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Impact of Global Economic Disruptions on Singapore's Balance of Payments

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Introduction

Since the emergence of the Coronavirus Disease 2019 (COVID-19) in end 2019, global economic activities have been severely disrupted, following the implementation of public health measures such as lockdowns and border closures in many countries, including Singapore. As a financial and trading hub, Singapore is exposed to these COVID-19-led external shocks.

This article examines the impact of COVID-19 on Singapore's balance of payments (BOP). The BOP summarises the economic transactions between Singapore residents[1] and non-residents. In addition, it compares the impact of COVID-19 on Singapore's BOP with similar historical events such as the outbreak of Severe Acute Respiratory Syndrome (SARS) in 2003 and the Global Financial Crisis (GFC) in 2007-2009.

Current Account

Current account surplus rose during COVID-19, led by a large decline in services imports. In contrast, during SARS and the GFC, current account surpluses trended downwards with goods surpluses.

Singapore's BOP current account comprises cross-border flows of goods, services, primary income and secondary income. The current account surpluses have historically been attributed to goods account surpluses since 1995 and in times of the SARS

What is the Balance of Payments?

Balance of Payments is a statement that summarises the economic transactions between residents of an economy and non-residents. It is the **overall balance** of the current account and the capital and financial account. These transactions are financed by official reserves.

Current Account is a set of transactions consisting of exports and imports of goods and services, as well as primary and secondary income receipts and payments.

Capital and Financial Account covers net acquisitions of foreign financial assets by Singapore residents and net incurrence of foreign liabilities by Singapore residents.

Reserve Assets show the changes in Singapore's foreign reserves holdings, consisting of Singapore's official holdings of monetary gold and foreign exchange assets, as well as Singapore's special drawing rights and reserve position in the International Monetary Fund.

1 Residents refer to individuals residing in the country, corporations and enterprises located in the country, as well as its embassies, military units and official missions stationed abroad.

outbreak and the GFC, the fall in current account surpluses generally corresponded with lower goods account surpluses. While the goods surplus declined in 2020 amidst COVID-19, the current account surplus rose 13.2 per cent from a year ago to $82 billion on the back of a larger services account surplus and a smaller primary income deficit. The current account surplus was 17.6 per cent of Gross Domestic Product (GDP) in 2020, a moderate increase from the pre-COVID-19 average of 16.6 per cent between 2015 and 2019 though it remained generally lower in comparison to the periods of the SARS outbreak and the GFC (Chart 1).

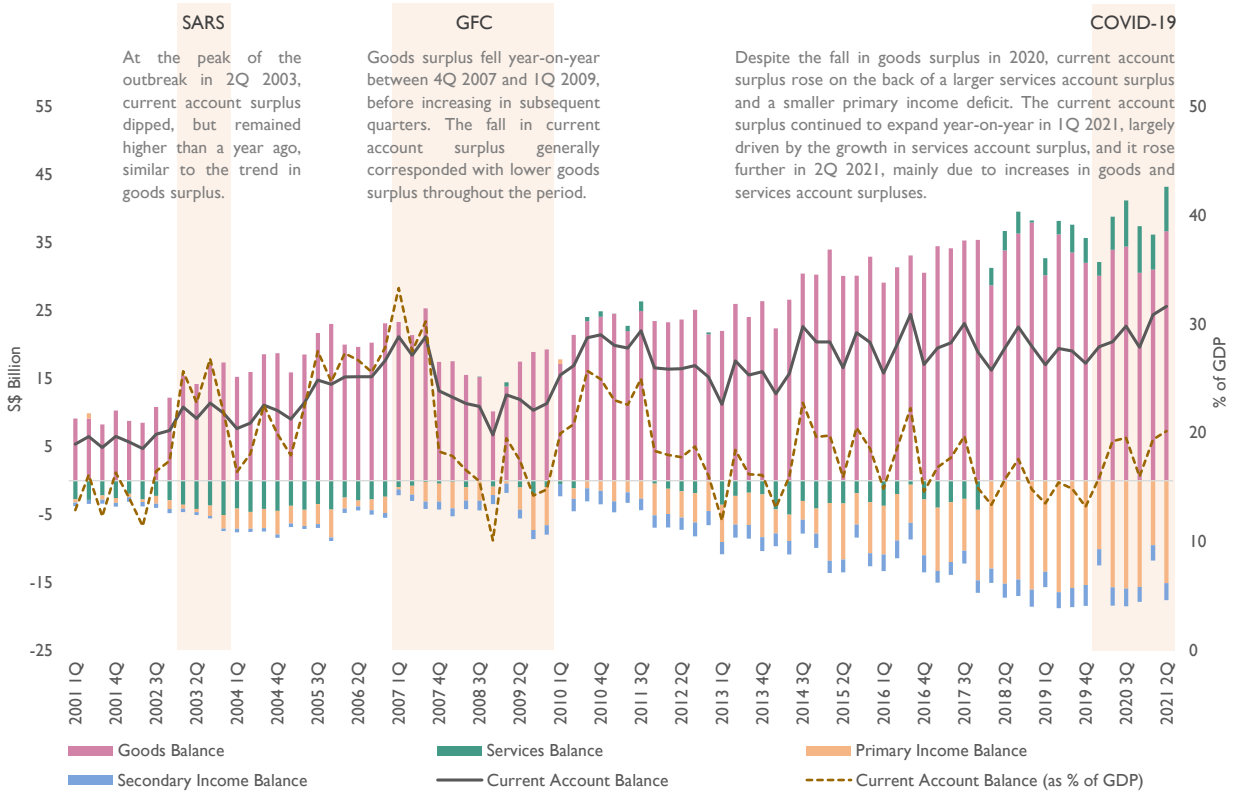
Goods Account

With the occurrence of COVID-19, Singapore's goods account surplus contracted by 2.2 per cent from a year ago to $129 billion in 2020, with exports and imports of goods decreasing 5.7 per cent and 6.6 per cent respectively. Although non-oil domestic exports (NODX) growth held up, supported by strong exports of pharmaceuticals and electronics, overall merchandise exports declined, weighed down mainly by oil trade amid low oil prices. Similar to goods exports, goods imports plunged in 2Q 2020, before rebounding to near pre-COVID-19 levels in the next two quarters, under the influence of global oil prices.

While the goods surplus dipped quarter-on-quarter during the peak of the SARS outbreak in 2Q 2003, the adverse economic impact of the epidemic was not apparent from exports and imports of goods which increased from the previous quarter. The goods surplus remained substantially higher than the previous year by two-thirds, as goods exports rose 7.8 per cent while goods imports fell 1.2 per cent.

In the midst of the US-centric subprime mortgage lending crisis between 4Q 2007 and 3Q 2008, the goods surplus trended downwards, with imports of goods increasing faster than exports. It was only after the GFC deepened in the second half of 2008 that its impact became more noticeable with relatively steep declines in cross-border flows of goods. From 4Q 2008 to 3Q 2009, goods exports and imports contracted year-on-year in the range of 5.4 per cent to 27.8 per cent. Correspondingly, goods surplus declined 41.7 per cent and 21.1 per cent in 4Q 2008 and 1Q 2009 respectively, before rebounding in the subsequent quarters.

CHART 1 CURRENT ACCOUNT, 1Q 2001 - 2Q 2021



Services Account

Amidst COVID-19, the services account surplus rose from $12 billion in 2019 to $21 billion in 2020 as the 16.1 per cent decline in services imports exceeded the 12.7 per cent decline in exports. The fall in net payments of travel services was the main driver of the increase in the services account surplus, alongside transport services which turned from net payments in 2019 to net receipts in 2020.

Travel receipts and payments suffered unprecedented declines of 74.1 per cent and 74.7 per cent in 2020, as tourist arrivals and resident departures fell sharply due to the implementation of border controls to curb cross-border transmissions. The impact was particularly pronounced in 2Q 2020 when stricter travel restrictions were imposed in response to the worsening spread of COVID-19. Travel receipts plunged 86.7 per cent year-on-year to a historic low of $886 million, following the 35.8 per cent decrease in 1Q 2020. Concomitantly, travel payments fell precipitously by 93.2 per cent from a year ago to $644 million in 2Q2020, the lowest on record since the early 1990s, after declining 19.6 per cent in 1Q 2020. Trade in travel services remained subdued from 3Q 2020 onwards due to ongoing travel restrictions.

Similarly, exports and imports of transport services fell 14.0 per cent and 17.6 per cent respectively in 2020, with quarterly trends corresponding to the severity of the outbreak over time (Charts 2 and 3).

In comparison, the impact of SARS was less significant as it was contained relatively rapidly without the need for extensive border restrictions. Although exports and imports of travel and transport services dipped during the height of the outbreak in 2Q 2003, it was followed by a quick recovery in the next quarter. While trade in travel and transport services similarly trended downwards in 2009 amidst the GFC, the impact was less significant compared to COVID-19.

