13.7%
3Q23	-4.4%

LABOUR MARKET

Change in Employment
(QoQ Change)



Period	Change (thousand)
2023	+26.8
3Q23	+29.6

Overall Unemployment Rate



Period	Rate (%)
Jun23	1.9%
Sep23	2.0%

Value-Added per Actual Hour Worked
(YoY Growth)



Period	YoY Growth
2023	-4.7%
3Q23	-0.6%

COSTS

Unit Labour Cost of Overall Economy
(YoY Growth)



Period	YoY Growth
2023	+10.5%
3Q23	+8.7%

Unit Business Cost of Manufacturing
(YoY Growth)



Period	YoY Growth
2023	+7.2%
3Q23	+6.4%

Unit Labour Cost of Manufacturing
(YoY Growth)



Period	YoY Growth
2023	+16.7%
3Q23	+11.0%

MERCHANDISE TRADE

Merchandise Exports



Period	Value (million)	YoY Growth
2023	\$153,117	-16.9%
3Q23	\$160,431	-15.6%

Merchandise Imports



Period	Value (million)	YoY Growth
2023	\$137,512	-20.7%
3Q23	\$144,974	-17.3%

SERVICES TRADE

Services Exports



Period	Value (million)	YoY Growth
2023	\$98,521	-2.5%
3Q23	\$99,119	-2.8%

Services Imports



Period	Value (million)	YoY Growth
2023	\$89,441	-0.6%
3Q23	\$89,535	-1.0%

CHAPTER

1

THE SINGAPORE ECONOMY





Chapter 1

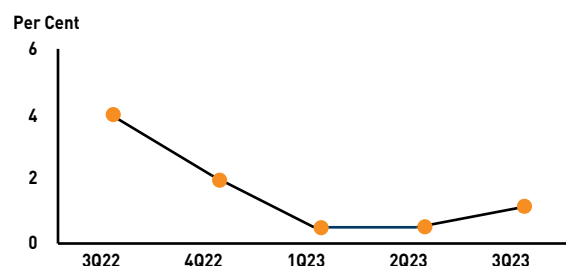
THE SINGAPORE ECONOMY

ECONOMIC PERFORMANCE

Real GDP grew by
1.1% in 3Q23



Quarterly Growth (YoY)



Main Drivers of Growth in 3Q23

Other Services Industries



0.4%-point
contribution

Information & Communications



0.3%-point
contribution

LABOUR MARKET

Resident Unemployment Rate



2.8%
in September 23

Employment (QoQ Change)



+29,600
employed in 3Q23

PRODUCTIVITY

(YoY Growth)
Value-Added per Actual Hour
Worked decreased by

0.6% in 3Q23



Sectors with the Highest Employment Growth in 3Q23

+13,100
employed



Other Services Industries

+3,900
employed



Construction

+2,900
employed



Finance & Insurance

Sectors with the Highest Growth in Value-Added per Actual Hour Worked in 3Q23

5.8%



Information & Communications

4.4%



Administrative & Support Services

4.1%



Real Estate

COSTS (YoY Growth)

Overall Unit Labour
Cost increased by
8.7% in 3Q23



Within the Manufacturing Sector

6.4%



Unit Business
Cost

11.0%



Unit Labour
Cost

PRICES (YoY Growth)

The Consumer Price
Index (CPI) rose by
4.1% in 3Q23



Categories with Price Increases

5.3%



Recreation
& Culture

4.9%



Transport

4.8%



Food

INTERNATIONAL TRADE (YoY Growth)

Total Merchandise
Exports decreased by
15.6% in 3Q23



Total Services
Exports decreased by
2.8% in 3Q23



-9.7%



Re-Exports

-18.8%



Non-Oil
Domestic
Exports

-26.9%



Oil
Domestic
Exports

Services Exports decline was led by...

-11.1%-pt



Transport

0.0%-pt



Manufacturing
Services

OVERVIEW

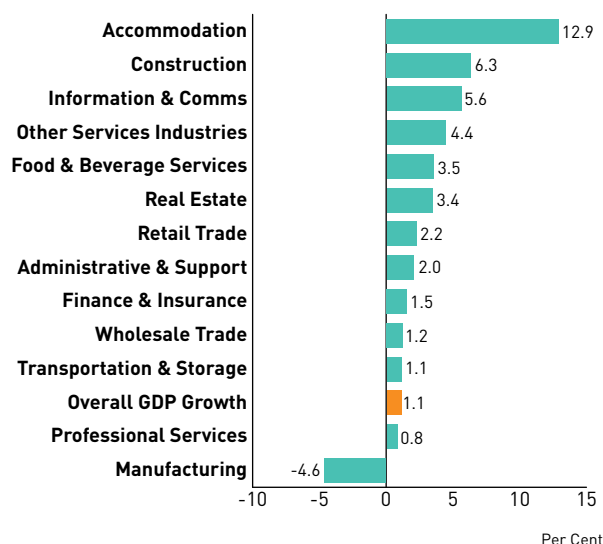
In the third quarter of 2023,

- The Singapore economy expanded by 1.1 per cent on a year-on-year basis. The sectors that contributed the most to GDP growth during the quarter were the other services industries, information & communications and wholesale trade sectors.
- The seasonally-adjusted unemployment rates rose marginally at the overall level, for residents and for citizens, but remained below their respective pre-pandemic levels. The number of retrenchments also increased over the quarter.
- Total employment rose by 29,600 on a quarter-on-quarter basis, extending the gains in the preceding quarter. Excluding Migrant Domestic Workers (MDWs), total employment increased by 24,000.
- The Consumer Price Index-All Items (CPI-All Items) rose by 4.1 per cent on a year-on-year basis, moderating from the 5.1 per cent increase in the preceding quarter.

OVERALL PERFORMANCE

The Singapore economy expanded by 1.1 per cent on a year-on-year basis in the third quarter of 2023, faster than the 0.5 per cent growth in the previous quarter. (Exhibit 1.1). On a quarter-on-quarter seasonally-adjusted basis, the economy grew by 1.4 per cent, accelerating from the 0.1 per cent expansion in the previous quarter.

Exhibit 1.1: GDP and Sectoral Growth Rates in 3Q 2023

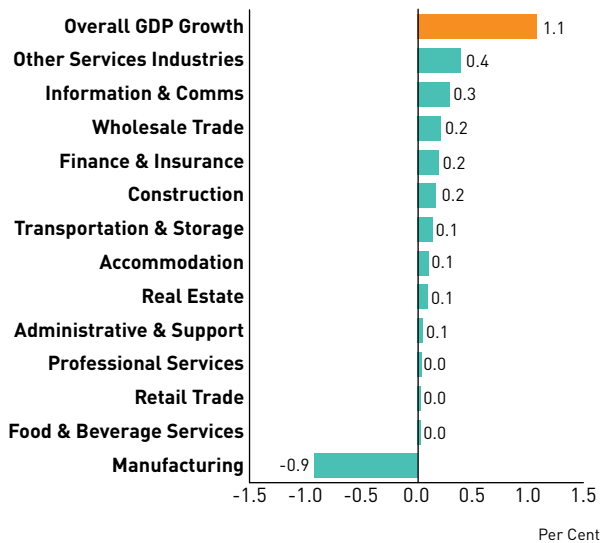


The manufacturing sector shrank by 4.6 per cent year-on-year, moderating from the 7.6 per cent contraction in the second quarter. All clusters within the sector contracted except for the transport engineering cluster which surged by 16.6 per cent. Among the clusters that contracted, biomedical manufacturing (-13.3 per cent), precision engineering (-10.7 per cent) and general manufacturing (-8.0 per cent) saw the largest declines.

The services producing industries grew by 2.3 per cent year-on-year, moderating from the 2.8 per cent growth registered in the previous quarter. Growth was supported by expansions in all services sectors, with the accommodation (12.9 per cent), information & communications (5.6 per cent) and other services (4.4 per cent) sectors recording the fastest expansions.

The construction sector grew by 6.3 per cent year-on-year, easing from the 7.7 per cent growth in the preceding quarter. Both public and private sector construction output increased during the quarter.

The top three positive contributors to GDP growth in the third quarter were the other services industries, information & communications and wholesale trade sectors (Exhibit 1.2).

Exhibit 1.2: Percentage-Point Contribution to Growth in Real GDP in 3Q 2023 (By Sector)

SOURCES OF GROWTH

Total demand fell by 0.3 per cent year-on-year in the third quarter of 2023, moderating from the 2.2 per cent decrease in the previous quarter (Exhibit 1.3). The decline in total demand during the quarter was due to a decrease in external demand, which was partially offset by an increase in domestic demand.

External demand fell by 1.0 per cent year-on-year, extending the 1.1 per cent contraction in the previous quarter. Meanwhile, domestic demand rose by 1.5 per cent year-on-year, a reversal from the 5.5 per cent decline in the preceding quarter.

Within domestic demand, consumption expenditure rose by 4.1 per cent year-on-year, faster than the 0.4 per cent increase in the preceding quarter. The increase in consumption expenditure was due to higher public (3.4 per cent) and private consumption expenditure (4.4 per cent).

Meanwhile, gross fixed capital formation (GFCF) decreased by 0.7 per cent year-on-year, easing from the 2.8 per cent decline in the previous quarter. The decrease in GFCF during the quarter was due to a decline in private sector GFCF (-2.0 per cent), which outweighed the increase in public sector GFCF (6.1 per cent). Public sector GFCF rose due to higher investments in public construction & works, machinery & equipment and intellectual property products, which more than offset lower public transport equipment investments. Meanwhile, private sector GFCF fell on the back of lower investments in private machinery & equipment, which more than offset the higher investments in private construction & works, transport equipment and intellectual property products.

Exhibit 1.3: Changes in Total Demand*

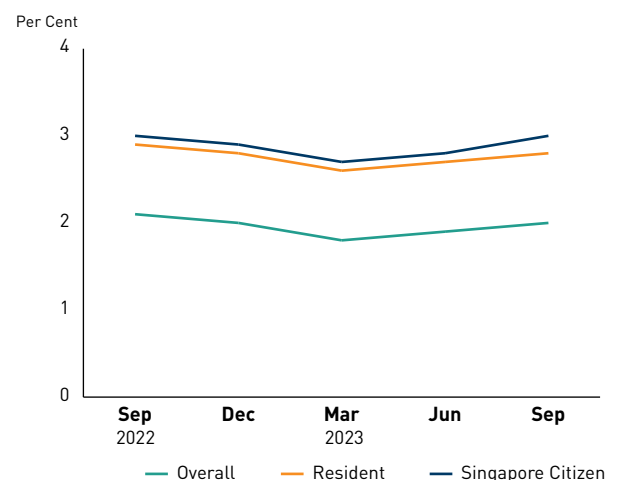
	2022		2023		
	III	IV	I	II	III
Total Demand	3.1	-4.1	1.2	-2.2	-0.3
External Demand	3.2	-7.0	1.9	-1.1	-1.0
Total Domestic Demand	2.8	4.6	-0.8	-5.5	1.5
Consumption Expenditure	7.9	6.7	6.2	0.4	4.1
Public	-3.6	-1.5	5.7	-4.1	3.4
Private	12.0	9.5	6.2	1.9	4.4
Gross Fixed Capital Formation	3.4	-1.2	0.5	-2.8	-0.7
Changes in Inventories	-2.1	0.4	-3.1	-3.1	-0.5

* For inventories, this refers to the contribution to GDP growth.

LABOUR MARKET

Unemployment and Retrenchment¹

Compared to June 2023, the seasonally-adjusted unemployment rates in September 2023 increased marginally at the overall level (from 1.9 per cent to 2.0 per cent), for residents (from 2.7 per cent to 2.8 per cent) and for citizens (2.8 per cent to 3.0 per cent) (Exhibit 1.4). As of September 2023, unemployment rates for the three groups remained below their respective pre-pandemic levels.²

Exhibit 1.4: Unemployment Rate (Seasonally-Adjusted)

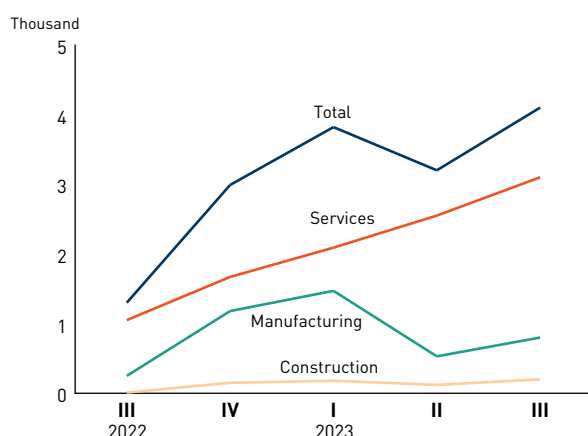
¹ Retrenchment figures pertain to private sector establishments with at least 25 employees and the public sector.

² The average pre-pandemic (i.e., 2018 and 2019) overall, resident and citizen unemployment rates were 2.2 per cent, 3.0 per cent and 3.2 per cent respectively.

In September 2023, an estimated 68,000 residents, including 60,300 Singapore citizens, were unemployed. These were higher than the number of unemployed residents (65,600) and citizens (57,800) in June 2023.³

Total retrenchments rose to 4,100 in the third quarter of 2023, from 3,200 in the preceding quarter (Exhibit 1.5). Over the quarter, retrenchments increased in the services (from 2,550 to 3,100), manufacturing (from 530 to 800), and construction (from 120 to 200) sectors.

Exhibit 1.5: Retrenchments



Employment⁴

Total employment increased by 29,600 on a quarter-on-quarter basis in the third quarter of 2023, extending the gains recorded in the preceding quarter (26,800) (Exhibit 1.6). Excluding MDWs, total employment rose by 24,000, on the back of employment growth for both residents and non-residents.

Total employment growth was largely driven by the services sector (+25,700; or +20,100 excluding MDWs), supported by employment gains in the other services (+13,100), finance & insurance services (+2,900), and professional services (+2,100) sectors (Exhibit 1.7). Over the same period, employment in the construction sector rose by 3,900 while it declined in the manufacturing sector (-100).

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

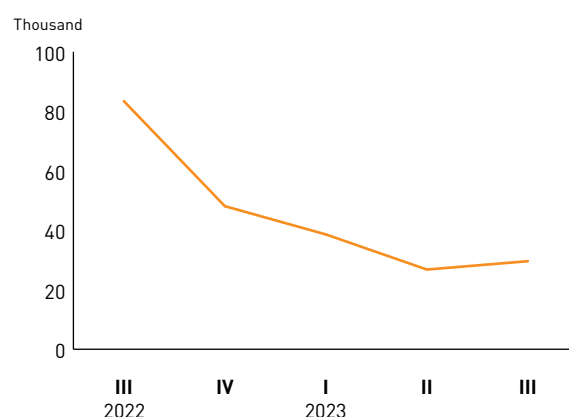
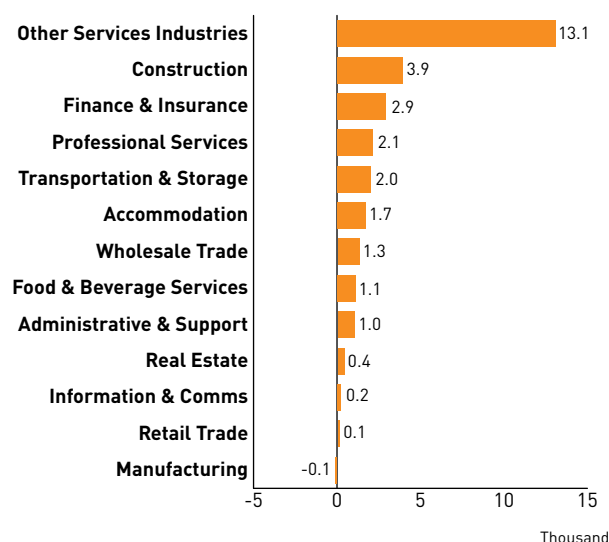


Exhibit 1.7: Changes in Employment by Sector in 3Q 2023



³ Based on seasonally-adjusted data on the number of unemployed persons.