Generally, the impact of COVID-19 on the BOP services account was severe, but uneven. In addition to travel and transport services, other business services exports and imports fell in 2020 by 3.7 per cent and 4.2 per cent respectively after expanding consistently in recent years. Exports of maintenance and repair services fell 27.5 per cent, more significantly than imports at 17.0 per cent, while construction services exports and imports registered respective declines of 35.9 per cent and 36.3 per cent. Similarly, charges for the use of intellectual property saw declines in receipts and payments, albeit at relatively moderate rates of

CHART 2 SERVICES EXPORTS, 1Q2001 - 2Q 2021

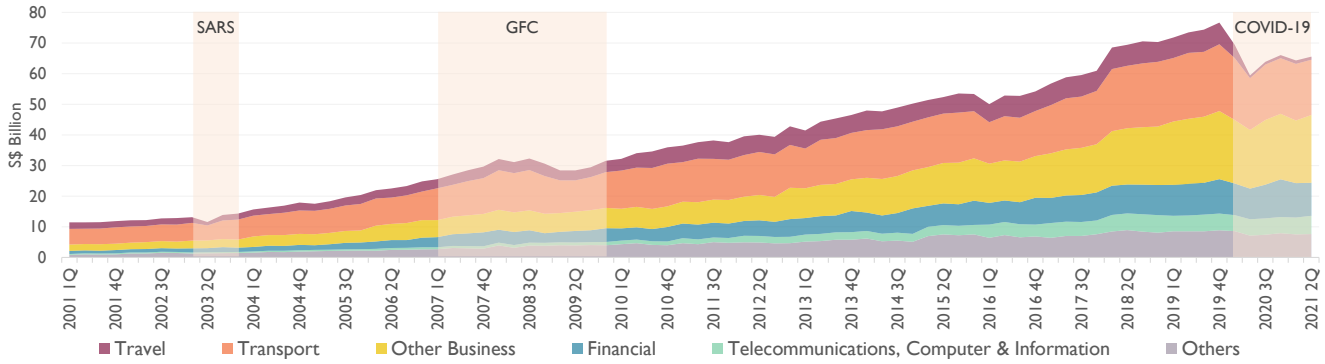
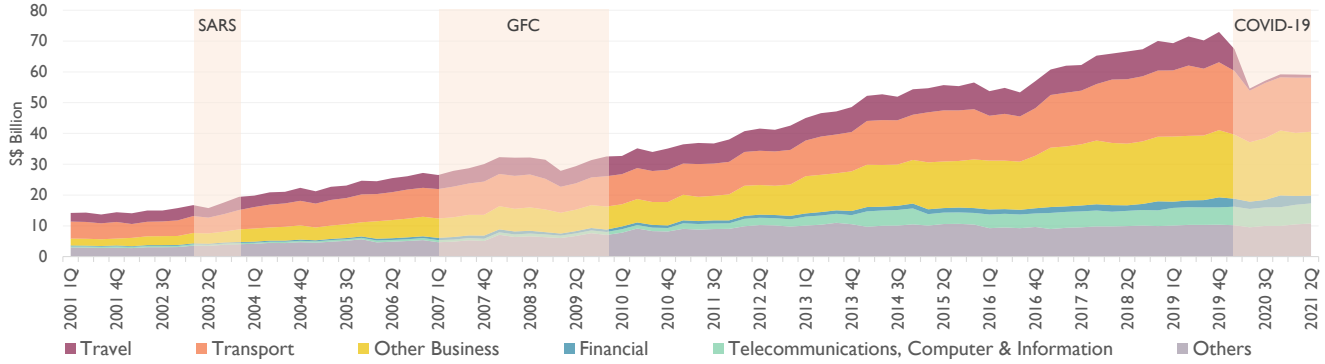


CHART 3 SERVICES IMPORTS, 1Q2001 - 2Q 2021



1.4 per cent and 1.0 per cent respectively. In contrast, trade performance of financial services was strong, with exports and imports increasing 3.7 per cent and 13.9 per cent respectively. Similarly, exports of telecommunications, computer & information services held up and was almost unchanged from a year ago, while imports grew 5.5 per cent.

Primary and Secondary Income Accounts

In 2020, the primary income deficit narrowed from $61 billion a year ago to $57 billion, with primary income receipts and payments decreasing 7.8 per cent and 7.3 per cent respectively. Prior to COVID-19, primary income receipts and payments had generally been expanding since 2009, after significant declines of 21.6 per cent and 17.0 per cent were last recorded in 2008 during the GFC. Despite the occurrence of SARS, primary income receipts and payments registered strong growth in the early 2000s before the onset of the GFC (Chart 4).

On the other hand, the secondary income deficit narrowed 5.7 per cent to $9.9 billion in 2020 as secondary income receipts grew 0.7 per cent while payments fell 1.2 per cent. The trends in secondary income have generally been stable in comparison throughout the years, seemingly resilient to disruptions caused by major global economic events.

Financial Account

General decline in direct investment during prolonged disruptions, but impact on portfolio and other investment mixed.

Singapore's BOP financial account is a measure of Singapore's net acquisition of financial assets and net incurrence of financial liabilities from non-residents and consists of main functional categories such as direct investment, portfolio investment, financial derivatives and other investment. The financial account had persistently recorded annual net outflows from 2001 to 2019, even during SARS and the GFC, though the latter episode saw periods of discernible declines in net financial outflows. In comparison, COVID-19 had a greater impact on the financial account and resulted in Singapore switching from a position of net financial outflows to the rest of the world to net inflows in 2020 (Chart 5).

Direct Investment

Singapore's direct investment was the least affected by the SARS outbreak as overall annual net inflows still grew by $17 billion in 2003 as compared to a year ago, largely owing to significant foreign direct investment inflows. Despite a $20 billion decline in inward flows from non-resident investors in 2Q 2003 at the height of SARS, this was partially offset by the subsequent $13 billion increase in direct investment inflows in the following quarter as the spread of the virus was contained and investor confidence returned. In contrast, the GFC resulted in economic instability stemming from the subprime mortgage crisis to the collapse of US investment bank Lehmann Brothers, which led to both direct investment assets and liabilities in Singapore plummeting 81.7 per cent and 73.0 per cent respectively in 2008 from the then-historic peaks in 2007. Investors cut back on cross-border investments during the GFC period,

CHART 4 PRIMARY AND SECONDARY INCOME ACCOUNTS, 2001 - 2020

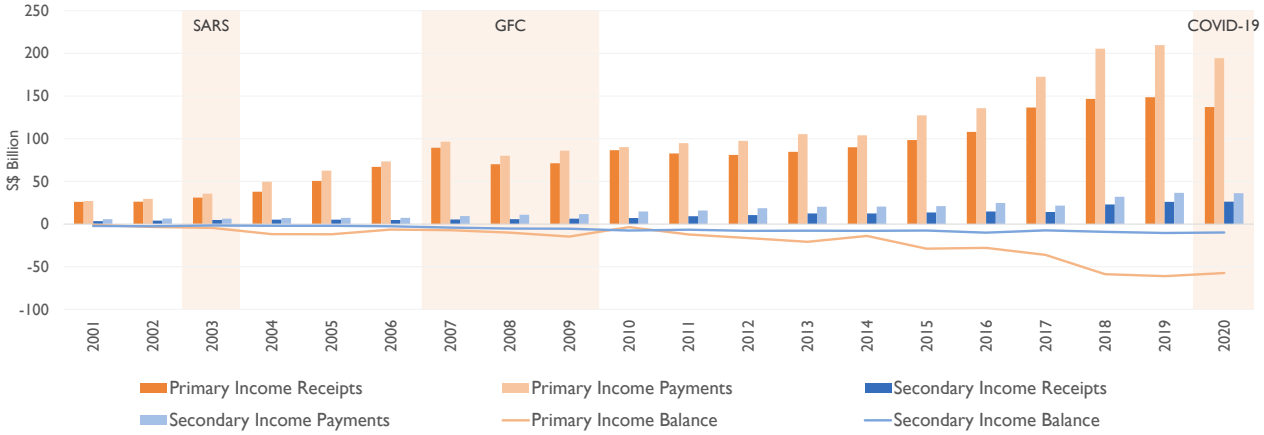
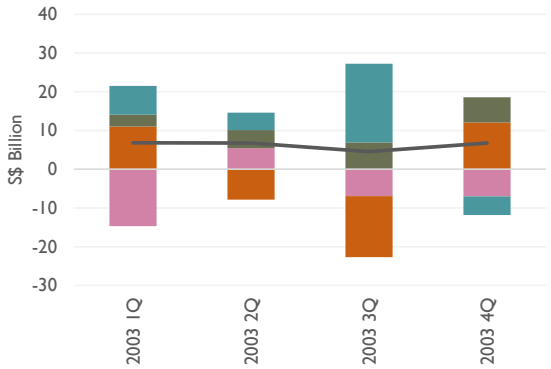


CHART 5 COMPARISON OF GLOBAL ECONOMIC EVENTS ON THE FINANCIAL ACCOUNT

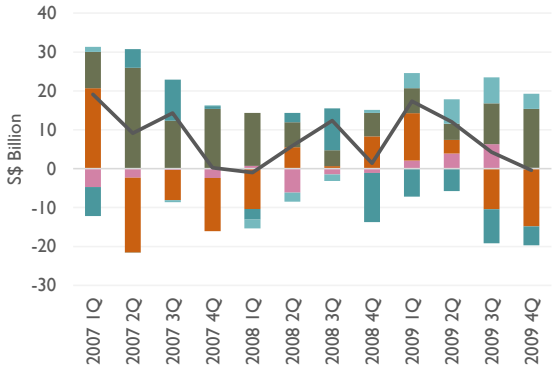
SARS

Financial account net outflows dipped slightly at the height of the SARS outbreak in 2Q 2003 and the decline extended into 3Q 2003.



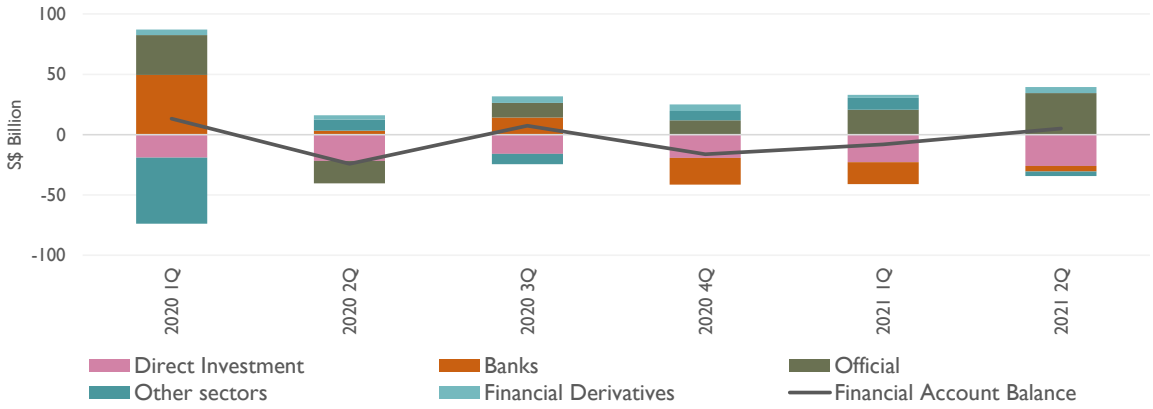
GFC

Financial account net inflows was registered in 1Q 2008, contributed by net inflows of financial derivatives and other investment.



COVID-19

Rapid fluctuations in the levels of financial account flows, switching from net outflows to net inflows from one quarter to the other from 1Q 2020 to 2Q 2021.



Note: Financial Derivatives is only available from reference year 2006 onwards.

before a gradual recovery saw direct investment assets outpacing liabilities throughout the quarters of 2009. Similarly, direct investment annual net inflows experienced a slowdown due to COVID-19, which saw a 20.3 per cent year-on-year decline in 2020 on the back of lower foreign direct investment into Singapore and residents' direct investment abroad (Chart 6).

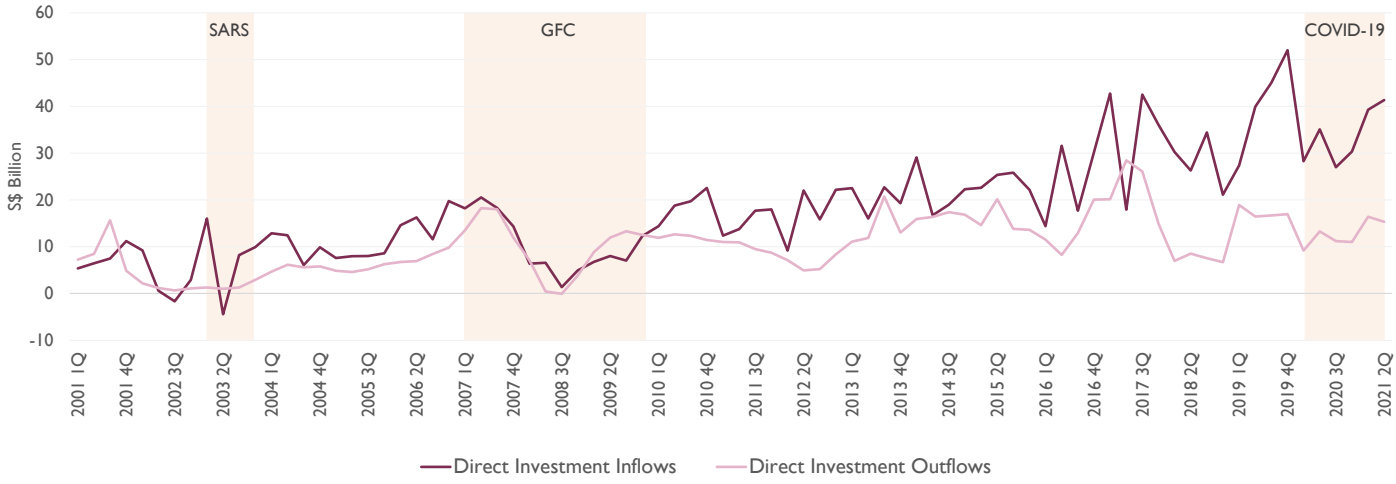
Portfolio Investment

Portfolio investment, comprising mainly transactions in equity and investment fund shares, has been recording annual net outflows for most years over the last two decades, largely driven by movements in the banking (i.e. deposit-taking corporate) sector. The exception was in 2008, as the onset of the GFC brought about substantial withdrawals of overseas debt securities by resident deposit-taking corporations, resulting in a sharp decline in portfolio investment assets. This in turn reversed portfolio investment annual net outflows of $72 billion to net inflows of $16 billion.

During COVID-19 in 2020, resident banks similarly scaled back on activities in foreign markets by selling overseas debt securities, switching from net purchases in the preceding year. On the other hand, net outflows of portfolio investment shrank against

CHART 6

QUARTERLY INFLOWS AND OUTFLOWS OF FOREIGN DIRECT INVESTMENT, 1Q2001 - 2Q22021



the backdrop of SARS in 2Q 2003 through 3Q 2003 but ended the year positively with 40.7 per cent year-on-year growth for the full year.

Other Investment and Financial Derivatives

Other investment has generally been volatile and was driven by broad-based transactions in all institutional sectors. The volatility was evidenced by large swings in financial flows during the periods of crises, especially during the GFC in 2007-2009 and COVID-19 since 1Q 2020.

The huge fluctuations to other investment assets and liabilities were largely attributable to banking sector movements, notably throughout the quarters in 2008 and especially in the first half of 2020, with interbank activities switching between net outflows and net inflows in view of heightened financial market instability before subsequent sharp corrections as the market normalised.

In addition, net inflows of other investment in the domestic non-bank private sector surged to a record high in 2020, outstripping the net inflows during the GFC in 2008 while other investment net outflows increased year-on-year in 2003 in the midst of the SARS outbreak.

Meanwhile, cross-border financial derivatives consistently recorded overall net outflows during COVID-19 in 2020. In contrast, substantial transactions in both assets and liabilities undertaken in the derivatives markets during the GFC resulted in net outflows in 2007, followed by a shift to net inflows in the following year before reverting to net outflows in 2009.

Overall Balance and Reserve Assets

Singapore's BOP registered a surplus of $103 billion in 2020, reversing from a deficit of $11 billion a year ago, due largely to a turnaround in the financial account balance from net outflows to net inflows alongside a relatively moderate increase in the current account surplus. In comparison, the BOP surpluses during SARS and the GFC were driven mainly by the persistent current account surpluses recorded throughout both periods.

Conclusion

Being a small and open economy, Singapore has experienced the ripple effects of global economic disruptions over the last two decades. While Singapore's overall BOP has generally recorded surpluses during the period, the extent to which its various accounts and balances were affected depended on a confluence of factors such as the scale and duration of such disruptions as well as the underlying economic conditions.

By highlighting the impact of past and present downturns, this article serves as a useful analytical reference to better understand the potential effects of future external headwinds on Singapore's BOP.

Impact of COVID-19 on the Sea Freight Transport and Freight Forwarding Price Indices

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Introduction

The COVID-19 outbreak in end 2019 saw many countries implementing strict public health measures and border restrictions to manage it. Logistic arrangements for transportation of goods across countries were thus affected.

The Sea Freight Transport Price Index (SFTPI) and Freight Forwarding Price Index (FFPI) compiled by the Singapore Department of Statistics exhibited significant movements over this period due to the supply chain disruptions.

This article highlights the impact of COVID-19 on the SFTPI and FFPI.

Sea Freight Transport Price Index (SFTPI)

The SFTPI[1] measures changes in the prices of transporting seaborne freight by Singapore-registered ship operators. The SFTPI comprises five sub-indices for measuring average changes in the prices for transporting the various freight types (Figure 1).

The SFTPI was on an upward trend from 1Q 2019 until 1Q 2020 before falling in 2Q 2020 due to decreases mainly from the Crude Oil Transport, Dry Bulk Transport and Containerised Freight Transport Price Indices (Chart 1). The decline in SFTPI moderated in 3Q 2020 and began to increase from 4Q 2020, driven largely by the Containerised Freight Transport Price Index which had started rising from 3Q 2020.

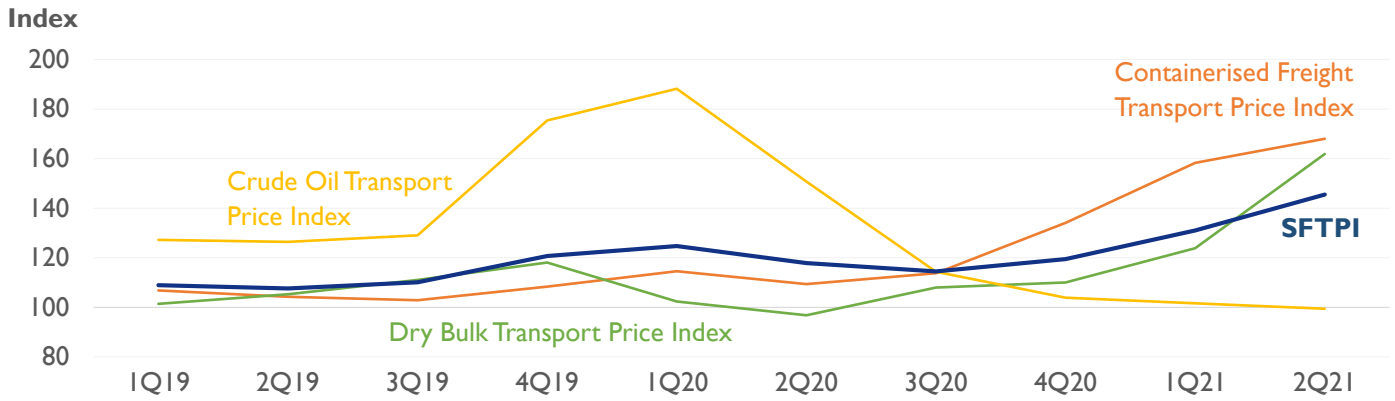
FIGURE 1 SFTPI BY FREIGHT TYPE

WEIGHTS: 100%	SEA FREIGHT TRANSPORT PRICE INDEX
38.4%	**Containerised Freight Transport Price Index**: Measures changes in the prices of cargoes shipped in container boxes transported by container ships
28.5%	**Dry Bulk Transport Price Index**: Measures changes in the prices of dry commodity cargoes in large unpacked quantities, e.g. coal and ore, that are transported by dry bulk/cargo ships
9.8%	**Crude Oil Transport Price Index**: Measures changes in the prices of unrefined petroleum or crude oil in bulk volumes, transported by crude oil tankers
18.3%	**Bulk Liquid Transport Price Index**: Measures changes in the prices of liquid goods e.g. processed petroleum and chemicals in bulk volumes, transported by bulk liquid/chemical tankers
5.0%	**Other Freights Transport Price Index**: Measures changes in the prices of other seaborne freight transport, e.g. cars and gas transported by car carriers and gas tankers respectively