⁴ Based on preliminary estimates.

Hiring Expectations

According to EDB's latest Business Expectations Survey for the Manufacturing Sector, hiring expectations in the sector were slightly negative. Specifically, a net weighted balance of 3 per cent of manufacturers expected to hire fewer workers in the fourth quarter of 2023 as compared to the third quarter. Firms in the marine & offshore engineering segment of the transport engineering cluster were the most positive, with a net weighted balance of 34 per cent of firms expecting to increase hiring in the fourth quarter. By contrast, firms in the precision modules & components segment of the precision engineering cluster were the most negative, with a net weighted balance of 25 per cent of firms expecting a lower level of hiring in the fourth quarter.

Hiring expectations for services firms remained positive. According to DOS' latest Business Expectations Survey for the Services Sector, a net weighted balance of 12 per cent of services firms expected to increase hiring in the fourth quarter of 2023 as compared to the third quarter. Among the services sectors, firms in the accommodation sector had the strongest hiring sentiments, with a net weighted balance of 45 per cent of firms expecting to increase hiring in the fourth quarter. On the other hand, firms in the finance & insurance sector were the most negative, with a net weighted balance of 0 per cent of firms expecting to hire more workers in the fourth quarter.

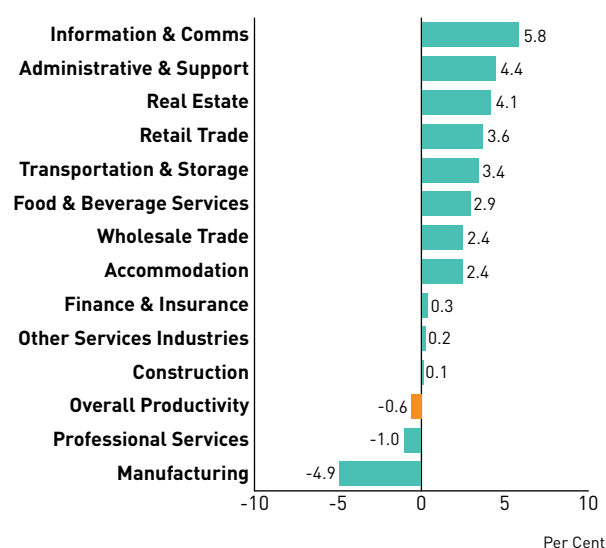
COMPETITIVENESS

Productivity

Overall labour productivity, as measured by real value-added per actual hour worked, fell by 0.6 per cent year-on-year in the third quarter of 2023, moderating from the 4.7 per cent decline in the previous quarter (Exhibit 1.8).⁵

Among the sectors, the information & communications (5.8 per cent), administrative & support services (4.4 per cent) and real estate (4.1 per cent) sectors recorded the strongest productivity gains in the third quarter. The retail trade (3.6 per cent), transportation & storage (3.4 per cent), food & beverage services (2.9 per cent), wholesale trade (2.4 per cent), accommodation (2.4 per cent), finance & insurance (0.3 per cent), other services (0.2 per cent) and construction (0.1 per cent) sectors also saw productivity improvements. By contrast, productivity declines were observed in the manufacturing (-4.9 per cent) and professional services (-1.0 per cent) sectors.

Exhibit 1.8: Changes in Value-Added per Actual Hour Worked for the Overall Economy and Sectors in 3Q 2023



In the third quarter, the productivity of the outward-oriented sectors as a whole fell by 0.1 per cent year-on-year, moderating from the 4.9 per cent decline in the previous quarter.⁶ Meanwhile, the productivity of the domestically-oriented sectors as a whole increased by 0.9 per cent year-on-year, reversing the 0.7 per cent decline in the preceding quarter.

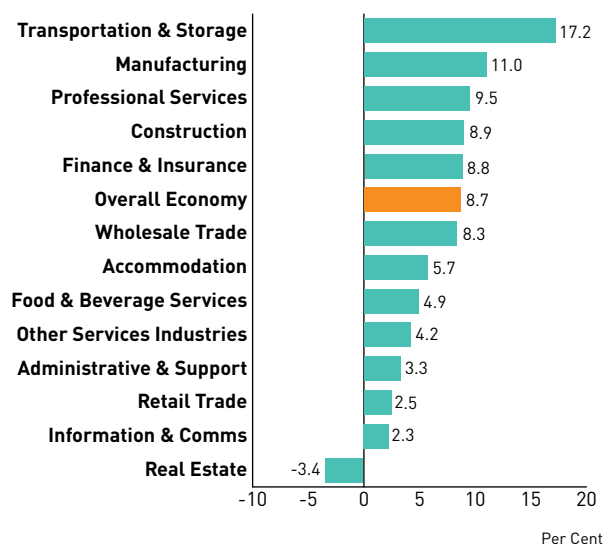
⁵ Similarly, overall labour productivity as measured by real value-added per worker, fell by 3.0 per cent in the third quarter of 2023, moderating from the 4.9 per cent decline in the preceding quarter.

⁶ 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, real estate, administrative & support services and other services industries.

Unit Labour Cost and Unit Business Cost

Overall unit labour cost (ULC) for the economy rose by 8.7 per cent on a year-on-year basis in the third quarter of 2023 (Exhibit 1.9), moderating from the 10.5 per cent increase in the preceding quarter. The rise in overall ULC during the quarter was due to an increase in total labour cost per worker along with a fall in labour productivity as measured by real value-added per worker.

Exhibit 1.9: Changes in Unit Labour Cost in 3Q 2023



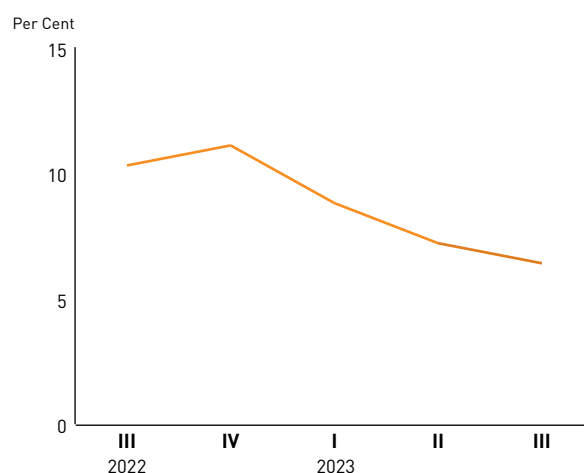
By sectors, the ULC for the construction sector was 8.9 per cent higher year-on-year in the third quarter as a fall in labour productivity was accompanied by an increase in total labour cost per worker.

The ULC for services producing industries rose by 7.3 per cent year-on-year. Among the services sectors, ULC increased the most in the transportation & storage sector (17.2 per cent), reflecting a pickup in total labour cost per worker alongside a decline in productivity. Meanwhile, ULC fell in the real estate (-3.4 per cent) sector on the back of productivity gains and a fall in total labour cost per worker.

Over the same period, the ULC for the manufacturing sector picked up by 11.0 per cent year-on-year. The rise in the sector's ULC occurred on the back of a fall in labour productivity while total labour cost per worker rose.

Unit business cost (UBC) for the manufacturing sector rose by 6.4 per cent on a year-on-year basis in the third quarter of 2023, moderating from the 7.2 per cent increase in the previous quarter (Exhibit 1.10). The rise in UBC during the quarter was due to the increase in unit services costs (4.9 per cent), manufacturing ULC (11.0 per cent) and unit non-labour production taxes (13.9 per cent).

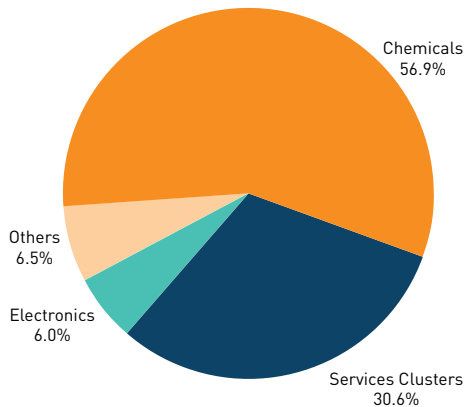
Exhibit 1.10: Changes in the Manufacturing Unit Business Cost



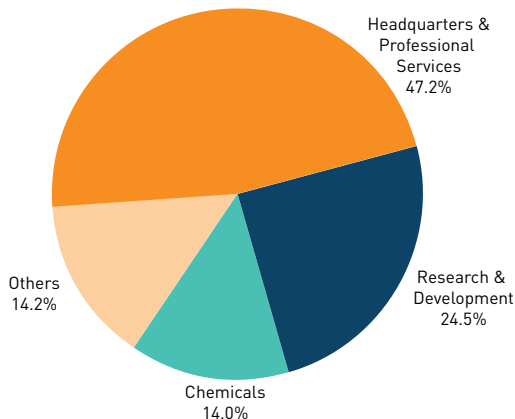
Investment Commitments

Investment commitments garnered by the Economic Development Board (EDB) in terms of Fixed Asset Investments (FAI) and Total Business Expenditure (TBE) amounted to \$7.4 billion and \$2.8 billion respectively in the third quarter of 2023 (Exhibit 1.11 and Exhibit 1.12).

For FAI, the largest contribution came from the manufacturing sector, which attracted \$5.1 billion worth of commitments. Within the manufacturing sector, the chemicals and electronics clusters garnered the largest amounts of commitments, at \$4.2 billion and \$445 million respectively. Meanwhile, the research & development cluster attracted the most FAI commitments within the services sector, at \$1.8 billion. Investors from the United States contributed the most to total FAI, at \$5.0 billion (67.8 per cent).

Exhibit 1.11: Fixed Asset Investments by Industry Cluster in 3Q 2023

For TBE, the services sector attracted the highest amount of commitments, at \$2.1 billion. Within the sector, the headquarters & professional services and research & development clusters garnered the most TBE commitments, at \$1.3 billion and \$678 million respectively. Among the manufacturing clusters, the chemicals and electronics clusters attracted the largest amounts of TBE commitments, at \$389 million and \$213 million respectively. Investors from the United States were the largest source of TBE commitments, with commitments of \$1.3 billion (46.5 per cent).

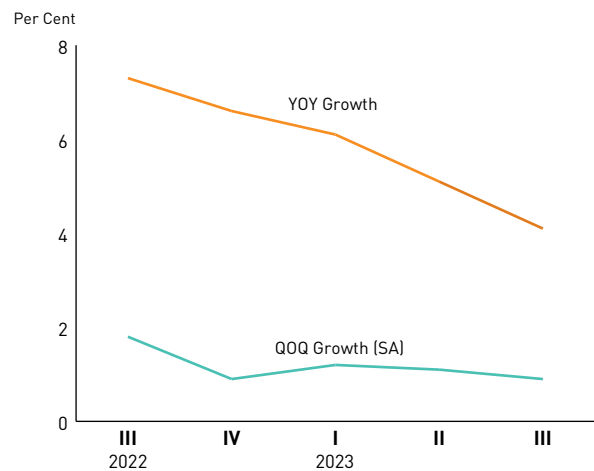
Exhibit 1.12: Total Business Expenditure by Industry Cluster in 3Q 2023

When these projects are fully implemented in the coming years, they are expected to generate \$13.4 billion of value-added and to create more than 7,800 jobs.

PRICES

Consumer Price Index

Consumer Price Index-All Items (CPI-All Items) rose by 4.1 per cent on a year-on-year basis in the third quarter of 2023, moderating from the 5.1 per cent increase in the preceding quarter (Exhibit 1.13). On a quarter-on-quarter seasonally-adjusted basis, CPI-All Items inflation came in at 0.9 per cent, slowing from the 1.1 per cent recorded in the previous quarter.

Exhibit 1.13: Changes in CPI

Most CPI categories saw price increases on a year-on-year basis in the third quarter of 2023, thus contributing positively to CPI-All Items inflation during the quarter. Food prices rose by 4.8 per cent on account of the higher costs of food services, such as hawker food and restaurant meals, as well as non-cooked food items such as bread & cereals, milk, cheese & eggs, and fish & seafood. Housing & utilities costs increased by 3.8 per cent because of a higher costs of accommodation. Prices of household durables & services went up by 1.8 per cent as the prices of household durables and domestic & household services increased. Healthcare costs rose by 4.3 per cent on the back of an increase in the costs of outpatient and hospital services. Transport costs climbed by 4.9 per cent due to an increase in costs of cars and higher bus & train fares outweighed lower airfares. Communication costs picked up by 3.0 per cent on account of a rise in the prices of telecommunication services. Recreation & culture prices increased by 5.3 per cent as a result of the higher costs of holiday travel, as well as recreational & cultural services. Education costs rose by 2.5 per cent because of higher fees at commercial institutions and universities. Prices of miscellaneous goods & services increased by 3.6 per cent due to a rise in the costs of personal care items and alcoholic drinks & tobacco. By contrast, clothing & footwear prices fell by 0.5 per cent, mainly driven by cheaper ready-made garments.

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

Per Cent

	2022		2023		
	III	IV	I	II	III
All items	7.3	6.6	6.1	5.1	4.1
Food	6.5	7.3	8.0	6.6	4.8
Clothing & Footwear	7.1	5.2	6.8	4.5	-0.5
Housing & Utilities	6.0	5.7	5.3	4.4	3.8
Housing Durables & Services	2.1	2.3	2.6	1.9	1.8
Healthcare	2.7	2.8	4.0	4.6	4.3
Transport	19.4	14.3	9.2	6.4	4.9
Communication	-0.8	-0.5	2.1	2.7	3.0
Recreation & Culture	5.6	6.3	6.8	6.5	5.3
Education	2.2	2.0	3.0	2.7	2.5
Miscellaneous Goods & Services	0.5	1.1	2.6	3.3	3.6

INTERNATIONAL TRADE

Merchandise Trade

Singapore's total merchandise trade contracted by 16.4 per cent on a year-on-year basis in the third quarter, moderating from the 18.7 per cent decline in the preceding quarter (Exhibit 1.15). The decline in total merchandise trade was due to decreases in both non-oil trade (-14.1 per cent) and oil trade (-25.1 per cent).

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

Per Cent

	2022			2023		
	III	IV	ANN	I	II	III
Merchandise Trade	25.7	-1.0	17.7	-7.8	-18.7	-16.4
Merchandise Exports	23.4	-2.3	15.6	-6.5	-16.9	-15.6
Domestic Exports	27.9	-2.1	18.2	-7.9	-19.5	-22.2
Oil	75.2	21.6	52.4	8.5	-28.1	-26.9
Non-Oil	7.1	-14.0	3.0	-16.1	-13.4	-18.8
Re-Exports	19.8	-2.4	13.5	-5.3	-14.6	-9.7
Merchandise Imports	28.1	0.5	20.1	-9.3	-20.7	-17.3
Oil	58.8	8.2	43.9	-7.0	-34.4	-25.0
Non-Oil	21.2	-1.4	14.6	-9.9	-16.4	-15.0

Total merchandise exports contracted by 15.6 per cent in the third quarter, following the 16.9 per cent decrease in the preceding quarter. This was due to declines in both domestic exports (-22.2 per cent) and re-exports (-9.7 per cent).

The decline in domestic exports was on account of lower oil domestic exports (-26.9 per cent) and non-oil domestic exports (NODX) (-18.8 per cent). In volume terms, oil domestic exports declined by 16.5 per cent.

Meanwhile, NODX decreased by 18.8 per cent in the third quarter, following the 13.4 per cent contraction in the previous quarter. The decline in NODX was due to decreases in both electronics and non-electronics domestic exports.

Total merchandise imports contracted by 17.3 per cent in the third quarter, easing from the 20.7 per cent decline in the previous quarter, as both oil and non-oil imports fell. Specifically, oil imports contracted by 25.0 per cent, while non-oil imports declined by 15.0 per cent due to lower electronics and non-electronics imports.

Services Trade

Total services trade contracted by 1.9 per cent on a year-on-year basis in the third quarter, extending the 1.6 per cent decline in the previous quarter (Exhibit 1.16). Both the exports and imports of services saw negative year-on-year growth during the quarter.

Services exports fell by 2.8 per cent in the third quarter, following the 2.5 per cent decrease in the preceding quarter. This was largely driven by a fall in the exports of transport services, which more than offset the increases in the exports of travel services, financial services and charges for the use of intellectual property. Meanwhile, services imports contracted by 1.0 per cent, as compared to the 0.6 per cent decrease in the previous quarter. The fall in services imports was mainly due to the decrease in the imports of transport services, which outweighed increases in the imports of travel services, financial services and other business services.

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

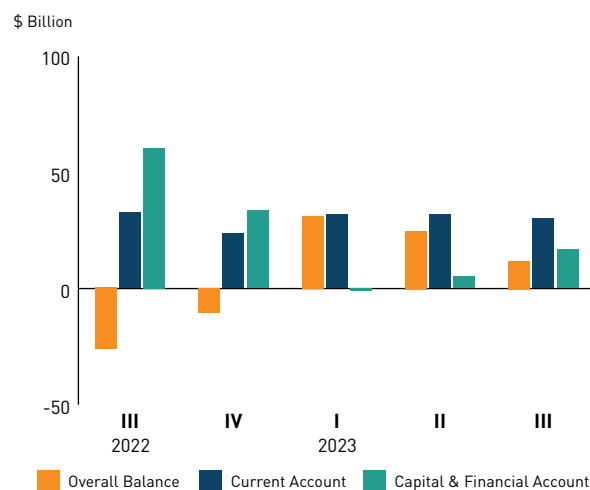
Per Cent

	2022			2023		
	III	IV	ANN	I	II	III
Total Services Trade	12.5	7.0	10.8	1.9	-1.6	-1.9
Services Exports	14.1	8.2	12.1	0.6	-2.5	-2.8
Services Imports	10.6	5.7	9.3	3.8	-0.6	-1.0

BALANCE OF PAYMENTS

Singapore recorded an overall balance of payments surplus of \$12.2 billion in the third quarter of 2023, narrower than the surplus of \$25.1 billion in the preceding quarter (Exhibit 1.17).

Exhibit 1.17: Balance of Payments



Current Account

The current account surplus declined to \$30.1 billion in the third quarter of 2023, from \$31.5 billion in the previous quarter. The decline was mainly due to the fall in the goods trade surplus, which more than offset the increase in the services trade surplus and the narrowing primary income deficit.

The surplus in the goods balance fell by \$2.8 billion to \$52.1 billion in the third quarter, as goods imports increased by more than goods exports.

In comparison, the surplus in the services balance rose by \$0.5 billion to \$9.6 billion in the third quarter. This was mainly due to the increase in net receipts for maintenance & repair services and other business services, as well as the decrease in net payments for telecommunications, computer & information services, which more than outweighed the increase in net payments for transport services.

At the same time, the primary income deficit narrowed by \$0.9 billion to \$29.6 billion in the third quarter, as primary income receipts rose while payments fell slightly.

The secondary income deficit edged up by \$0.1 billion to \$2.0 billion in the third quarter, as secondary income receipts declined more than the fall in payments.

Capital and Financial Account⁷

The capital and financial account registered a net outflow of \$16.4 billion in the third quarter of 2023, larger than the net outflow of \$4.9 billion recorded in the preceding quarter. The increase in net outflows was driven by the step-up in net outflows of portfolio investment and the decline in net inflows of direct investment. These more than offset the reversal from net outflows to net inflows of “other investment” as well as the decline in net outflows of financial derivatives.

Net outflows of portfolio investment rose by \$12.2 billion to \$38.3 billion in the third quarter as resident deposit corporations and the non-bank private sector recorded increases in net outflows.

At the same time, net inflows of direct investment fell to \$17.1 billion in the third quarter, from \$28.8 billion in the preceding quarter, as foreign direct investments into Singapore fell by more than residents’ direct investments abroad fell.

In comparison, “other investment” switched to a net inflow position of \$5.2 billion in the third quarter from a net outflow position of \$5.4 billion in the previous quarter. This reflected the increase in net inflows into deposit-taking corporations, as well as the turnaround in the non-bank private sector from a net outflow position to a net inflow position.

Meanwhile, net outflows of financial derivatives decreased by \$1.9 billion to \$0.4 billion in the third quarter.

⁷ 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”.



Box Article 1.1

RELATIONSHIP BETWEEN GROSS DOMESTIC PRODUCT AND EMPLOYMENT

Overview

Economic activity in Singapore has slowed since the second quarter of 2022, and the labour market has also shown signs of cooling in recent quarters. Historically, labour market conditions tend to lag changes in economic activity. This box article examines the relationship between economic activity and labour market conditions, specifically that between real Gross Domestic Product (GDP) growth and employment growth, in Singapore.

Economic Activity and its Impact on the Labour Market

The academic literature postulates several reasons why a change in economic activity may affect the labour market with a lag. First, adherence to hiring practices could delay employment responses to changes in economic activity (Australian Bureau of Statistics, 2006; Edwards & Gustafsson, 2013). For example, the hiring process may take up to several months as employers have to advertise a job posting before evaluating suitable candidates. Employment contracts may also stipulate notice periods of a few months before an employee can leave.

Second, faced with hiring rigidities, firms may choose to temporarily increase production without hiring more workers by maximising the utilisation of existing resources when economic activity picks up (Reserve Bank of Australia, 2014). Conversely, during a downturn, firms may hold on to their workforce and delay retrenchments, possibly because of minimum staffing requirements or employment contracts and/or to avoid losing the human capital that they have invested in, even as they cut production (Kuan, 2022).

Third, sector-specific characteristics and policies to support local employment during downturns may affect local employment responses to changes in economic activity in Singapore (Chan & Tang, 2012). For example, sectors that are reliant on temporary or part-time workers may see a shorter lag in employment responses. Government support during economic crises may also incentivise firms to hold on to their local manpower despite a decline in economic activity.

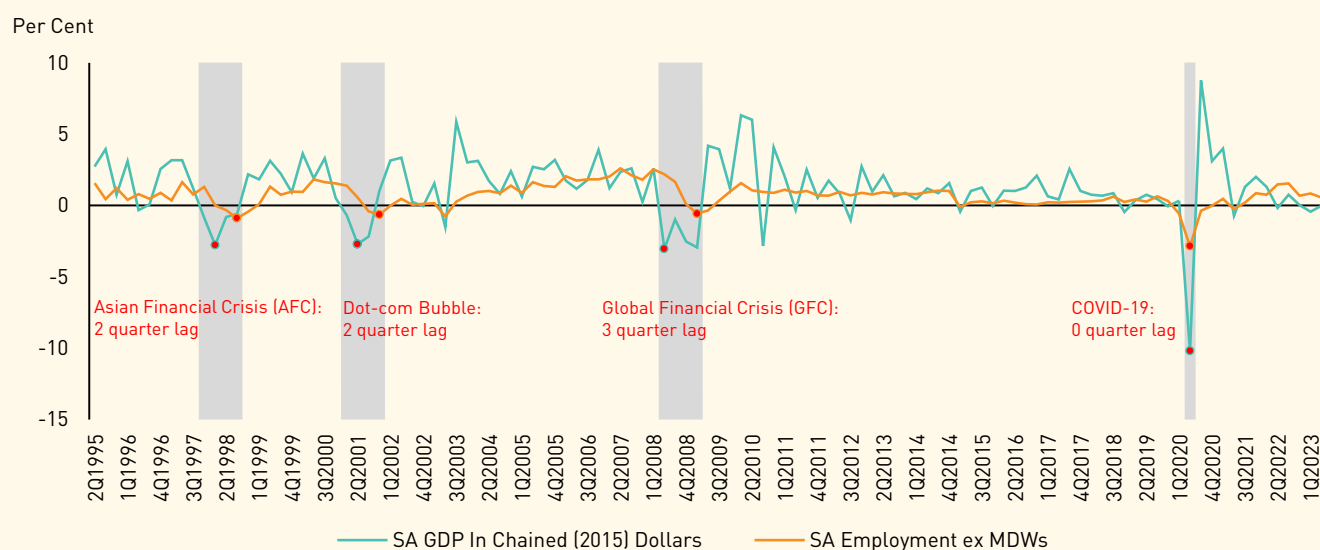
Based on a scan of the literature, apart from Chan & Tang (2012), several authors have documented the relationship between employment and economic activity in various economies (Akkemik, 2007; Chen, 2014; Ciuhu & Vasile, 2018). On the other hand, other authors have examined the relationship between economic activity and labour market conditions through the lens of Okun's law, which models the changes in GDP against changes in unemployment (Elbourne & Teulings, 2011; Reserve Bank of Australia, 2014; Sadiku et al., 2015; Omitogun & Longe, 2017; Di Iorio & Triacca, 2022). The latter empirical approach is useful in labour markets with sufficient fluctuations in unemployment rates. However, as unemployment rates in Singapore tend to be stable over extended periods of time, this study focuses on changes in employment instead.

The rest of the article is organised as follows. First, we descriptively identify the timing of the troughs in real GDP and employment during past periods of economic downturns in Singapore. Next, we run a vector autoregression (VAR) analysis to estimate the lag and magnitude of the employment response subsequent to a real GDP shock. Similar to Chan & Tang (2012), we exclude the construction sector from our analysis as its business cycles did not align closely with that of the wider economy. The last section concludes.

Trough-to-trough Analysis of Real GDP and Employment

Using quarter-on-quarter seasonally-adjusted (qoq sa) real GDP and employment data from 1Q1995 to 2Q2023, we compare the difference in the timing of the troughs in both data series. Exhibit 1 shows that changes in employment tended to lag GDP shocks by two to three quarters, as seen during the Asian Financial Crisis, Dot-com Bubble Bust and Global Financial Crisis. By contrast, the real GDP-employment dynamics during the COVID-19 pandemic exhibits an atypical contemporaneous relationship. This was partly because of the stringent measures put in place, especially border restrictions, to limit the spread of the pandemic, which had simultaneously curbed both economic activity and the inflow of non-resident workers.

Exhibit 1: Quarter-on-quarter Real GDP and Employment Growth in Singapore (excluding Migrant Domestic Workers (MDWs) and Construction Sector), 1Q1995 – 2Q2023



Sources: Ministry of Manpower, Singapore, Singapore Department of Statistics

Notes: Employment data excludes MDWs and employment count in the construction sector, while the real GDP data excludes real value-added from the construction sector. Red dots on the charts represent the trough employment and real GDP change on a quarter-on-quarter basis during each of the following downturns: Asian Financial Crisis, Dot-com Bubble Bust, Global Financial Crisis, and COVID-19 Pandemic.

VAR Analysis of Real GDP and Employment

To formally examine the dynamics of the real GDP-employment relationship, we use a VAR model to estimate the lag and magnitude of the employment response to changes in real GDP.¹ Apart from real GDP, we also include wages as proxied by average monthly earnings (AME) in the model. We postulate that including wages would better account for the effects of policy measures that affect employment through wages, e.g., the Job Support Scheme during COVID-19.

¹ Our theoretical framework is motivated by Tan et al. (2002)'s study, where they derived the dynamics between employment changes and economic growth through the theory of marginal productivity and labour demand. In particular, a positive GDP shock that leads to an increase in marginal productivity and thus labour demand would result in positive employment responses.

The VAR methodology models the interdependencies between multiple time series and estimates how each variable responds to shocks in the other variables. The resulting impulse response functions (IRFs) shed light on the magnitude and persistence of the impact of a shock to a variable in the model on the other variables, assuming no further shocks. The system of equations is as follows:

$$\begin{aligned}\Delta Emp_t &= c_1 + \sum_{i=1}^p (\Delta Emp_{t-i} + \Delta GDP_{t-i} + \Delta AME_{t-i}) + u_{1t} \\ \Delta GDP_t &= c_2 + \sum_{i=1}^p (\Delta Emp_{t-i} + \Delta GDP_{t-i} + \Delta AME_{t-i}) + u_{2t} \\ \Delta AME_t &= c_3 + \sum_{i=1}^p (\Delta Emp_{t-i} + \Delta GDP_{t-i} + \Delta AME_{t-i}) + u_{3t}\end{aligned}$$

where:

- Emp_t refers to Singapore's employment (excluding MDWs and workers in the construction sector) in quarter t ;
- GDP_t refers to Singapore's real GDP (excluding the real value-added of the construction sector) in quarter t ;
- AME_t refers to real average monthly earnings;
- c denotes a set of constants;
- u_t denote the error terms

The optimal lag order of the VAR model is selected based on the Akaike's Information Criterion (AIC). We also transform the data using a log-difference transformation to ensure stationarity. Augmented Dickey-Fuller (ADF) tests, which test the null hypothesis that a unit root is present in the series against the alternative hypothesis of stationarity, indicated stationarity in the three variables after transformation. We then derive IRFs from the estimated VAR model, with a focus on analysing the magnitude and persistence of employment changes over time in response to an exogenous one-off shock to real GDP.

We also conduct heterogeneity analyses by estimating the VAR model for the manufacturing and services sectors to provide additional insights for these broad sectors.