1 Prices used in the SFTPI compilation were actual transacted prices, including surcharges and net of discounts. These are obtained quarterly from selected ship operators classified under the Singapore Standard Industrial Classifications 2020 (SSIC 2020) code: 50021-Shipping Companies, including chartering of ships and boats with crew (freight). Chartering of vessels without operator, and operation of barges, tugboats are excluded.

CHART 1

SFTPI AND SELECTED SUB-INDICES (2017=100)



Rising Containerised Freight Transport Rates Due to Global Container Shortage

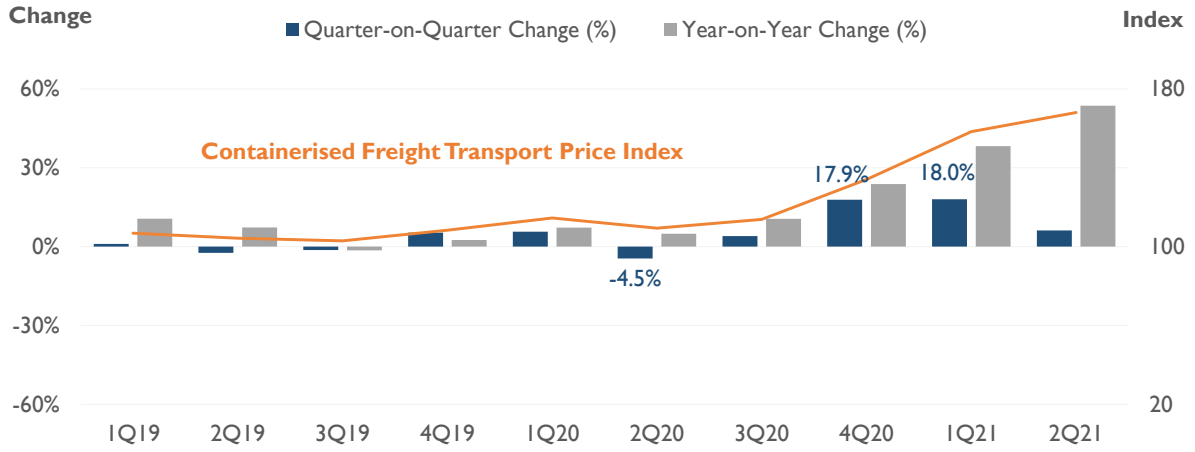
The Containerised Freight Transport Price Index accounts for 38.4 per cent of the SFTPI weight. After declining 4.5 per cent in 2Q 2020, the index began increasing in 3Q 2020, and rose 17.9 per cent and 18.0 per cent in 4Q 2020 and 1Q 2021 respectively (Chart 2) on a quarter-on-quarter basis, before the increase slowed down in 2Q 2021.

As many countries started national lockdowns and ceased the production of some goods in early 2020, shipping companies reduced the number of cargo ships sent out[2], resulting in some uncollected empty containers being stacked up at cargo ports[3]. These created a backlog of containers, leading to critical shortage and worldwide port congestion[4]. Coupled with rising demand for essential products, containerised freight transport prices rose and are expected to persist for some time[5].

The supply constraint is observed based on data from the Maritime and Port Authority of Singapore (MPA) (Chart 3). The number of container vessel arrivals[6] in Singapore had been trending downwards,

CHART 2

PERCENTAGE CHANGE IN CONTAINERISED FREIGHT TRANSPORT PRICE INDEX (2017=100)



2 Ship Technology, 29 Apr 2021: Global shipping container shortage: the story so far

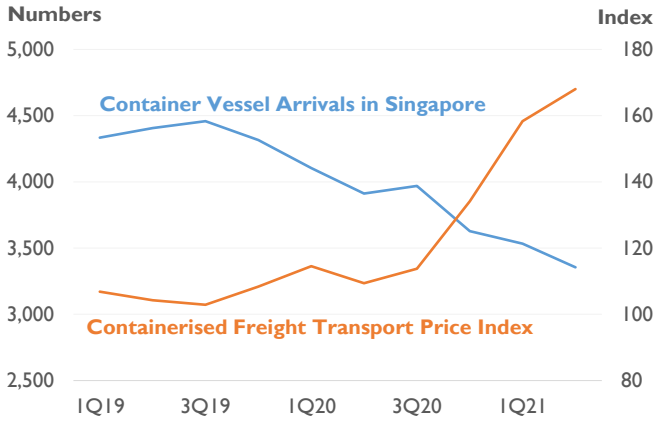
3 The Straits Times, 12 Mar 2021: Container ships facing longer wait times at Singapore port amid global surge in cargo demand

4 Source Today, 12 Apr 2021: Port congestion continues to throttle the world's supply chains

5 The Business Times, 5 Jul 2021: Pandemic drives sea freight prices to record high

6 Based on published Sea Cargo and Shipping Statistics from MPA.

CHART 3
CONTAINERISED FREIGHT TRANSPORT PRICE INDEX AND CONTAINER VESSEL ARRIVALS IN SINGAPORE



Source: Maritime and Port Authority of Singapore

especially with a larger fall registered in 4Q 2020, when the Containerised Freight Transport Price Index started to spike upwards.

Falling Demand for Crude Oil Leading to its Lower Prices

The Crude Oil Transport Price Index dipped 19.9 per cent in 2Q 2020 and dropped a further 24.1 per cent in 3Q 2020 (Chart 4). This could be attributed to the falling demand for crude oil[7, 8], as a result of travel restrictions, reduced air traffic, more business shutdowns, etc. Nonetheless, the decline in the price index slowed down in 1Q 2021 following the slight recovery in the global oil demand[9].

Freight Forwarding Price Index (FFPI)

The FFPI[10] measures changes in the prices of services provided by Singapore-registered freight forwarding companies and non-vessel operating common carriers categorised under the SSIC 2020 code: 52292 (Freight Transport Arrangement). These companies arrange cargo transportation on behalf of a shipper via air, sea, and land transportation modes. The FFPI is stratified into three transportation modes, namely air, sea and land[11] freight forwarding.

The FFPI increased substantially in 2Q 2020 (Chart 5), reflecting the spike in air freight forwarding charges following the reduction in air cargo

CHART 5
FFPI AND SUB-INDICES (2017=100)

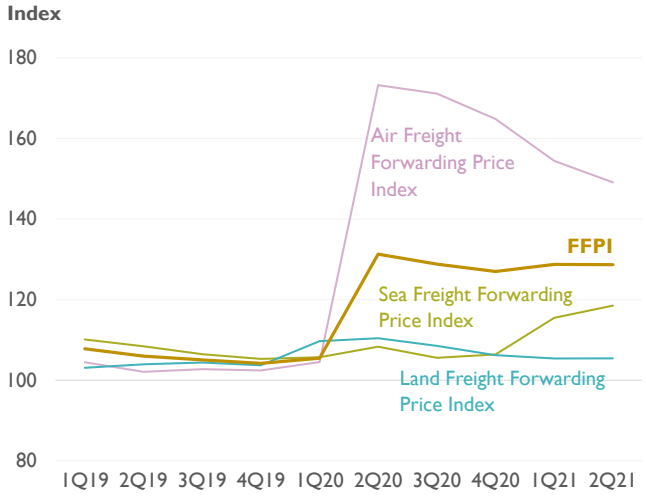
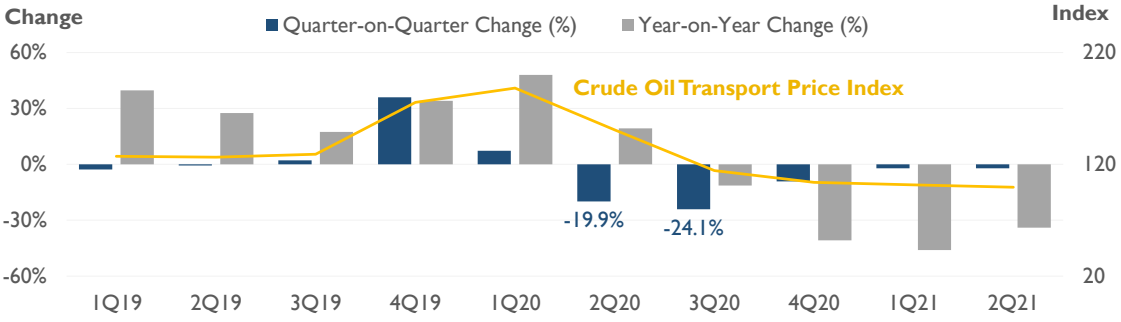


CHART 4
PERCENTAGE CHANGE IN CRUDE OIL TRANSPORT PRICE INDEX (2017=100)



7 The Business Times, 29 Apr 2020: Oil prices sink as world runs low on storage capacity amid frail demand

8 The Straits Times, 15 Sep 2020: Oil industry paints grimmer picture of pandemic's harm to demand

9 MarketWatch (The Wall Street Journal), 14 Apr 2021: IEA (International Energy Agency) says global oil market is recovering and lifts demand forecast

10 The index excludes shipping agents, haulage services and companies whose primary services are packing and crating services. Prices used in the index compilation include actual transacted prices that are net of discounts and are obtained quarterly from selected freight forwarding companies.