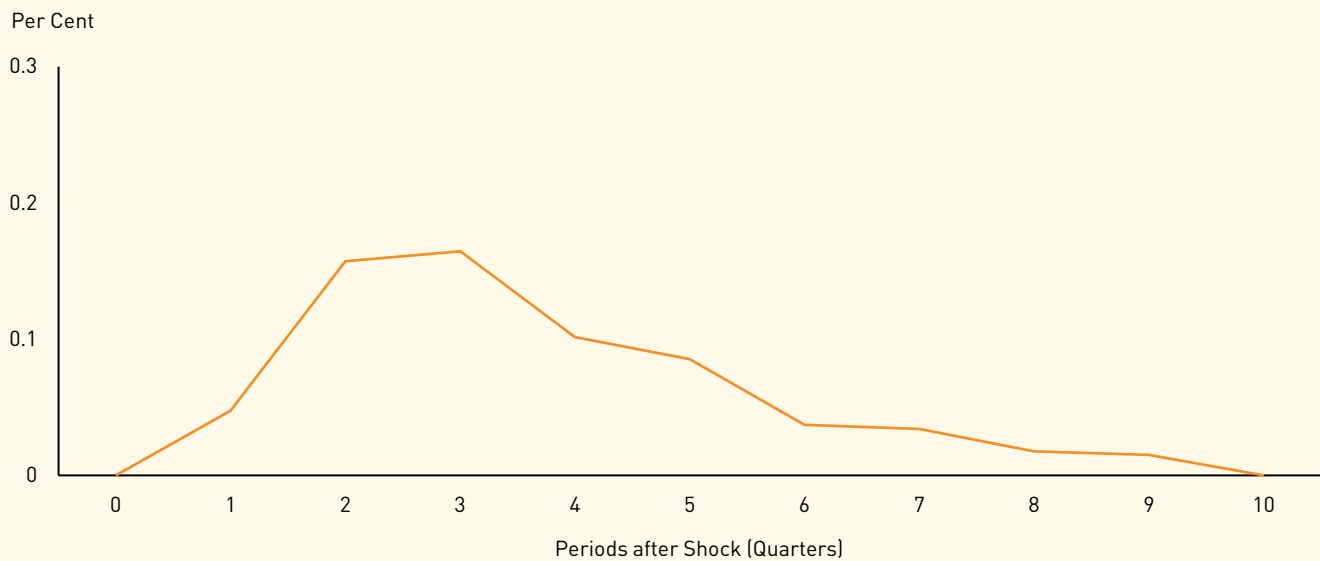
Results of VAR Analysis

Overall Economy

The results show that given a one-off 1 per cent increase in real GDP, employment growth peaks three quarters after, before tapering off in subsequent quarters (Exhibit 2). The delayed employment response to changes in economic activity is consistent with the presence of labour market frictions, including the time taken by firms to assess the persistence of the economic shock before adjusting their manpower needs. Cumulatively, employment increased by 0.37 per cent in the first three quarters after the initial shock to real GDP, and 0.66 per cent by the tenth quarter.² The persistence in the employment response suggests that businesses tend to gradually expand their workforce to meet the increased demand for goods and services, leading to a permanently higher level of employment after the initial real GDP increase, in the absence of a further shock to real GDP.

These findings are consistent with the trends observed in the earlier trough-to-trough analysis, and are also robust to the use of the Bayesian Information Criterion (BIC) to select the optimal lag for the VAR model as well as the exclusion of AME from the model.

² It should be noted that the estimates lose statistical significance at the 5% level from the sixth quarter onwards.

Exhibit 2: Impulse Response Function of Employment from Shock in Real GDP for the Overall Economy

Source: MTI staff estimates

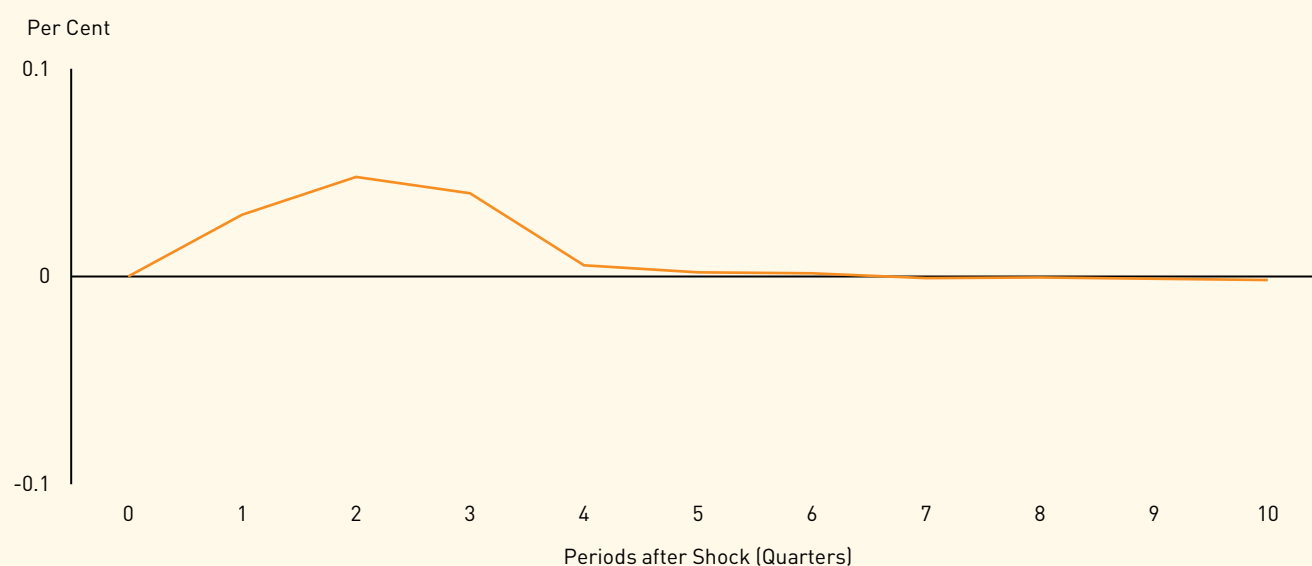
Notes: Y-axis indicates the change in employment (in percentage terms) following a shock in real GDP. Employment data excludes MDWs and employment count in the construction sector, while the real GDP data excludes real value-added from the construction sector.

Manufacturing Sector

For the manufacturing sector, employment responds more swiftly to a 1 per cent increase in the real value-added (VA) of the sector, with employment growth peaking two quarters after the initial shock and tapering off rapidly thereafter (Exhibit 3). While the peak impact on employment in the manufacturing sector is realised faster than in the overall economy, the magnitude of the impact is smaller. The IRF indicates that a 1 per cent increase in the real VA of the sector translates to a cumulative increase in employment within the sector of 0.12 per cent by the third quarter, with minimal further increases thereafter.³

There are two possible explanations for these findings. First, changes in the real VA of the manufacturing sector are generally more pronounced compared to changes in employment within the sector, and this would likely manifest as a smaller employment response to a change in real VA in the sector. For example, within the manufacturing sector, the pharmaceuticals segment is subject to plant-level production schedules that may not have an impact on employment. Second, the smaller response in employment could reflect the highly productive nature of the sector as manufacturing activities tend to be capital intensive.

³ It should be noted that only the estimate for the second quarter is statistically significant at the 5% level, although the estimate for the first quarter comes close to being statistically significant.

Exhibit 3: Impulse Response Function of Employment from Shock in Real VA in the Manufacturing Sector

Source: MTI staff estimates

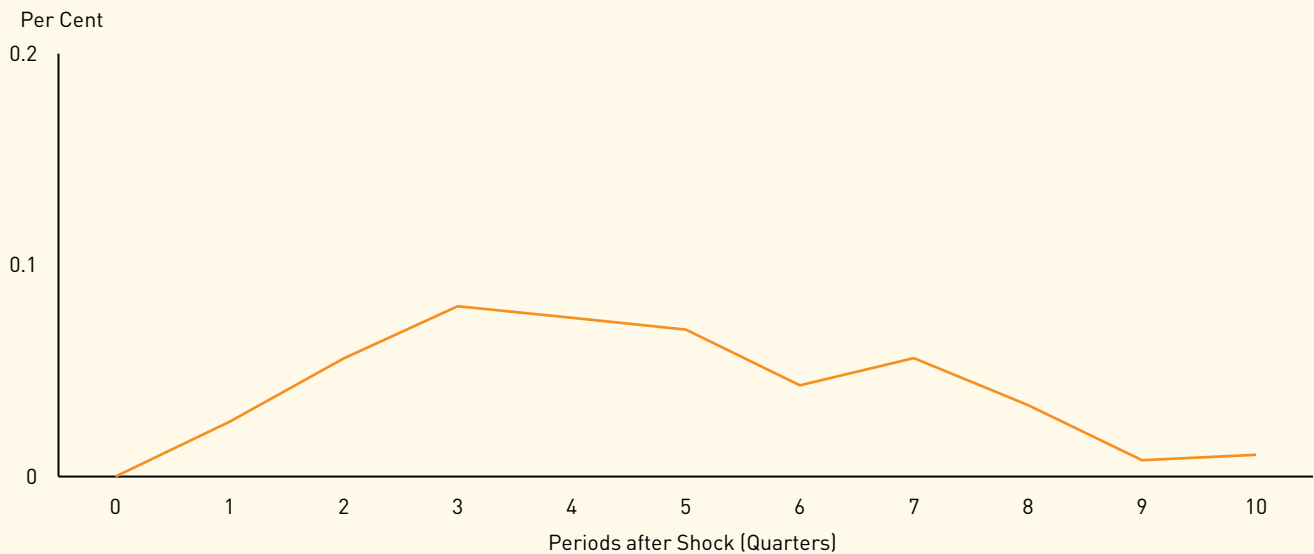
Notes: Y-axis indicates the change in employment (in percentage terms) following a shock in real GDP.

Services Sector

Given a 1 per cent increase in real VA in the overall services sector, employment growth in the sector is found to peak after three quarters, before gradually tapering over the subsequent quarters (Exhibit 4). The persistence displayed in the IRF indicates a more extended employment response compared to the IRFs of the overall economy and the manufacturing sector. Cumulatively, employment increased by 0.16 per cent in the first three quarters after the initial shock to real GDP and 0.46 per cent by the tenth quarter.⁴

While we have presented the results for the services sector as a whole, there could be heterogeneity in the relationship between employment and real VA in the various services sectors. For instance, the information & communications sector typically experiences longer product development cycles and requires more specialised skillsets. As a result, firms in the sector may not adjust their employment significantly in response to an economic shock. Over time, as the digital economy matures and becomes more saturated, firms in the information & communications sector may become more sensitive to business cycles. On the other hand, firms in the retail trade and food & beverages services sectors tend to rely on temporary or part-time workers to meet fluctuating customer demand and could hence be more responsive in adjusting the size of their workforce in response to an economic shock.

⁴ These figures should be taken as indicative as the estimates are not statistically significant at the 5% level, possibly due to heterogeneity across the various services sectors.

Exhibit 4: Impulse Response Function of Employment from Shock in Real VA in the Services Sector

Source: MTI staff estimates

Notes: Y-axis indicates the change in employment (in percentage terms) following a shock in real GDP. Employment data excludes MDWs.

Summary and Concluding Remarks

Our study finds that a shock to real GDP affects employment growth in Singapore, although the amplitude, timing and persistence vary across sectors. In particular, our results, through the trough-to-trough analysis and VAR model, show that for the overall economy, employment growth peaks around two to three quarters after a shock to real GDP. This is corroborated by our experience in recent quarters, where employment growth started to slow a few quarters after real GDP growth slowed. Specifically, while real GDP growth slowed in 2Q2022 on a qoq sa basis, employment growth began to ease only two quarters later in 4Q2022.

Looking ahead, the expected pickup in real GDP growth over the course of 2024 should lend some support to employment growth towards the end of 2024 or early 2025. At the same time, the Government remains committed to continuing to support workers and jobseekers such as through Workforce Singapore's Career Conversion Programmes, and also to helping companies make their jobs more productive and attractive to jobseekers through the Support for Job Redesign under Productivity Solutions Grant.

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CHAPTER

2

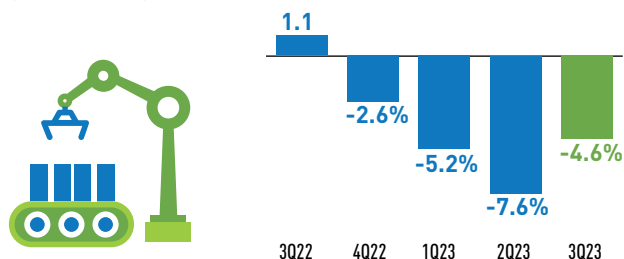
SECTORAL PERFORMANCE



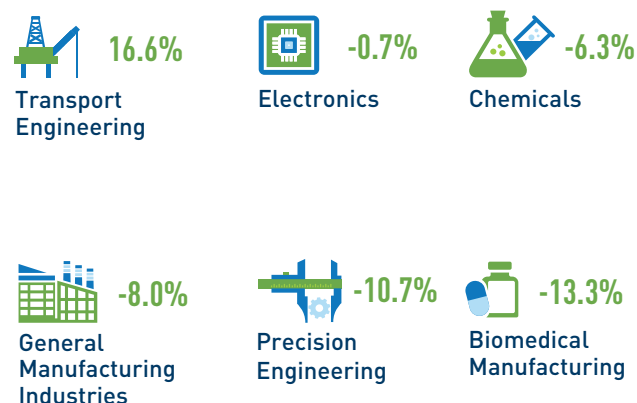
Chapter 2

SECTORAL PERFORMANCE

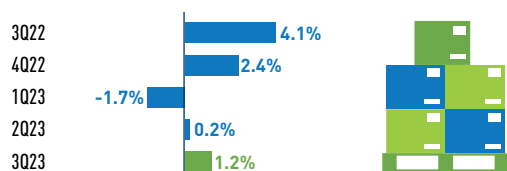
MANUFACTURING (YoY Growth)



CLUSTERS IN MANUFACTURING SECTOR



WHOLESALE TRADE (YoY Growth)

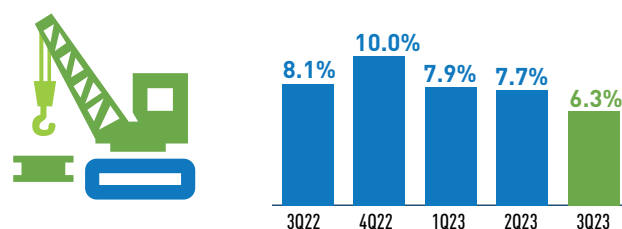


Foreign Wholesale Trade Index Growth **5.7%**



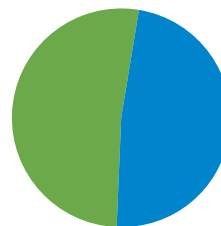
Domestic Wholesale Trade Index Growth **-7.2%**

CONSTRUCTION (YoY Growth)



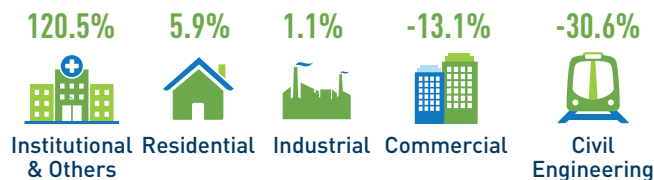
CERTIFIED PAYMENTS (% Share)

49.7%
Public

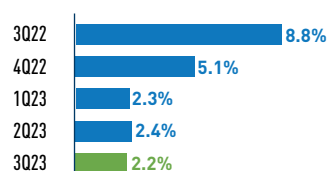


50.3%
Private

CONTRACTS AWARDED (YoY Growth)



RETAIL TRADE (YoY Growth)



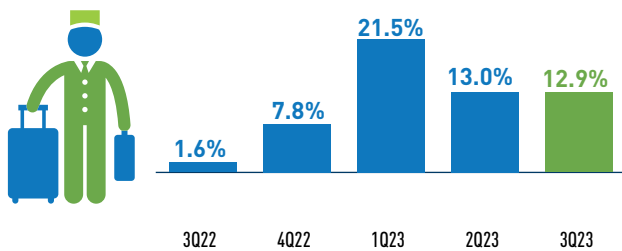
Retail Sales Index Growth (Motor Vehicles) **4.7%**



Retail Sales Index Growth (Non-Motor Vehicles) **0.9%**

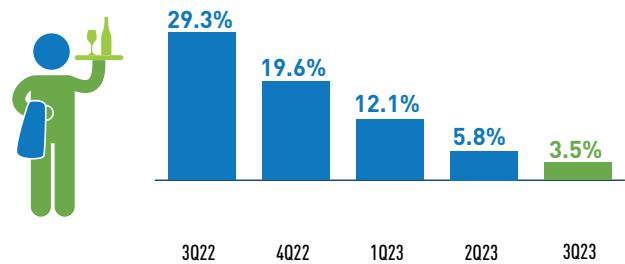
ACCOMMODATION

(YoY Growth)