11 Land freight forwarding is defined as the arrangement of transporting freight via land across national borders. It excludes trucking/in-land transportation which is classified under SSIC 2020 code: 49231 (Freight transport by road).

capacity[12] during COVID-19. Some of the reported air freight forwarding price increases were about five times more than their usual charges. Although the air freight forwarding charges had declined gradually since 2Q 2020, the prices remained above the pre-COVID level[13]. While the Air Freight Forwarding index slipped downwards, the Sea Freight Forwarding Index crept up in 1Q 2021.

Spike in Prices for Air Freight Forwarding as a Result of Reduction in Air Cargo Capacity

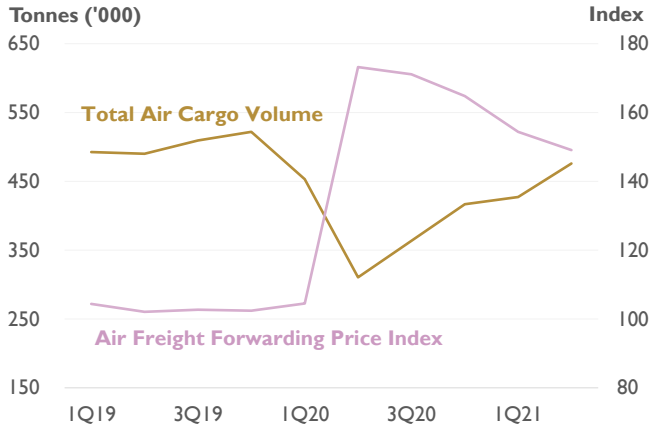
Given the travel restrictions imposed, the supply for air freight space became very limited as most of the airlines grounded their aircrafts[14].

According to the Civil Aviation Authority of Singapore (CAAS), the total air cargo volume[15] in 2Q 2020 fell close to half of that in 4Q 2019, before rising progressively in the later half of the year (Chart 6).

With the gradual recovery in air cargo capacity from 3Q 2020 onwards, marginal declines were observed in the Air Freight Forwarding Index. Nevertheless, given the faster turnaround time of air cargo as compared to sea cargo, the demand for air cargo remained for essential goods, resulting in persistently high air freight forwarding charges.

CHART 6

AIR FREIGHT FORWARDING PRICE INDEX AND TOTAL AIR CARGO VOLUME



Source: Civil Aviation Authority of Singapore

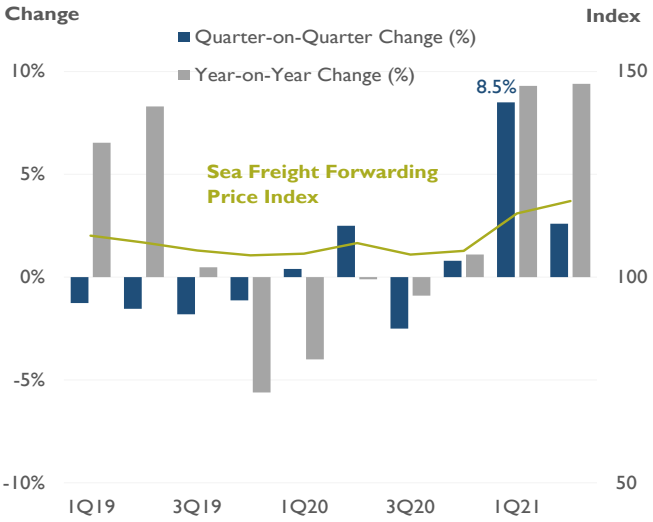
Higher Rates for Sea Freight Forwarding Following Global Container Shortage and Congestion in Some Ports

Prices for sea freight forwarding services were similarly affected, where the demand for container space exceeded the available supply of containers. The laden containers were held up in congested ports, causing a lack of reusable empty containers[16]. These delayed effects were passed on, giving rise to general price increases in sea freight forwarding services since 4Q 2020.

The Sea Freight Forwarding Price Index which makes up close to two thirds (60.0 per cent) of the total FFPI's weight, rose 8.5 per cent in 1Q 2021 over the last quarter (Chart 7), highest quarter-on-quarter change since the start of the index in 1Q 2017.

CHART 7

PERCENTAGE CHANGE IN SEA FREIGHT FORWARDING PRICE INDEX (2017=100)



Concluding Remarks

With uncertainty over the length and severity of COVID-19, as well as the trajectory of the recovery in the global economy, the longer term impact on the transportation and logistics industry remains ambiguous. The SFTPI and FFPI which track price changes in these sectors serve as useful indicators for further analysis.

12 The Straits Times, 29 Apr 2020: Aviation industry warns of severe cargo capacity shortage amid coronavirus crisis

13 The Business Times, 27 Jul 2020: Air freight rates ease, but yet to come back down to earth

14 The Business Times, 13 Apr 2020: Freight rates soar as cargo capacity shrinks amid Covid-19 crisis

15 Based on published Air Cargo Discharged and Air Cargo Loaded data from CAAS.

16 CNA, 26 Mar 2021: Singapore navigating shipping squeeze, container congestion amid surge in cargo demand

Income-Based Gross Domestic Product: Key Concepts and Principles

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Introduction

The Gross Domestic Product (GDP) is compiled from three approaches viz. production, expenditure and income. Since 2017, Singapore releases the income-based GDP or GDP(I) by industry at current prices on a quarterly basis[1]. The quarterly production-based and expenditure-based GDP at current prices were released in 2000 and 2016 respectively. Similar to the other approaches, the compilation of GDP(I) is based on the conceptual framework underpinning the System of National Accounts[2] (SNA). GDP(I) can be measured by the sum of income flows, i.e.,

GDP(I) = *Compensation of Employees (CoE)*
+ *Gross Operating Surplus (GOS)*
+ *Taxes less Subsidies on Production and on Imports (TSPI)*

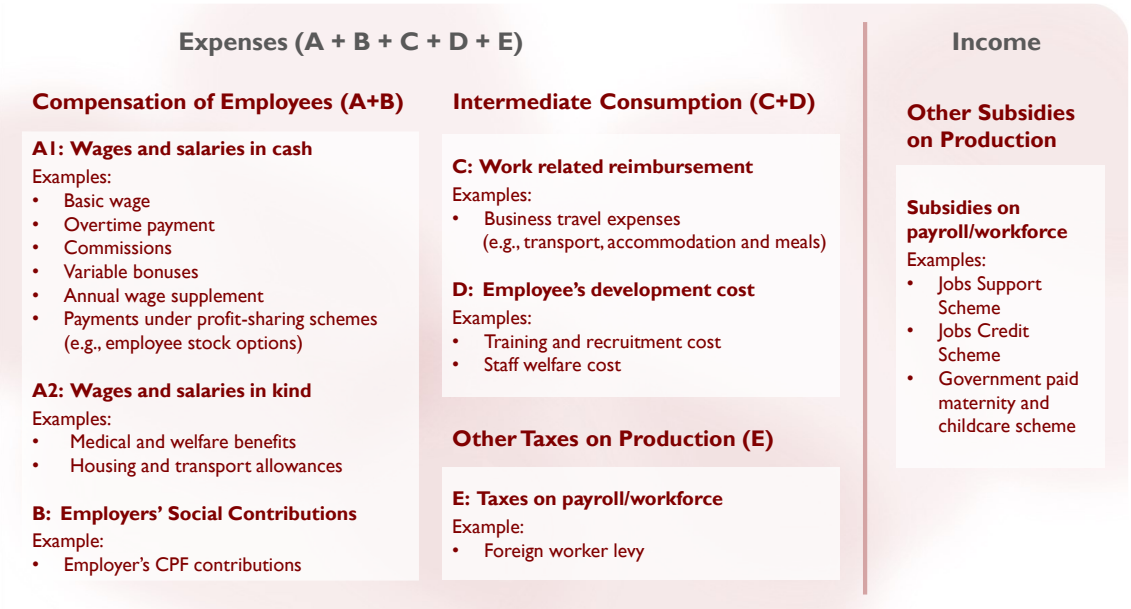
This article discusses the key concepts and principles underlying the compilation of GDP(I) and analyses the impact of government's fiscal support to help businesses and workers during COVID-19 on GDP(I).

Compensation of Employees

Compensation of employees (CoE) in the national accounts broadly refers to remuneration received by employees for the provision of labour services in the production of goods and services. CoE is a subset of employee-related expenses and comprises two components viz. wages and salaries (in cash and in kind) and employers' social contributions (Figure 1).

Wages and salaries in cash include gross salary paid to employees (i.e., before deduction of personal income tax and employees' contributions to the Central Provident Fund (CPF)), as well as bonuses, commissions, gratuities and tips paid directly to

FIGURE 1 EMPLOYEE-RELATED EXPENSES AND INCOME



1 Quarterly income-based GDP data are available from the Ministry of Trade and Industry's Economic Survey of Singapore (https://www.mti.gov.sg/Resources/Economic-Survey-of-Singapore) and on the SingStat Website (https://www.tablebuilder.singstat.gov.sg).

2 SNA 2008 is available for reference at http://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf.

the employees by a third parties. Wages and salaries in kind refer to the cost incurred by employers for the provision of goods and services to the employees for free or at a discount (e.g., housing allowances).

Employers' social contributions are payments or contributions made by employers to provide social benefits for their employees. An example of employers' social contributions in Singapore is the employers' contributions to CPF on behalf of their employees.

CoE, however, excludes reimbursements of work-related expenses incurred by employees (e.g., transportation expenses incurred on business travel). Such work-related reimbursements are treated as operating expenses (or intermediate consumption) incurred by employers for their employees to carry out their work duties.

Taxes payable by employers in the wage and salary bill (e.g., foreign worker levy) are excluded from CoE. Such taxes are treated as other taxes on production in the national accounts, similar to taxes on buildings, land and any other assets used in the production process. The remuneration of self-employed individuals (e.g., working owners of unincorporated enterprises or sole proprietors) is considered as mixed income under gross operating surplus, rather than CoE.

Gross Operating Surplus

The Gross Operating Surplus (GOS) refers to income generated by enterprises from the production of goods and services. GOS is a measure of the surplus accruing to owners from production before deducting any explicit or implicit interest charges, rent[3] or other property incomes payable on financial assets, land and other natural resources.

GOS in national accounts differs from the concept of profit and loss in business accounting[4]. For example, unlike company's business profits, GOS excludes incomes from capital gains and property incomes (e.g., interest and dividend) as these do not accrue from the company's production of goods and services. Likewise, capital losses and property incomes paid are excluded from GOS.

Taxes Less Subsidies on Production and on Imports

Taxes less subsidies on production and on imports (TSPI) comprise taxes on products and other taxes less subsidies on production.

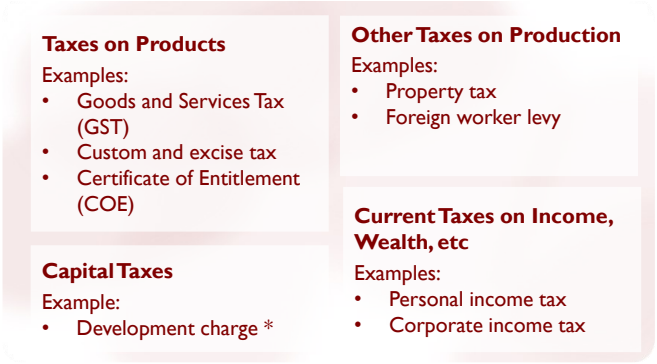
TSPI = *Taxes on Products (TOP)*
+ Other Taxes less Subsidies on Production (OTSP)

TOP are taxes payable per unit of goods or services when they are produced, delivered, sold, transferred, or disposed of by their producers. Examples of TOP include Goods & Services Tax (GST) and Custom & Excise Tax (Figure 2).

OTSP consist of taxes payable (and subsidies receivable) on the land, assets, labour, etc., employed in production that are independent of the quantity or value of the goods and services produced. Examples of other taxes on production include foreign worker levy and property tax payable by enterprises. On the other hand, an example of other subsidies on production is the Jobs Support Scheme (JSS), which entail wage support by the government that help employers retain their local employees amidst the economic downturn caused by COVID-19. Notably, not all taxes levied by the government are treated as TOP or other taxes on production as described above. For example, personal and corporate income taxes are treated as current taxes levied on the incomes of households and corporations while development charge is treated as capital taxes.

FIGURE 2

CLASSIFICATION OF TAXES IN THE SNA



* Development charge is a tax that is levied when planning permission is granted to carry out development projects that increase the value of the land. For instance, (i) rezoning to a higher value use or (ii) increasing the plot ratio.

3 Based on the SNA, a distinction is made between rent and rental. Rent is a form of property income derived from non-produced assets such as land, while rental is payable under operating leases relating to produced assets, including dwellings and buildings.

4 Refer to details in Chapter 7 of the OECD's Understanding National Accounts on 'Profits and Gross Operating Surplus: Not to be Confused' at https://www.oecd.org/sdd/UNA-2014.pdf.

Did You Know?

The onset of COVID-19 had seen governments around the world deploying large fiscal stimulus to support workers and businesses. This was also the case in Singapore. The Government's strong response to the crisis in the form of five Budgets was the largest in Singapore's history. The unprecedented level of income support provided by the Government was reflected in the taxes less subsidies on production and on imports (TSPI) turning negative in 2Q 2020 for the first time since the series began (i.e., subsidies outstripped taxes on production and on imports).

To facilitate a cross-country comparison of the changes in TSPI since COVID-19, the TSPI series in Singapore and selected countries (i.e., Canada, Germany, U.K., U.S.) were normalised to their pre-crisis levels (i.e., 4Q 2019).

Singapore's TSPI showed a significant dip into negative territory in 2Q 2020. This was due to the strong fiscal support provided to businesses and workers in Singapore in the form of large subsidies or reduction in taxes on production (e.g., Jobs Support Scheme, foreign worker levy rebates/waiver, property tax rebates, rental rebates etc.). Similarly, taxes on products (TOP) fell significantly in 2Q 2020 due the circuit breaker measures imposed to reduce movements and interactions during COVID-19.

Like Singapore, the TSPI series for the selected countries plunged, given the sizeable amounts of subsidies that their respective governments had provided in face of COVID-19. The collections of TOP were also lowered due to lockdown measures, resulting in further declines in their TSPI, which nonetheless remained in the positive territory.

Source: Official statistical publications and websites

Singapore's Monitoring of Sustainable Development Goals Implementation

by Estee Tan and Grace Yaw
Policy Planning Division
Singapore Department of Statistics

Introduction

The United Nations' 2030 Agenda for Sustainable Development was adopted by countries including Singapore at the United Nations (UN) Sustainable Development Summit in September 2015 as a global framework for achieving a sustainable future. It comprises 17 Sustainable Development Goals (SDGs) with 169 targets across the economic, social and environmental domains, and a total of 247 indicators (known as the Global SDG Indicator Framework) to measure countries' progress in ending poverty, improving healthcare and education, reducing inequality, dealing with climate change and spurring economic growth, among others.

This article reports on Singapore's monitoring of SDG implementation under the SDG Indicator Framework.

DOS's Role in Monitoring Singapore's SDGs

An Inter-Ministry Committee on SDGs (IMC-SDG) was formed to lead a Whole-of-Government (WOG) approach towards SDG implementation, co-led by the Ministry of Foreign Affairs (MFA) and Ministry of Sustainability and the Environment (MSE)[1].

The Singapore Department of Statistics (DOS) is a member of the IMC-SDG. DOS supports the work of the IMC-SDG by collating SDG data from government agencies to report on Singapore's progress at various international and regional fora. With the help of IMC-SDG members, DOS identifies the relevant source agencies to obtain data for the SDG indicators.

Apart from serving as the national SDG indicators focal point for the UN, DOS is also an active member of the ASEAN Working Group on SDG Indicators (WGSDGI) since 2019, as well as chair of the WGSDGI jointly with the ASEAN Statistics Division over a 2-year term from 2020 to 2021. The WGSDGI's key deliverables include the release of the inaugural ASEAN SDG Indicators Baseline Report 2020[2] and the ASEAN online SDG database on 23 Oct 2020.

As Singapore adopts a decentralised statistical system, SDG indicators and sub-indicators which cover a wide range of topics and data domains come under the purview of various agencies.

For instance, the source agency for data on air quality and climate-related indicators (e.g. SDG 13.2.2 "Total greenhouse gas emissions per year") is the National Environment Agency (NEA).

There are also indicators which are cross-cutting and fall under the purview of more than one source agency, such as SDG 9.1.2 "Passenger and freight volumes, by mode of transport", with data being provided by the Civil Aviation Authority of Singapore (CAAS), Land Transport Authority (LTA), Maritime and Port Authority of Singapore (MPA) and Singapore Tourism Board (STB).

DOS works with agencies on the provision of data for the SDG indicators to align them with the global metadata on methodology, definition and units of measurement. Where data are not available, proxy indicators or alternative indicators that better reflect Singapore's unique national circumstances and priorities are used.

1 More information on Singapore's SDG work and indicators can be found in:
- MFA's website at https://www.mfa.gov.sg/SINGAPORES-FOREIGN-POLICY/International-Issues/Sustainable-Development
- MSE's website at https://www.mse.gov.sg
- Voluntary National Review 2018 publication: https://sustainabledevelopment.un.org/content/documents/19439Singapores_Voluntary_National_Review_Report_v2.pdf

2 The ASEAN SDG Indicators Baseline Report 2020 is available at: https://www.aseanstats.org/publication/asean-sdg-report-2020.

Singapore's SDG Performance

To facilitate the reporting and monitoring of the progress in Singapore's sustainable development journey, DOS has developed an SDG webpage[3] on the SingStat Website in Sep 2019, which serves as a one-stop online portal to provide access to statistics on Singapore's performance on the relevant SDG indicators.