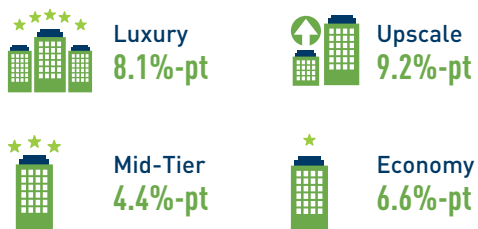
FOOD & BEVERAGE SERVICES

(YoY Growth)



OCCUPANCY RATES OF HOTELS

(YoY Change)



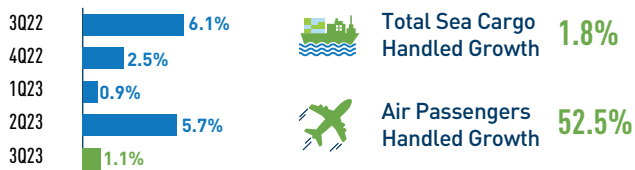
FOOD & BEVERAGE SALES INDEX GROWTH

(YoY Growth)



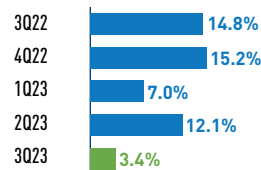
TRANSPORTATION & STORAGE

(YoY Growth)



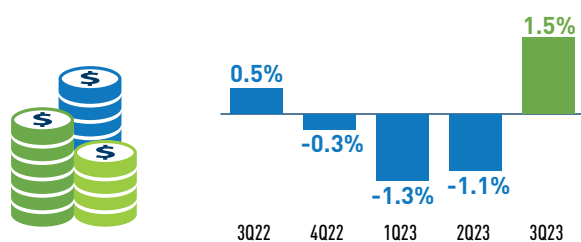
REAL ESTATE

(YoY Growth)

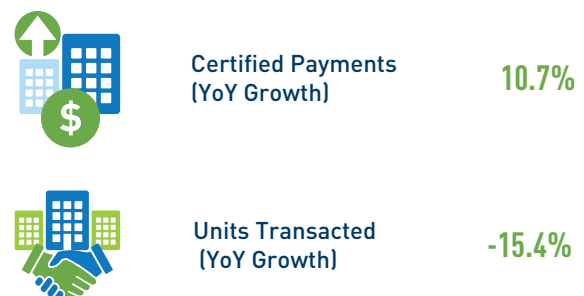


FINANCE & INSURANCE

(YoY Growth)



PRIVATE RESIDENTIAL REAL ESTATE



OVERVIEW

In the third quarter of 2023,

- The manufacturing sector contracted by 4.6 per cent year-on-year, following the 7.6 per cent decline in the preceding quarter. All clusters saw a fall in output except for the transport engineering cluster.
- The construction sector expanded by 6.3 per cent year-on-year, extending the 7.7 per cent expansion in the previous quarter.
- The wholesale trade sector expanded by 1.2 per cent year-on-year, picking up from the 0.2 per cent expansion recorded in the preceding quarter.
- The retail trade sector expanded by 2.2 per cent year-on-year, following the 2.4 per cent recorded in the second quarter of 2023.
- The transportation & storage sector posted growth of 1.1 per cent year-on-year, moderating from the 5.7 per cent growth recorded in the previous quarter.
- The accommodation sector expanded by 12.9 per cent year-on-year, following the 13.0 per cent growth in the preceding quarter.
- Growth in the food & beverage services sector moderated to 3.5 per cent year-on-year, from the 5.8 per cent in the second quarter of 2023.
- The finance & insurance sector expanded by 1.5 per cent year-on-year, following the 1.1 per cent decline in the preceding quarter.
- The real estate sector expanded by 3.4 per cent year-on-year, moderating from the 12.1 per cent growth in the previous quarter.
- The professional services sector expanded by 0.8 per cent year-on-year, extending the 1.3 per cent expansion in the preceding quarter.

MANUFACTURING

The manufacturing sector contracted by 4.6 per cent on a year-on-year basis in the third quarter of 2023, following the 7.6 per cent decline in the previous quarter (Exhibit 2.1). Decline in the third quarter of 2023 was due to output contractions in all clusters except for the transport engineering cluster (Exhibit 2.2).

Exhibit 2.1: Manufacturing Sector's Growth Rate

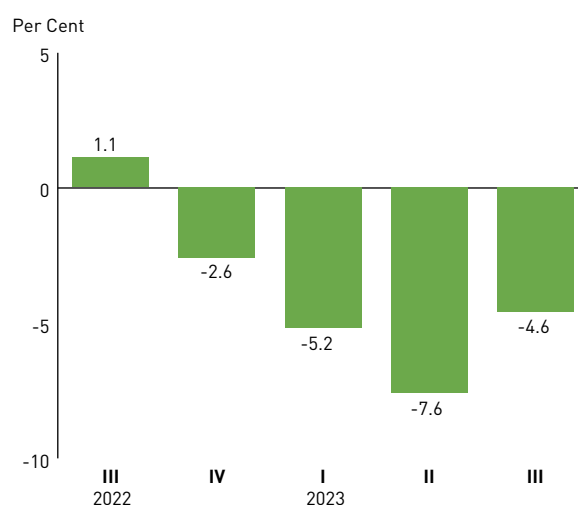
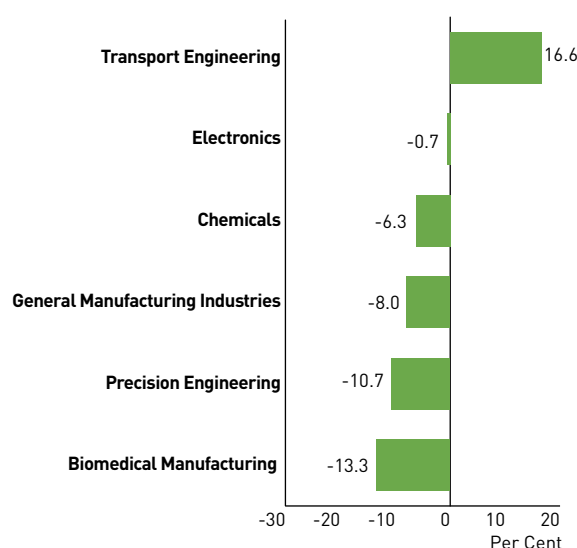


Exhibit 2.2: Manufacturing Clusters' Growth Rates in 3Q 2023

Output in the transport engineering cluster grew by 16.6 per cent year-on-year in the third quarter, supported by expansions in the marine & offshore engineering (M&OE) and aerospace segments. The M&OE segment rose by 27.9 per cent, supported by a higher level of activity in the shipyards as well as increased production of oil & gas field equipment. Similarly, in the aerospace segment, output grew by 18.5 per cent on account of higher demand for aircraft parts and more maintenance, repair and overhaul (MRO) jobs from commercial airlines on the back of strong air travel demand globally. By contrast, the land segment contracted by 14.2 per cent.

The electronics cluster contracted by 0.7 per cent year-on-year in the third quarter, driven by output declines across all segments except the infocomms & consumer electronics segment. Output of the computer peripherals & data storage, other electronic modules & components and semiconductors segments fell by 16.9 per cent, 1.4 per cent and 0.9 per cent respectively, amid continued weak electronics end-markets' demand globally. By contrast, output for infocomms & consumer electronics segment grew by 13.9 per cent.

Output in the chemicals cluster shrank by 6.3 per cent year-on-year in the third quarter, driven by output declines in all segments. The petrochemicals (-11.6 per cent) and petroleum (-9.3 per cent) segments recorded lower levels of output amidst plant maintenance shutdowns and weak market demand. The specialties segment contracted 5.3 per cent on account of a lower level of production of mineral oil and food additives, while other chemicals segment fell by 0.6 per cent with lower output of fragrances.

The general manufacturing cluster contracted by 8.0 per cent year-on-year in the third quarter, with output contractions across all segments. Output of the miscellaneous industries and printing segments declined by 15.2 per cent and 9.8 per cent respectively, with the former recording lower production of batteries and structural metal products. Meanwhile, the food, beverages & tobacco segment declined 2.5 per cent due to lower output of beverage products.

Output in the precision engineering cluster fell by 10.7 per cent year-on-year in the third quarter. The precision modules & components segment shrank by 17.2 per cent due to lower production of optical instruments, plastic and metal precision components and dies, moulds, tools, jigs and fixtures. Output in the machinery & systems (M&S) segment declined by 8.3 per cent, weighed down by lower production of semiconductor-related equipment.

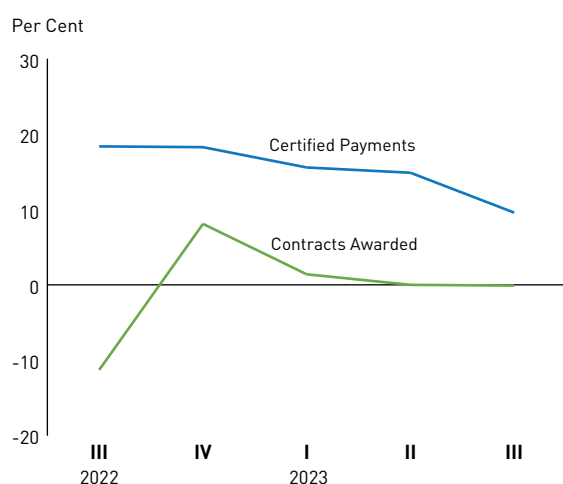
The biomedical manufacturing cluster contracted by 13.3 per cent year-on-year in the third quarter. This was largely due to a 27.8 per cent decline in pharmaceutical output, resulting from a different mix of active pharmaceutical ingredients (APIs) being produced. On the other hand, output in the medical technology segment rose by 6.1 per cent, supported by export demand for medical devices.

CONSTRUCTION

The construction sector grew by 6.3 per cent year-on-year in the third quarter of 2023, extending the 7.7 per cent expansion in the previous quarter.

In the third quarter, nominal certified progress payments, a proxy for construction output, rose by 9.6 per cent year-on-year, moderating from the 14.9 per cent increase recorded in the previous quarter (Exhibit 2.3). Higher certified progress payments were seen in both the public (9.3 per cent) and private (9.9 per cent) sectors. The growth in public certified progress payments was largely driven by higher outturns in public institutional & others (18.2 per cent) and industrial (57.7 per cent) building works. Meanwhile, the increase in private certified progress payments was led by expansions in private commercial (30.5 per cent) and residential (10.7 per cent) building works.

Exhibit 2.3: Changes in Contracts Awarded and Certified Payments



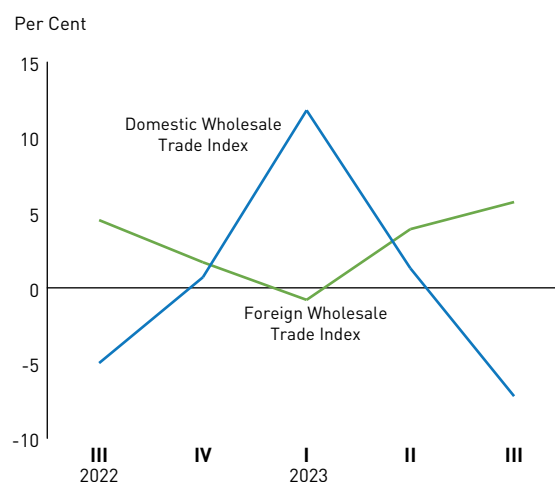
On the other hand, construction demand in terms of contracts awarded fell marginally by 0.1 per cent year-on-year in the third quarter, following flat growth in the previous quarter (Exhibit 2.3). The fall in contracts awarded during the quarter was on account of lower private sector construction demand (-18.8 per cent), which outweighed an increase in public sector construction demand (17.7 per cent). The former was led by a fall in contracts awarded for private institutional & others building (-62.0 per cent) and civil engineering (-72.0 per cent) works, while the latter was driven by an increase in contracts awarded for public residential (1.4 per cent) and institutional & others (150.6 per cent) building works.

WHOLESALE TRADE

The wholesale trade sector expanded by 1.2 per cent year-on-year in the third quarter of 2023, picking up from the 0.2 per cent expansion in the previous quarter.

The expansion in the sector was led by a 5.7 per cent year-on-year growth in foreign wholesale trade sales volume over the period (Exhibit 2.4), accelerating from the 3.9 per cent expansion recorded in the previous quarter. The increase was led by expansions in the sales volumes of petroleum & petroleum products (14.0 per cent) and electronic components (22.6 per cent). Meanwhile, there were large declines in the sales volumes of other wholesale trade (-11.9 per cent) and telecommunications & computers (-9.9 per cent).

Exhibit 2.4: Changes in Wholesale Trade Index in Chained Volume Terms



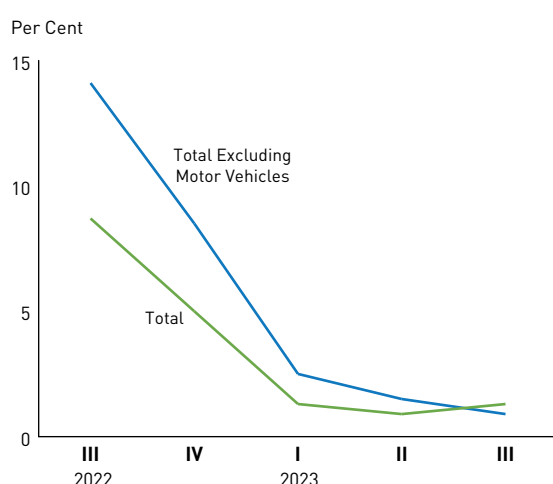
On the other hand, the domestic wholesale trade sales volume declined by 7.2 per cent year-on-year, reversing the 1.3 per cent growth in the previous quarter. The contraction was primarily due to declines in sales volume of petroleum & petroleum products (-18.9 per cent), other wholesale trade (-5.4 per cent) and telecommunications & computers (-4.4 per cent).

RETAIL TRADE

The retail trade sector posted growth of 2.2 per cent year-on-year in the third quarter of 2023, following the 2.4 per cent expansion in the previous quarter.

In the third quarter, overall retail sales volume increased by 1.3 per cent year-on-year, following the 0.9 per cent growth in the preceding quarter (Exhibit 2.5). Growth in overall retail sales volume in the third quarter of 2023 was driven by both motor vehicular sales (4.7 per cent) and non-motor vehicular sales (0.9 per cent). Non-motor vehicular sales volume was supported primarily by the wearing apparel & footwear (8.5 per cent) and food & alcohol (17.3 per cent) segments. By contrast, sales volumes for the supermarkets & hypermarkets (-3.0 per cent) and petrol service stations (-4.5 per cent) segments shrank.