Singapore's SDG data profile covers a broad range of areas, with at least some data[4] available across all 17 goals (Chart 1). For example, data are available for indicators across different subject areas under health (SDG 3), education and technology (SDG 4), economic growth (SDG 8), urbanisation (SDG 9) to global development (SDG 17).

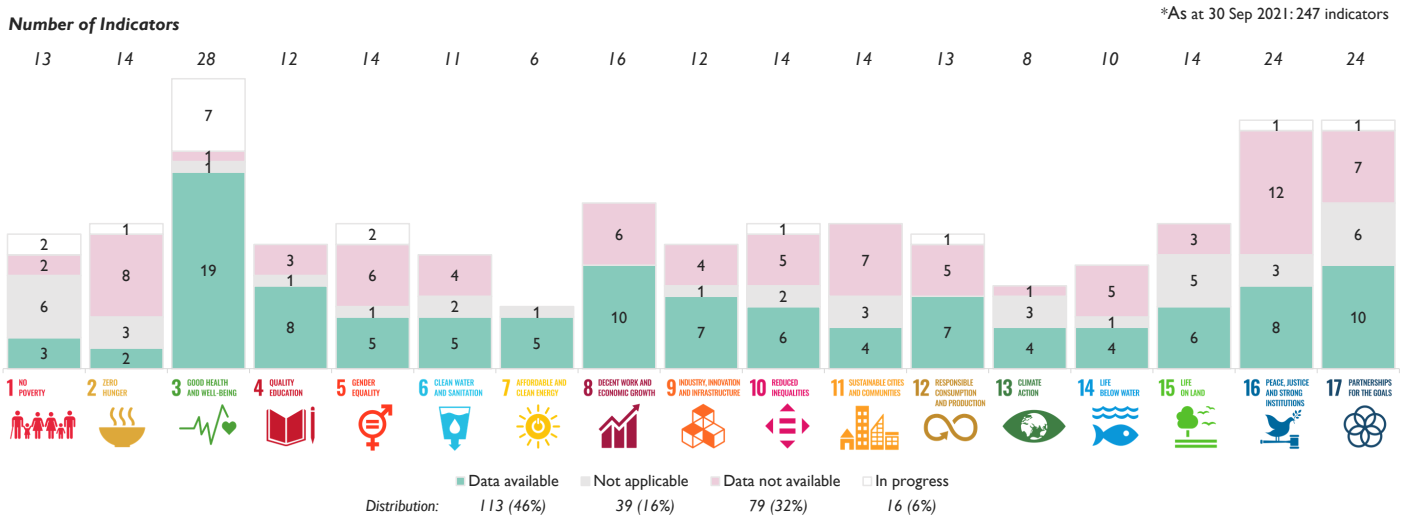
Singapore has performed well in terms of data availability and progress for education-related indicators under SDG 4 "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all". In 2020, Singapore achieved near gender parity in gross enrolment across all education levels (SDG 4.5.1) and literacy proficiency rates were above 95 per cent among resident population aged 15 years and over for both genders (SDG 4.6.1). Moreover, nearly all (97.1 per cent) of Singapore's youth aged 15 to 24 years possessed some information and communications technology skills (SDG 4.4.1) in 2019.

Like other countries, Singapore has strived to make progress in collecting and reporting data on SDG indicators despite the challenges. In some cases, source agencies do not regularly collect data which are no longer relevant in the Singapore context. For example, as the burden of stunting is low in Singapore, data are not collected for SDG 2.2.1 "Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organization (WHO) Child Growth Standards) among children under 5 years of age". In other instances, source agencies may collect or track an alternative series of data that is more relevant to the local context as opposed to the parameters set out by global metadata. For example, although data for SDG 7.3.1 "Energy intensity measured in terms of primary energy and GDP" are not available, the source agency provided an alternative set of data on energy consumption per Singapore dollar gross domestic product (per cent improvement from 2005 levels).

Concluding Remark

Recognising the importance of the SDGs for global comparison and monitoring, DOS will continue to explore with the relevant policy and source agencies to identify appropriate data, proxy or alternative indicators, including the usage of UN custodian agencies' data for reporting and monitoring of the progress Singapore's SDG performance.

CHART 1 AVAILABILITY OF SINGAPORE'S DATA FOR SDG INDICATORS



Note: Data may not add up to 100% due to rounding.

3 DOS's SDG webpage: https://www.singstat.gov.sg/find-data/sdg

4 Singapore's data are available for 113 out of the 247 (46%) SDG indicators as at 30 Sep 2021, with 39 indicators (16%) not applicable to our context. Data for the remaining 95 indicators (38%) are either unavailable or still being developed.

Coding of SSOC/SSIC in Census 2020 using Machine Learning

by Chen Tian Min, Teo Zhiwei, and Chan Wen Chang
Longitudinal Data Analytics Division
Singapore Department of Statistics

Introduction

The Singapore Census of Population 2020 (Census 2020) adopted a register-based approach, supplemented with a large-scale sample survey, to provide the most comprehensive source of information on the population and households of Singapore.

The processing of survey returns included the coding of free-text responses describing the occupations of respondents and the industries they work in, into Singapore Standard Occupational Classification[1] (SSOC) and Singapore Standard Industrial Classification[2] (SSIC) codes respectively.

The coding of occupations to SSOC codes was done using job titles and descriptions of main tasks and duties (Figure 1). The coding of industries to SSIC codes was performed using firm names and descriptions of principal economic activities (Figure 2).

Two methods of coding were used – batch coding and manual coding. All responses would first be processed using batch coding, which is an automated process that assigns appropriate codes using predetermined coding rules. Responses which could not be coded using the predefined rules were then manually coded. In general, batch coding was suitable for responses that were straightforward, while manual coding handled responses which needed human intervention.

This article presents the application of machine learning (ML) techniques in the processing of Census 2020 survey returns to improve the coding of free-text responses and reduce manual coding. The improvements were realised in two areas: 1) *automatic coding* of responses with strong predictions; and 2) *recommendation of codes* for responses with weaker predictions. The addition of a ML model into the coding process reduced the number of responses which were passed to the manual coders, and was estimated to have saved 5,600 man-hours.

FIGURE 1 EXAMPLE OF CODING OCCUPATIONS

Job Title	Main Tasks and Duties	→	SSOC Code
Head waiter	Manage waiters and ensure guest satisfaction		51311 – Captain waiter

FIGURE 2 EXAMPLE OF CODING INDUSTRIES

Firm Name	Principal Economic Activity	→	SSIC Code
Big Wheels	Manufacture non-motorized bicycles		30920 – Manufacture and assembly of bicycles, tricycles, trishaws and invalid carriages (including parts and accessories)

1 The SSOC is the national standard for classifying occupations. It consists of structured five-digit codes that classify occupations by their main tasks and duties. The SSOC publication is available on the SingStat Website at www.singstat.gov.sg/standards/standards-and-classifications/ssoc.

2 The SSIC is the national standard for classifying economic activities undertaken by economic units. It consists of structured five-digit codes that classify firms by their principal economic activities. The SSIC publication is available on the SingStat Website at www.singstat.gov.sg/standards/standards-and-classifications/ssic.

Using Machine Learning for Automatic Coding

ML models are capable of learning sophisticated rules for automatic coding. Hence, they can handle responses that batch coding cannot. If ML models cannot confidently code a response, they can provide suggested codes for the manual coders' reference, thereby expediting the coding process. These qualities make a ML model suitable for implementation as a step in between the batch coding and manual coding steps (Figure 3).

The ML coding step used in Census 2020 comprised four sub-steps (Figure 4):

1) *Data preparation*: Pre-processed training data into a standard format acceptable for model use. This sub-step was also applied to survey responses during model deployment.
2) *Model training and selection*: Decided on model specification for use in deployment.
3) *Coding of responses*: Generated predicted codes for the survey responses.
4) *Quality assessment*: Evaluated quality of predicted codes and identified issues to be addressed. This was also the start of feedback loop to glean insights and incorporate feedback to improve the entire ML coding step.

Data Preparation

As the survey responses involved descriptive information in free-text format, it was necessary to pre-process them into a standard format so that a ML model could use them. This also helped to improve information quality.

Some of the text pre-processing techniques used in the data preparation sub-step included:

i. Converted abbreviations to their full forms and standardised characters of the same field to the same letter case

ii. Removed uninformative characters and words (e.g. 'is', 'the')

iii. Corrected spelling, while keeping localised words (e.g. 'garang guni' was corrected to 'karung guni')

As an example, the sentence "I serve customrrs in a F&B business" was pre-processed into "serve customers food beverage business".