Exhibit 2.5: Changes in Retail Sales Index in Chained Volume Terms

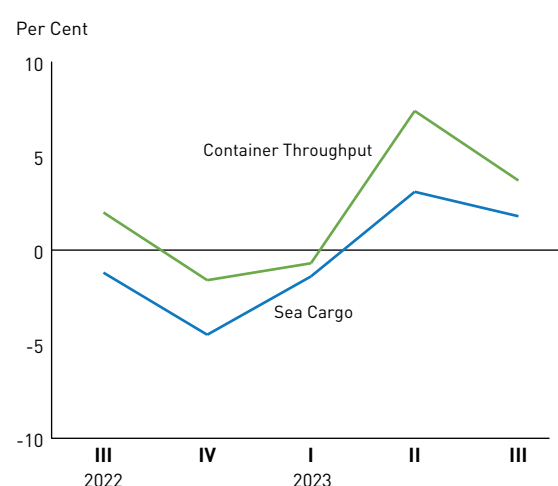


TRANSPORTATION & STORAGE

The transportation & storage sector expanded by 1.1 per cent year-on-year in the third quarter of 2023, moderating from the 5.7 per cent growth posted in the previous quarter. The water transport, air transport and land transport segments expanded during the quarter.

In the water transport segment, the volume of sea cargo handled grew by 1.8 per cent year-on-year in the third quarter, moderating from the 3.1 per cent expansion in the previous quarter (Exhibit 2.6). The expansion in sea cargo volume handled was due to the increase in general cargo (4.2 per cent), which more than offset the declines in bulk cargo (-2.1 per cent) and oil-in-bulk cargo volumes (-2.0 per cent). At the same time, container throughput grew by 3.7 per cent during the quarter.

Exhibit 2.6: Changes in Container Throughput and Sea Cargo Handled

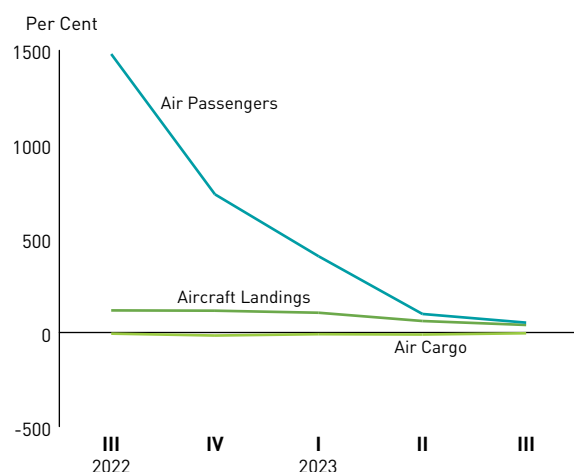


Meanwhile, the air transport segment saw robust growth in the third quarter. In particular, the volume of air passenger traffic (less transit) handled at Changi Airport surged by 52.5 per cent year-on-year in the third quarter, following the 98.6 per cent increase in the previous quarter (Exhibit 2.7). The high growth rates in both quarters were due to the low bases in the second and third quarter of 2022, when the volume of air passenger traffic was weak as countries were in the early stages of reopening their borders¹. While air passenger traffic volume continued to recover in the third quarter, it remained 11.4 per cent below its pre-COVID level (i.e., third quarter of 2019).

¹ For instance, the volume of air passenger traffic in the second and third quarters of 2022 was 56.3 and 41.9 per cent below their pre-COVID levels (i.e., the second and third quarter of 2019) respectively. The Vaccinated Travel Framework was rolled out in the second quarter of 2022 (i.e., from 1 April 2022).

Reflecting the recovery in air travel, the number of aircraft landings climbed by 40.1 per cent year-on-year to reach 42,806 in the third quarter of 2023, extending the 61.1 per cent increase in the preceding quarter. On the other hand, total air cargo shipments handled at Changi Airport declined by 4.0 per cent in the third quarter, easing from the 10.8 per cent contraction in the previous quarter.

Exhibit 2.7: Changes in Air Transport

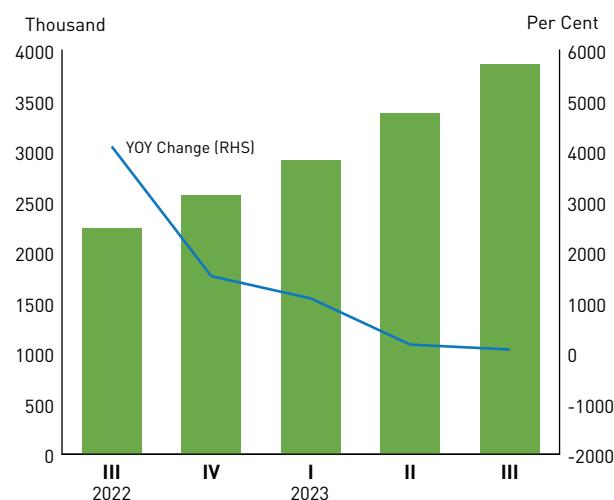


ACCOMMODATION

The accommodation sector expanded robustly by 12.9 per cent year-on-year in the third quarter of 2023, following the 13.0 per cent growth in the preceding quarter.

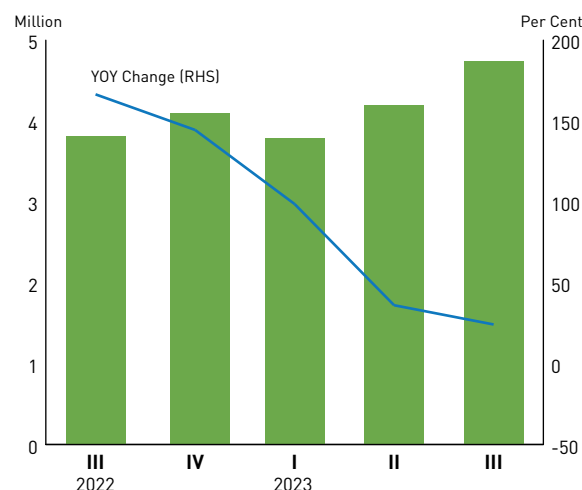
In the third quarter, total visitor arrivals grew by 72.5 per cent year-on-year, slowing from the 168 per cent growth in the previous quarter (Exhibit 2.8). The strong growth in both quarters was on account of low base effects in the corresponding quarters in 2022. In level terms, the number of visitor arrivals in the third quarter of 2023 was around 3.9 million, reaching 77.2 per cent of the 5.0 million visitor arrivals recorded in the third quarter of 2019 (i.e., pre-COVID level).

Exhibit 2.8: Visitor Arrivals



Reflecting the recovery in visitor arrivals, gross lettings at gazetted hotels climbed by 24.2 per cent year-on-year in the third quarter, a moderation from the 36.1 per cent increase in the previous quarter (Exhibit 2.9). At the same time, the average occupancy rate of gazetted hotels rose by 6.6 percentage-points year-on-year to reach 86.2 per cent in the third quarter of 2023. This was an improvement over the 79.1 per cent recorded in the previous quarter.

Exhibit 2.9: Gross Lettings at Gazetted Hotels



FOOD & BEVERAGE SERVICES

The food & beverage services sector expanded by 3.5 per cent year-on-year in the third quarter of 2023, moderating from the 5.8 per cent growth in the previous quarter.

Overall food & beverage sales volume rose by 3.2 per cent year-on-year in the third quarter, moderating from the 4.2 per cent growth in the previous quarter (Exhibit 2.10). The increase in food & beverage sales volume was led by food caterers (19.5 per cent), followed by cafes, food courts & other eating places (2.3 per cent). On the other hand, the sales volume for restaurants (-1.4 per cent) and fast food outlets (-0.2 per cent) fell.

Exhibit 2.10: Changes in Food & Beverage Services Index in Chained Volume Terms



FINANCE & INSURANCE

The finance & insurance sector expanded by 1.5 per cent year-on-year in the third quarter of 2023, following the 1.1 per cent decline in the preceding quarter.

Growth in the sector was led by other auxiliary activities (comprising mainly payment processing players), as card fees picked up amid the recovery in travel spending. The fund management segment also grew alongside higher portfolio flows into Asia-Pacific equity funds in recent months. Meanwhile, the banks segment posted a small expansion, supported by higher net fees and commissions, even as credit intermediation continued to decline in the high interest rate environment. Non-bank loans to residents fell by 6.1 per cent on a year-on-year basis, led by a fall in loans to the general commerce sector (Exhibit 2.11). Likewise, loans to non-residents fell by 7.7 per cent, weighed down by loans to East Asia and the Americas (Exhibit 2.12). The insurance segment also remained weak, amid lacklustre sales of insurance savings products.

Meanwhile, the fund management and security dealing segments continued to expand, alongside the improved sentiment in global equities in recent months. The other auxiliary activities segment (comprising mainly payments processing players) also grew as card fees continued to pick up on the back of recovering tourism demand.

Exhibit 2.11: Growth of Bank Loans & Advances to Non-Bank Residents by Industry in 3Q 2023

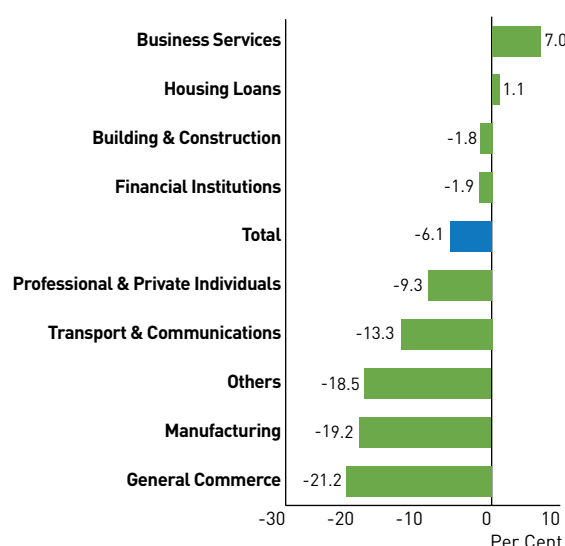
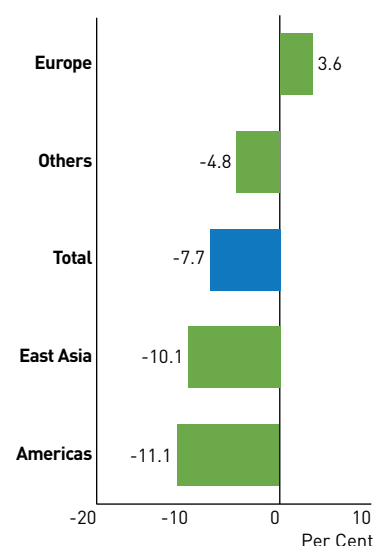


Exhibit 2.12: Growth of Bank Loans & Advances to Non-Bank Non-Residents by Region in 3Q 2023

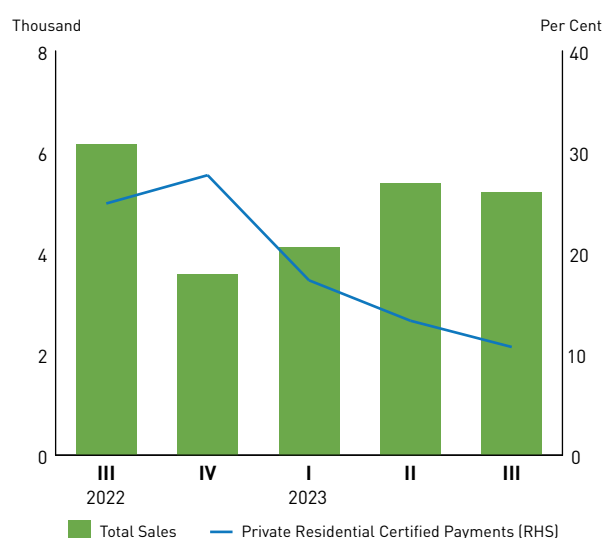


REAL ESTATE

The real estate sector expanded by 3.4 per cent year-on-year in the third quarter of 2023, moderating from the 12.1 per cent growth in the preceding quarter. The growth of the sector was due to expansions in the residential, commercial and industrial property segments.

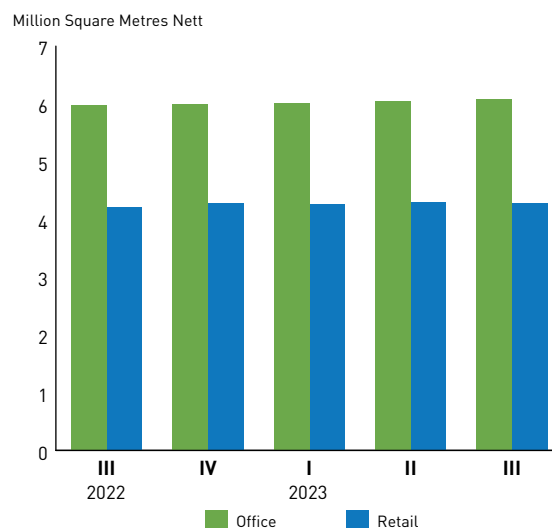
Within the sector, private residential certified payments² grew by 10.7 per cent year-on-year in the third quarter, extending the 13.3 per cent increase in the previous quarter. Meanwhile, total private residential property sales fell by 15.4 per cent in the third quarter, extending the 20.9 per cent decrease in the previous quarter. (Exhibit 2.13).

Exhibit 2.13: Total Sales for Private Residential Units and Private Residential Certified Payments



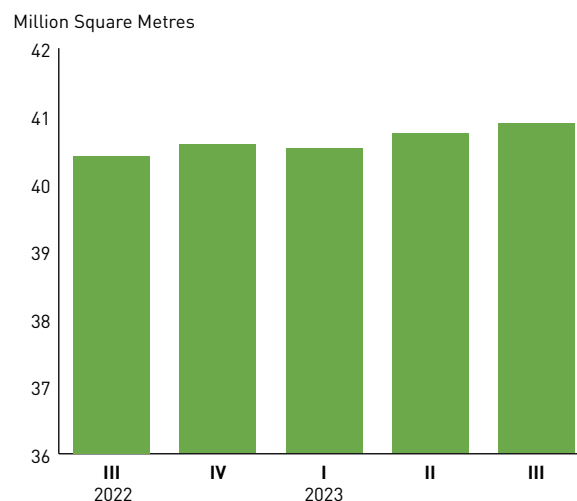
In the private commercial retail space market, demand, as measured by total occupied space, rose by 1.5 per cent on a year-on-year basis in the third quarter of 2023, continuing the 2.6 per cent expansion in the previous quarter. In the same vein, demand for private commercial office space rose by 1.6 per cent in the third quarter, extending the 1.5 per cent increase in the preceding quarter (Exhibit 2.14).

Exhibit 2.14: Total Occupied Space for Private Sector Commercial Office and Retail Spaces



Similarly, demand for private industrial space rose by 1.2 per cent on a year-on-year basis in the third quarter, following the 0.7 per cent increase in the preceding quarter (Exhibit 2.15).

Exhibit 2.15: Total Occupied Space for Private Sector Industrial Space



² Private residential certified payments is a proxy for the growth of the private residential property segment.

PROFESSIONAL SERVICES

In the third quarter of 2023, the professional services sector grew by 0.8 per cent year-on-year, following the 1.3 per cent growth in the previous quarter. Growth of the sector was mainly driven by expansions in the architectural & engineering, technical testing & analysis and the other professional, scientific & technical services segments, which outweighed contractions in the legal, head offices & business representative offices and business & management consultancy segments.

CHAPTER

3

ECONOMIC OUTLOOK





Chapter 3

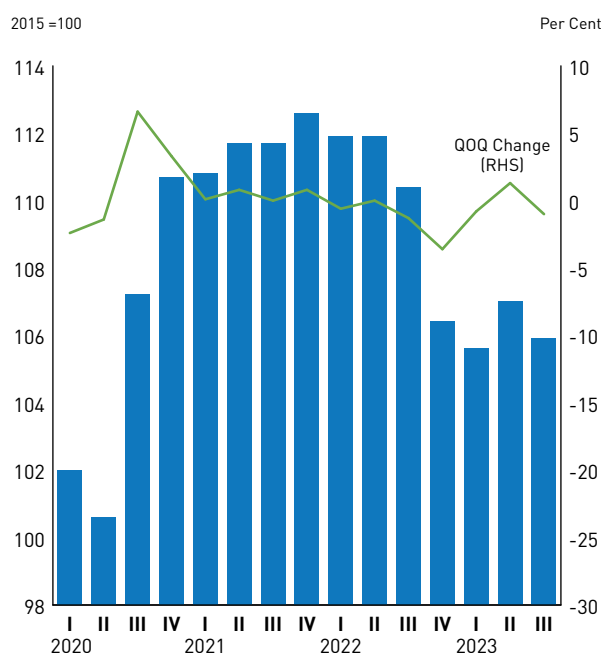
ECONOMIC OUTLOOK

LEADING INDICATORS

On a quarter-on-quarter basis, the composite leading index (CLI) fell by 1.0 per cent in the third quarter of 2023, a reversal from the 1.3 per cent expansion in the previous quarter (Exhibit 3.1).

Of the nine components of the CLI, five components fell on a quarter-on-quarter basis, namely new companies formed, stock price, non-oil retained imports, domestic liquidity and the stock of finished goods. By contrast, wholesale trade, money supply and the US Purchasing Managers' Index increased, while non-oil sea cargo handled remained unchanged from the previous quarter.

Exhibit 3.1: Composite Leading Index Levels and Growth Rate



OUTLOOK FOR 2023

Since the Economic Survey of Singapore in August, the US economy has performed better than expected, largely due to resilience in its domestic services activity. However, for the rest of the year, growth in the US and Eurozone is projected to moderate due to the cumulative effects of monetary policy tightening. Likewise, China's growth is likely to slow further amidst ongoing weaknesses in its property sector and domestic consumption, as well as subdued external demand. At the same time, global electronics demand remains sluggish given elevated inventory levels, although there are signs that the downturn may be bottoming.

Given subdued external demand, Singapore's manufacturing and trade-related sectors such as precision engineering and water transport are likely to remain weak for the rest of 2023. On the other hand, the ongoing recovery in air travel and inbound tourism is expected to support the growth of aviation- and tourism-related sectors such as air transport and accommodation. Meanwhile, resilient labour market conditions will continue to lend support to consumer-facing sectors like retail trade and food & beverage services.

Taking into account the performance of the Singapore economy in the first three quarters of the year (i.e., 0.7 per cent year-on-year), as well as the latest external and domestic developments, the 2023 GDP growth forecast for Singapore is narrowed to **around 1.0 per cent**, from 0.5 to 1.5 per cent.

OUTLOOK FOR 2024

Looking ahead to 2024, GDP growth rates in major economies such as the US and Eurozone are projected to slow further in the first half of the year due to continued tight financial conditions, before picking up gradually in the second half. At the same time, as the post-pandemic boost in demand for services dissipates, there could be a rebalancing of demand towards goods in the year ahead. This, alongside a normalisation of inventory levels, is likely to support a turnaround in global manufacturing activity over the course of the year. In particular, global electronics demand is projected to recover, which will bolster the growth of most regional economies.

In the US, GDP growth is expected to moderate in the first half of 2024 as economic activity continues to be weighed down by tight financial conditions, before picking up in the second half in line with expectations of an easing of the monetary policy stance. Similarly, GDP growth in the Eurozone is forecast to remain subdued in the first half of 2024 due to restrictive financial conditions and sluggish external demand, before improving in the second half, supported by a pickup in domestic consumption as inflation recedes.

In Asia, China's growth is projected to remain sluggish in 2024 and come in lower than that in 2023, given sustained weakness in its property sector. At the same time, domestic consumption and exports growth are likely to remain lacklustre, in line with weak consumer confidence and sluggish external demand respectively. On the other hand, GDP growth in the Southeast Asian economies of Malaysia and Thailand is expected to pick up, supported by an improvement in external demand for electronics and resilient domestic demand.

Nonetheless, significant downside risks in the global economy remain. First, sticky core inflation in advanced economies could induce central banks to maintain current high interest rates for longer, increasing strains to the global financial system. Second, an escalation or widening of the Israel-Hamas conflict or the war in Ukraine could lead to renewed supply disruptions and commodity price shocks. The confluence of these factors could weigh on both business and consumer sentiments along with demand, leading to a slowdown in global growth and trade.

Against this backdrop, the growth prospects of the manufacturing and trade-related sectors in Singapore are expected to improve in tandem with the turnaround in global electronics demand. In particular, the electronics and precision engineering clusters are expected to benefit from a recovery in demand for semiconductors and semiconductor equipment respectively. Similarly, growth in the wholesale trade sector is projected to strengthen on the back of an improvement in external demand for electronic components and telecommunications & computers. If global interest rates start to moderate in 2024, the finance & insurance sector is also expected to post a modest recovery.

At the same time, the continuing recovery in air travel and tourist arrivals will support the growth of aviation- and tourism-related sectors, including air transport and accommodation, although the pace of growth is likely to moderate. Likewise, consumer-facing sectors such as retail trade and food & beverage services are projected to continue to expand amidst resilient labour market conditions.

Taking these factors into account, and barring the materialisation of downside risks, the Singapore economy is expected to grow by **1.0 to 3.0 per cent** in 2024.

**FEATURE
ARTICLE**

ANALYSIS OF RETAIL PETROL PRICES IN SINGAPORE



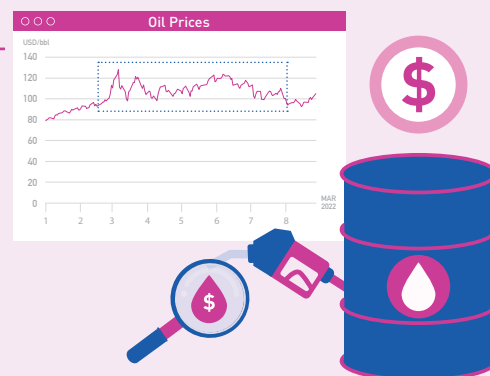


Feature Article

ANALYSIS OF RETAIL PETROL PRICES IN SINGAPORE

OVERVIEW

Following the start of the war in Ukraine on 20 February 2022, Brent crude oil prices surged amidst global supply concerns, peaking at US\$133 per barrel (/bbl) in March 2022. They remained elevated and volatile in 2022 and only dipped below US\$100/bbl in August 2022, before gradually declining further in end-2022 and 2023. Following the surge in oil prices in 2022, retail petrol prices in Singapore, as well as some developed economies such as the UK, rose sharply. Amidst elevated retail petrol prices, questions have been raised in Singapore as to whether petrol retailers pass through oil price increases to a greater extent than decreases (i.e., the “rocket and feather” effect). For example, while oil prices receded for the most part in June 2022 from its peak in March 2022, retail petrol prices in Singapore climbed to even higher levels in June 2022 and exceeded their March 2022 levels. At the same time, there were questions on whether retail pricing behaviour might have changed given the higher volatility in oil prices following the war.



FINDINGS

We analyse the magnitude and latency of the passthrough from oil price changes to retail petrol price movements, including whether there is evidence of the passthrough of oil price increases to retail petrol price being greater compared to that of decreases (i.e., the “rocket and feather” effect).

Finding 1:

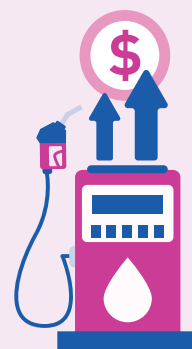
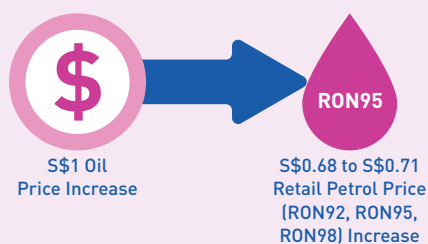
From 1 January 2016 to 30 September 2023, the cumulative passthrough to retail petrol prices of different grades from a S\$1 increase in oil price was S\$0.68 to S\$0.71, with a latency of more than a week.

Finding 2:

We examine the relationship between oil prices and retail petrol prices before and after the Ukraine war began on 20 February 2022 and find no statistically significant differences in passthrough rates between the two periods.

Finding 3:

Petrol price adjustments are more likely to occur when there are larger oil price changes, whether increases or decreases. The increase in volatility of oil prices following the outbreak of the war in Ukraine resulted in more frequent retail petrol price changes.



EXECUTIVE SUMMARY

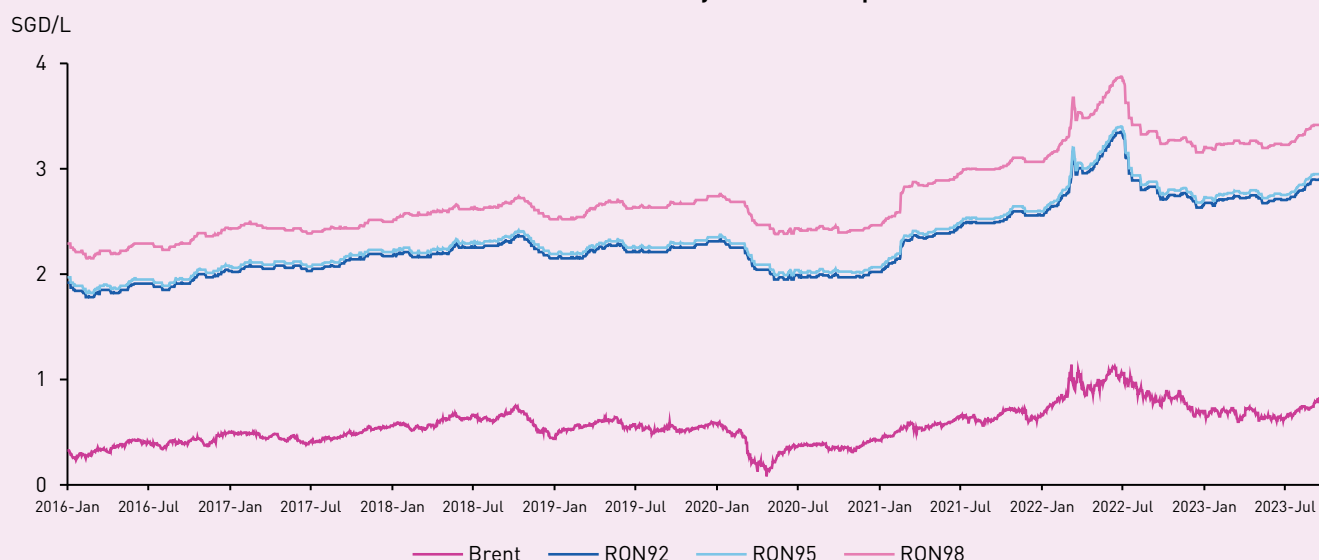
- This article examines the passthrough of oil prices to retail petrol prices in Singapore using daily data from 1 January 2016 to 30 September 2023.
- We analyse the magnitude and latency of the passthrough from oil price changes to retail petrol price movements, including whether there is evidence of the passthrough of oil price increases to retail petrol price being greater compared to that of decreases (i.e., the “rocket and feather” effect). Our findings show that the cumulative passthrough to retail petrol prices of different grades from a S\$1 increase in oil price was S\$0.68 to S\$0.71, with a latency of more than a week.
- Next, we investigate whether the relationship between oil prices and retail petrol prices was affected by the war in Ukraine. First, we examine the passthrough rates before and after the war began on 20 February 2022 and find no statistically significant differences between the two periods. Second, we examine if petrol price adjustments are more likely to occur when there are larger oil price changes, whether increases or decreases. Our findings show that the increase in volatility of oil prices following the outbreak of the war in Ukraine resulted in more frequent retail petrol price changes.

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

Following the start of the war in Ukraine on 20 February 2022, Brent crude oil prices surged amidst global supply concerns, peaking at US\$133 per barrel (/bbl) in March 2022. They remained elevated and volatile in 2022 and only dipped below US\$100/bbl in August 2022, before gradually declining further in end-2022 and 2023. Following the surge in oil prices in 2022, retail petrol prices in Singapore, as well as some developed economies such as the UK, rose sharply. Amidst elevated retail petrol prices, questions have been raised in Singapore as to whether petrol retailers pass through oil price increases to a greater extent than decreases (i.e., the “rocket and feather” effect).² For example, while oil prices receded for the most part in June 2022 from its peak in March 2022, retail petrol prices in Singapore climbed to even higher levels in June 2022 and exceeded their March 2022 levels [Exhibit 1]. At the same time, there were questions on whether retail pricing behaviour might have changed given the higher volatility in oil prices following the war.

Exhibit 1: Brent Crude Oil and Retail Petrol Prices from 1 January 2016 to 30 September 2023



Source: US Energy Information Administration (EIA), Consumers Association of Singapore (CASE), Monetary Authority of Singapore (MAS)

¹ We would like to thank Ms Yong Yik Wei, Dr Andy Feng and Dr Tan Di Song for their useful suggestions and comments. We are also grateful to the Consumers Association of Singapore (CASE) for providing daily retail petrol price data from the Fuel Kaki website for this study. All errors belong to the authors.

² The question of whether there is a “rocket and feather” effect is of interest in many countries. In Singapore, the Competition and Consumer Commission of Singapore (CCCS) conducted a 2017 market inquiry into the retail petrol market, following a 2011 Economic Survey of Singapore Feature Article on the same issue. Both studies were unable to find statistically significant empirical evidence for a “rocket and feather” effect.

This article examines the relationship between crude oil prices and retail petrol prices, and whether this relationship changed after the start of the war in Ukraine. Using daily data on crude oil prices and retail petrol prices from 1 January 2016 to 30 September 2023, we analyse (i) the magnitude and latency of the passthrough from oil price changes to retail petrol price movements, (ii) whether there is evidence of a “rocket and feather” effect, and (iii) whether there has been a change in the relationship between oil and retail petrol price movements following the onset of the war in Ukraine.

LITERATURE REVIEW

Internationally, several empirical studies have analysed the relationship between crude oil prices and retail petrol prices and some have found asymmetric price adjustments in various markets (e.g., Bacon (1991), Reilly & Witt (1998) for the UK market, Borenstein et al. (1997) for the US market).

In Singapore, a 2017 market inquiry by the Competition and Consumer Commission of Singapore (CCCS) examined the pricing behaviour of petrol retailers using daily data on wholesale petrol prices (Mean of Platts Singapore (MOPS)³) and retail petrol prices from January 2010 to December 2016. The study found that wholesale petrol price changes did not pass through to retail petrol prices completely and immediately: the cumulative passthrough for a S\$1 increase (decrease) in MOPS was around S\$0.64 (S\$0.66), with price adjustments taking place over eight (six) days. In addition, the difference in the cumulative passthrough for an increase and decrease in oil prices was not statistically significant (i.e., no empirical evidence of a “rocket and feather” effect). The same market inquiry also found that wholesale petrol cost as a share of retail petrol prices decreased from 2010 to 2015 while non-fuel cost components (e.g., operating costs, levy & taxes, land costs, and discounts & rebates) increased.

Similarly, Liu et al. (2015) found no evidence to reject the hypothesis that passthrough estimates were symmetric for an increase and decrease in oil prices using weekly data in Singapore from November 2006 to March 2015. The study found that there was a complete passthrough from crude oil price changes to retail petrol price movements in the long run. Furthermore, the study hypothesised that increased smartphone usage, which enabled consumers to search for the best price, contributed to faster retail petrol price adjustments in response to crude oil price decreases but had no effect on retailers’ adjustments to crude oil price increases.

DATA AND METHODOLOGY

(i) Passthrough for the Full Sample Period

To examine how retail petrol prices respond to oil price changes over the period of 1 January 2016 to 30 September 2023, we use a dynamic autoregressive distributed lag model (ADLM) of retail petrol prices against changes in Brent crude oil prices, with a momentum term for petrol price changes (i.e., lag term ΔR_{t-1} as an independent variable) to reflect persistence in retail petrol pricing.⁴

Our main regression specification is as follows:

$$\Delta R_t = \kappa \Delta R_{t-1} + \sum_{i=0}^p \beta_i \Delta O_{t-i}^+ + \sum_{j=0}^q \gamma_j \Delta O_{t-j}^- + u_t$$

where:

- ΔR_t = change in average listed retail petrol price⁵ for a particular octane grade (we studied RON92, RON95 and RON98 prices), of all petrol retailers in Singapore, between time t and $t-1$;
- ΔO_{t-i}^+ = increase in Brent crude oil prices^{6,7} between time $t-i$ and $t-i-1$, 0 if oil prices did not increase;
- ΔO_{t-j}^- = decrease in Brent crude oil prices between time $t-j$ and $t-j-1$, 0 if oil prices did not decrease;
- u_t = error term.

³ MOPS is a price index for refined petroleum products in Southeast Asia.

⁴ When using an ADLM without the momentum term, the residuals were autocorrelated. On the other hand, the residuals of our dynamic model are not statistically significantly autocorrelated. The autocorrelation (ACF) plots of ΔR_t and univariate ARIMA models also indicate that an AR(1) term should be included in the specification. When we run unit root tests on the retail petrol price changes data, we are unable to conclude that there are unit roots.

⁵ As Fung et al. have noted, retail petrol prices across the five different petrol retailers in Singapore are quite similar for the same octane and tend to move in the same direction. We use the average price because not every retailer offers every octane.

⁶ We use European spot Brent crude oil prices as reported by the US Energy Information Administration (EIA). Crude oil prices in USD per barrel are converted to SGD per litre using the same-day USD to SGD exchange rate as reported by the Monetary Authority of Singapore (MAS).

⁷ A similar regression was performed using available MOPS data instead of Brent crude oil prices over a shorter time period, with similar results. Brent crude oil prices, which are available over a longer time, are therefore used as a proxy for MOPS in this study.

We use the Bayesian Information Criteria (BIC) to choose the number of lags for oil price increases (p) and decreases (q) in the regression specification.⁸ The procedure identified seven lags for oil price increases and ten lags for oil price decreases.

Our estimates suggest that $\kappa \in [0,1]$, which in turn implies that (i) our model passes the unit root test, and (ii) petrol price changes in the present period are positively correlated with petrol price changes in the previous period (i.e., price momentum). Given this, the cumulative impact on R_t from a S\$1 change in ΔO_t^+ and ΔO_t^- at time t (i.e., the total passthrough) are given by $\frac{\sum_{i=0}^p \beta_i}{1-\kappa}$ and $\frac{\sum_{j=0}^q \gamma_j}{1-\kappa}$ respectively.⁹

To determine whether there is evidence of asymmetry in the passthrough estimates through the relationship between ΔR_t and ΔO_t^\pm , we use the following linear test under the null hypothesis that there is no “rocket and feather” effect. Hence, a rejection of the null hypothesis implies the statistically significant presence of asymmetries in the effects of oil price increases and decreases on retail petrol prices.

$$H_0 : \sum_{i=0}^p \beta_i = \sum_{j=0}^q \gamma_j \quad H_A : \sum_{i=0}^p \beta_i \neq \sum_{j=0}^q \gamma_j$$

(ii) Sub-Sample Period and Structural Break Analysis

As both oil and petrol prices were elevated and volatile after the outbreak of the war in Ukraine, we study two sub-sample periods separately: (i) 1 January 2016 to 19 February 2022 (before the war), and (ii) 20 February 2022 to 30 September 2023.

We conduct a Chow test to determine if the average passthrough estimate changed after 20 February 2022 in the post-war period. To do so, we estimate a regression of the following form:

$$\Delta R_t = \kappa \Delta R_{t-1} + \sum_{i=0}^p \beta_i \Delta O_{t-i}^+ + \sum_{j=0}^q \gamma_j \Delta O_{t-j}^- + \sum_{i=0}^p \delta_{\geq 2022} \rho_i \Delta O_{t-i}^+ + \sum_{j=0}^q \delta_{\geq 2022} \sigma_j \Delta O_{t-j}^- + u_t$$

where:

- $\delta_{\geq 2022}$ = a dummy indicator for whether the time period is after 20 February 2022.¹⁰

The coefficients of interest are ρ_i and σ_j . We test for the presence of a structural break for the cumulative price increase passthrough and the cumulative price decrease passthrough separately, under the null hypotheses that there are no structural breaks. Hence, a rejection of either null hypothesis implies that there is a statistically significant change in the passthrough rate for either oil price increases or decreases.

$$\begin{aligned} H_0 : \sum_{i=0}^p \rho_i &= 0 & H_A : \sum_{i=0}^p \rho_i &\neq 0 \\ H_0 : \sum_{j=0}^q \sigma_j &= 0 & H_A : \sum_{j=0}^q \sigma_j &\neq 0 \end{aligned}$$

(iii) Retail Price Adjustments in Response to Magnitude of Oil Price Changes

As daily oil prices frequently exhibit mean-reverting behaviour (e.g., daily fluctuations around a certain price level), we hypothesise that petrol retailers may choose to hold back on petrol price adjustments in response to small oil price movements, and only make adjustments when oil price changes are large.

We use a logistic regression to test this hypothesis:

$$Prob(\Delta R_t \neq 0) = f(\kappa I_{>0}\{R_{t-1}\} + \sum_{k=0}^{max(p,q)} \delta_k I_{>0}\{|\Delta O_{t-k}|\} + \sum_{i=0}^p \beta_i |\Delta O_{t-i}^+| + \sum_{j=0}^q \gamma_j |\Delta O_{t-j}^-| + u_t)$$

⁸ For completeness, we also use the Akaike Information Criteria (AIC) to calibrate the number of lags in oil price changes. The results are similar, with the AIC identifying 10 lags for both oil price increases and decreases. We prefer the BIC for its tendency towards simpler models.

⁹ Refer to the Annex for a derivation of this expression.

¹⁰ As robustness checks, we explored a range of possible break points from the fourth quarter of 2021 to the end of the first quarter of 2022. The results were similar.

where:

- $I_{>0}\{R_{t-1}\}$ = a dummy indicator for whether retail petrol price changed between time $t-1$ and $t-2$;
- $I_{>0}\{\Delta O_{t-k}\}$ = a dummy indicator for whether oil price changed between time $t-k$ and $t-k-1$;
- $|\Delta O_{t-i}^+|$ = absolute change in Brent crude oil prices between time $t-i$ and $t-i-1$ if oil prices increased;
- $|\Delta O_{t-j}^-|$ = absolute change in Brent crude oil prices between time $t-j$ and $t-j-1$ if oil prices decreased.

If the magnitude of oil price movements has a bearing on the probability of petrol price changes, the β_i and γ_j coefficients in the specification would be statistically significant. In particular, positive coefficients would imply that petrol prices are more likely to change when oil price movements, either increases or decreases, are larger in magnitude. Given that oil price volatility increased following the outbreak of the war in Ukraine, this would further imply that petrol prices would change more frequently in the post-war period.

RESULTS

(i) Passthrough Estimates for the Full Sample Period

For the entire period from 1 January 2016 to 30 September 2023, the cumulative passthrough to petrol prices of different grades (i.e., RON92, RON95 and RON98) from a S\$1 increase in oil price was S\$0.68 to S\$0.71. In other words, petrol prices increased by S\$0.68 to S\$0.71 in total for a S\$1 increase in oil price. For a S\$1 decrease in oil price, the cumulative passthrough to petrol prices of different grades was S\$0.65 to S\$0.68, i.e., petrol prices fell by S\$0.65 to S\$0.68 in total for a S\$1 decline in oil price. All cumulative passthroughs were statistically significant at the 5% level [Exhibit 2]. However, the difference in the passthrough estimates between an oil price increase and an oil price decrease was not statistically significant. In other words, we do not find evidence of a “rocket and feather” effect as the passthrough estimates are symmetric for an oil price increase and decrease.

The estimated period over which petrol prices adjust to oil price changes was largely similar for a S\$1 increase in oil price and a S\$1 decrease in oil price, at seven days and ten days respectively.¹¹

Exhibit 2: Estimates of Passthrough from Oil Price to Petrol Price from 1 January 2016 to 30 September 2023

	RON92	RON95	RON98
Cumulative passthrough to petrol price from S\$1 oil price increase (S\$)	0.678	0.704	0.714
Cumulative passthrough to petrol price from S\$1 oil price decrease (S\$)	0.649	0.683	0.679
Any statistically discernible difference between the passthrough from a price increase vs decrease? (p-value)	No (0.771)	No (0.833)	No (0.736)

(ii) Sub-Sample Period Passthrough Estimates and Structural Break Analysis

The estimated cumulative passthrough to petrol prices from a S\$1 increase in oil price for the post-Ukraine war sub-sample period of 20 February 2022 to 30 September 2023 (i.e., S\$0.79 to S\$0.87) was slightly higher than that for the earlier period of 1 January 2016 to 19 February 2022 (i.e., S\$0.56 to S\$0.58) [Exhibit 3]. Similarly, for a S\$1 decrease in oil price, the estimated cumulative passthrough for the post-war period (i.e., S\$0.79 to S\$0.86) was slightly higher than that for the earlier period (i.e., S\$0.53 to S\$0.54). All cumulative passthroughs were statistically significant at the 5% level.

For both sub-periods, the difference in cumulative passthrough rates for oil price increases and decreases was not statistically significant, indicating that there is no evidence of a “rocket and feather” effect. The Chow test found that the difference in estimated cumulative passthroughs between the two periods was not statistically significant, suggesting that there was no structural change in retailers’ passthrough of oil price changes to retail petrol prices following the onset of the war.

¹¹ The estimated passthrough rates and adjustment periods are broadly similar to that found in the 2017 CCCS market inquiry.

Exhibit 3: Estimates of Passthrough from Oil Price to Petrol Price, 1 January 2016 to 19 February 2022 and 20 February 2022 to 30 September 2023

		RON92		RON95		RON98	
		1 Jan 2016 – 19 Feb 2022	20 Feb 2022 – 30 Sep 2023	1 Jan 2016 – 19 Feb 2022	20 Feb 2022 – 30 Sep 2023	Jan 2016 – 19 Feb 2022	20 Feb 2022 – 30 Sep 2023
Cumulative passthrough to petrol price from S\$1 oil price increase (S\$)		0.558	0.792	0.571	0.855	0.582	0.866
Cumulative passthrough to petrol price from S\$1 oil price decrease (S\$)		0.527	0.786	0.540	0.864	0.540	0.856
Any statistically discernible difference between the passthrough from a price increase vs decrease? (p-value)		No (0.542)	No (0.977)	No (0.551)	No (0.964)	No (0.385)	No (0.961)
Was there a statistically significant structural break on 20 Feb 2022? (p-value)	Price Increase	No (0.173)		No (0.122)		No (0.160)	
	Price Decrease	No (0.220)		No (0.143)		No (0.149)	

(iv) Estimates of Retail Price Adjustments in Response to Magnitude of Oil Price Changes

Daily oil price movements were more volatile after the war in Ukraine began on 20 February 2022 compared to the pre-war period. Specifically, the standard deviation in oil price changes from 20 February 2022 to 30 September 2023 was 2.63, higher than the 1.30 observed from 1 January 2016 to 19 February 2022.¹² Petrol price changes also became more frequent after the war started (0.22 to 0.30 changes per month from 20 February 2022 to 30 September 2023) compared to the earlier period (0.17 to 0.21 changes per month from 1 January 2016 to 19 February 2022).

Our logistic regression yields positive and statistically significant coefficients on the size of oil price increases and decreases (i.e., β_i and γ_j), suggesting that petrol retailers are more responsive towards large oil price changes (i.e., both increases and decreases) compared to smaller ones. Given that daily oil price movements were more volatile after the outbreak of the war in Ukraine, with both price increases and decreases being larger, this resulted in the higher frequency of retail petrol price changes that was observed.

CONCLUSION

Our findings show that the cumulative passthrough to retail petrol prices of different grades from a S\$1 increase in oil price was S\$0.68 to S\$0.71, with a latency of more than a week. We did not find empirical evidence of a “rocket and feather” effect. We also investigated if the relationship between oil prices and retail petrol prices was affected by the onset of the war in Ukraine. We did not find statistically significant differences in the passthrough rates in the post-war period, compared to the earlier period. Nonetheless, the increased volatility in oil price movements after the war began resulted in more frequent retail petrol price changes.

¹² Oil prices are measured in USD per barrel (rather than in SGD per litre) to capture the volatility in oil prices only.

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ANNEX

Proposition: The cumulative impact on R_t from a 1-unit change in ΔO_t^+ and ΔO_t^- at time t is given by $\frac{\sum_{i=0}^p \beta_i}{1-\kappa}$ and $\frac{\sum_{i=0}^q \gamma_i}{1-\kappa}$ respectively

Proof of Proposition: Consider the case where $p = q = 1$, where we look at a shock on ΔO_t^+ at time t . In the first period, the impact on ΔR_t would be β_0 , and in the second period the impact would be κ times the first period impact plus β_1 so we have $\kappa\beta_0 + \beta_1$. Thereafter, the impact would be κ times the previous period. Denoting the cumulative impact as ΔR (dropping the t subscript as we are considering the cumulative impact), it can be written as:

$$\Delta R = \beta_0 + \sum_{h=0}^{\infty} \kappa^h (\kappa\beta_0 + \beta_1) = \beta_0 + \frac{(\kappa\beta_0 + \beta_1)}{(1-\kappa)} = \frac{(\beta_0 + \beta_1)}{(1-\kappa)}$$

where the second equality is by the properties of a geometric series.

For the general, consider the cumulative impact being the sum of p geometric series, one for each lag of ΔO_t^+ . At time t , the shock results in a ΔR_t increase of β_0 through ΔO_t^+ . This is then propagated throughout the rest of the time periods $t + h$ for $h = 1, 2, \dots$ at a declining rate determined by κ , cumulatively forming the geometric series $\sum_{h=0}^{\infty} \kappa^h \beta_0$.

At time $t + 1$, the shock results in an ΔR_t increase of β_1 through ΔO_{t+1}^+ . This is then propagated throughout the rest of the time periods in a similar fashion forming the geometric series $\sum_{h=0}^{\infty} \kappa^h \beta_1$.

The above process continues for all p lag terms on ΔO_t^+ that are included in the model. Because the model only accounts for the dynamics of ΔR_t and not ΔO_t , each shock and its propagation are independent of the others. Therefore, the cumulative impact can be written as:

$$\Delta R = \sum_{i=0}^p \sum_{h=0}^{\infty} \kappa^h \beta_i = \sum_{h=0}^{\infty} \kappa^h \sum_{i=0}^p \beta_i = \frac{\sum_{i=0}^p \beta_i}{(1-\kappa)}$$

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