FIGURE 3 IMPLEMENTATION OF ML CODING IN THE CODING PROCESS

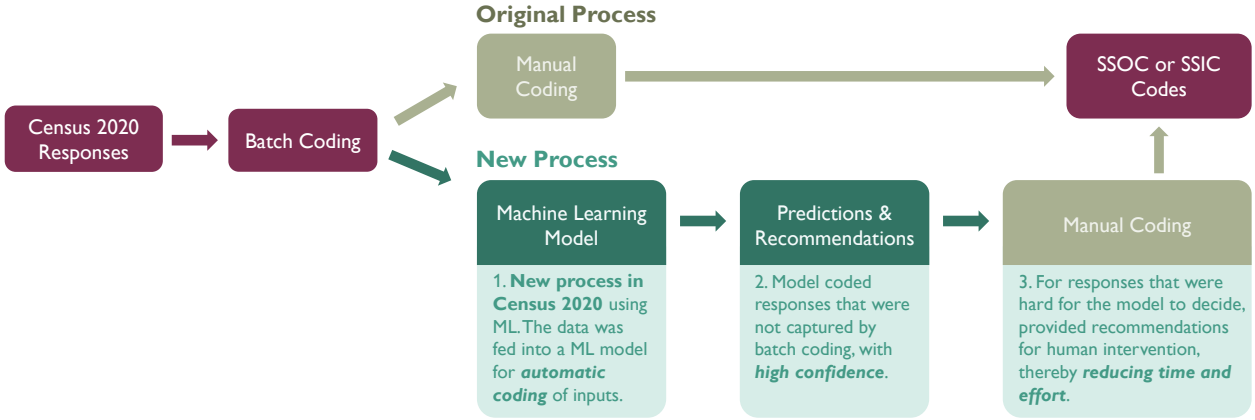
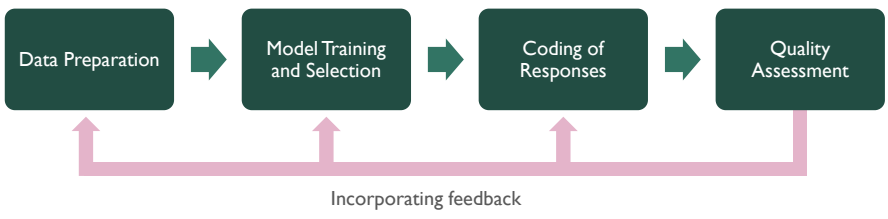


FIGURE 4 WORKFLOW FOR ML CODING STEP

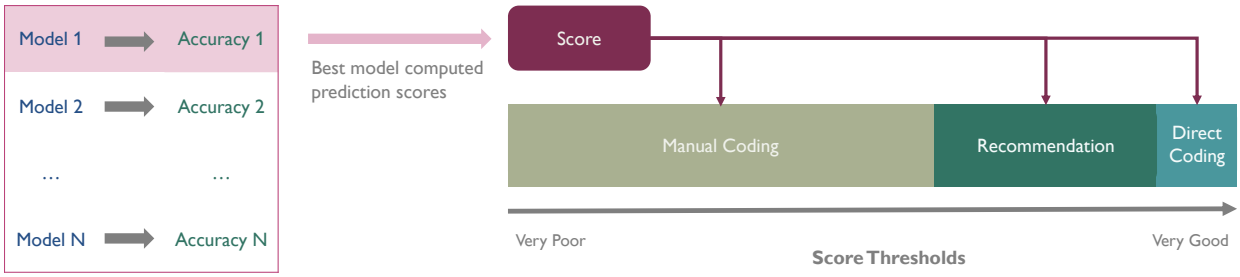


Model Training and Selection

In this sub-step, different supervised ML models were trained using data from past Comprehensive Labour Force Surveys conducted by the Ministry of Manpower. To ensure compatibility, the SSOC and SSIC codes in the training data from past years were mapped to the latest codes, i.e. version 2020, before they were used.

After comparing the prediction accuracies[3] of the various ML models (Figure 5), a neural network (NN) model was evaluated to be the best performing model.

FIGURE 5 ML MODEL TRAINING AND SELECTION, AND CODING OF RESPONSES



Basic Workings of Neural Network Models

NN models are a subset of ML models that mimic the way the human brain processes information. They typically consist of interconnected units, or "nodes" that resemble biological neurons, and connections between the units, or "weights" (Figure 5A). A NN model can be structured using three types of layers:

- **Input layer**: The first layer in which data are input into the network
- **Hidden layers**: Intermediate layers in which computations are performed on the data from the input layer, so that the data can be mapped into an output
- **Output layer**: The layer in which the output is generated

When an input, in numerical form, passes through a NN model, all node values from the previous layer are multiplied by the respective weights and added together (as reflected by the arrows in Figure 5A). The values are then transformed by a function at the respective nodes to produce the values for the next layer of nodes. This process is repeated until the output is generated. Figure 5B shows an example of how the node values pass from one layer to the next, in a simple feedforward NN with only one hidden layer. The bias terms are omitted for simplicity.

FIGURE 5A
EXAMPLE OF A NEURAL NETWORK SCHEMATIC

Nodes are represented by the circles and weights are represented by the arrows.

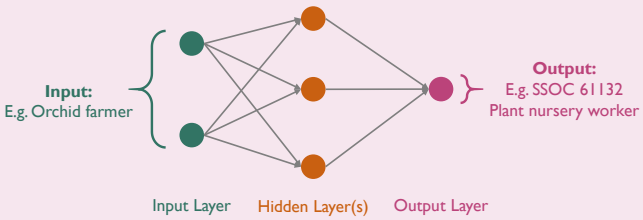
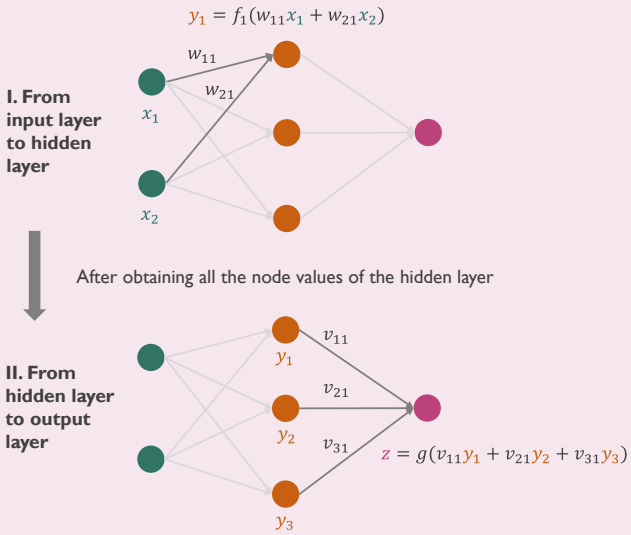


FIGURE 5B
EXAMPLE OF AN INPUT PASSING THROUGH A SIMPLE FEEDFORWARD NN WITH ONE HIDDEN LAYER



3 Prediction accuracy is a measure of how well a ML model is at providing the correct codes. It is obtained by using the model on responses that were not used for training and evaluating how many of those responses were coded correctly.

Coding of Responses

For each survey response, the NN model computed scores for all the possible SSOC/SSIC codes at the 5-digit level, which measured how likely the codes would be assigned to the response.

The code with the highest score was selected to be the predicted code. The score of the predicted code would then determine whether the response would undergo direct coding, recommendation or manual coding (Figure 5):

- *Direct coding*: When the score of the predicted code was very good, the response was coded with the predicted code.
- *Manual coding*: When the score of the predicted code was poor, the predicted code was not used. The response was passed on to manual coders to assign a code.
- *Recommendation*: When the score of the predicted code was neither poor nor good enough for direct coding, codes were recommended. Manual coders reviewed the recommended codes and assigned the most suitable code to the response. This process reduced the time and effort incurred as compared to manual coding directly.

Quality Assessment

The NN model's ability at handling incoming survey responses was monitored via periodic checks and feedback. The insights gleaned from the checks and feedback were used to improve the coding performance of the model. The following lists two issues that were identified:

a. Abnormal and new data behaviour

Due to COVID-19, the responses received reflected new working circumstances. Numerous respondents indicated that they worked from home as the job description, while retaining their job titles.

There were also new occupations such as "safe distancing ambassador" and "swab test assistant" which did not exist previously. This shift in data behaviour affected the model's performance, since it was trained based on pre-COVID-19 data.

b. Insufficient details in survey responses for certain occupations and industries

As with manual coding, if survey responses were not detailed enough, the NN model would not be able to provide accurate code predictions. Such cases usually required additional information from the respondents in order to be coded definitively.

As the example (Figure 6) illustrates, there could be many possible SSOC codes for a response on occupation that provided insufficient information to be allocated a code from numerous possible codes. More details on the driven vehicle would be useful in identifying the most suitable code.

To address the issues discovered, sub-steps 1, 2 and 3 were updated. Some of the updates included re-training the NN model with responses that were manually coded earlier, and reassigning predicted codes originally for direct coding to recommendations (for the affected groups of SSOC and SSIC codes).

FIGURE 6

EXAMPLE OF A RESPONSE THAT COULD NOT BE REASONABLY CODED FOR OCCUPATION

Job Title	Main Tasks and Duties	Possible SSOC Codes
Driver	Drive vehicle	83221 – Taxi driver 83222 – Chauffeur 83226 – Private-hire car driver

Effectiveness of Machine Learning in Census 2020

The ML coding step was estimated to have saved 5,600 man-hours in Census 2020. Most of the savings was for SSOC coding instead of SSIC coding, due to the following reasons.

Firstly, the task of a ML model predicting appropriate SSIC codes was harder than that for SSOC. The challenge in assigning SSIC codes stemmed from firm names not being analogous to job titles. For example, firm names might not be in proper English; even if they were, the words in the names did not necessarily carry their usual meanings.

Secondly, a large percentage of respondents were able to find and verify their firm names via a pre-defined list in the Census 2020 questionnaire; and this reduced the need for inputting free-text. As the list had a direct mapping to SSIC codes, responses that were selected from this list were batch coded without the need for the ML coding step. This efficiency of the pre-defined list for SSIC resulted in less use for the ML coding step, and only the most challenging responses that eluded the dropdown list required ML and manual coding.

These two factors led to the decision of having the NN model to only provide recommendations for SSIC coding instead of performing direct coding, resulting in less contributions for the coding of industries.

Concluding Remarks

The use of ML in Census 2020 had demonstrated that standardised tasks, such as the coding of SSOC and SSIC codes, which traditionally required human effort, can be automated using appropriate ML techniques.

Given the rapid developments in ML, ML is expected to contribute significantly in future surveys and related data processing problems.

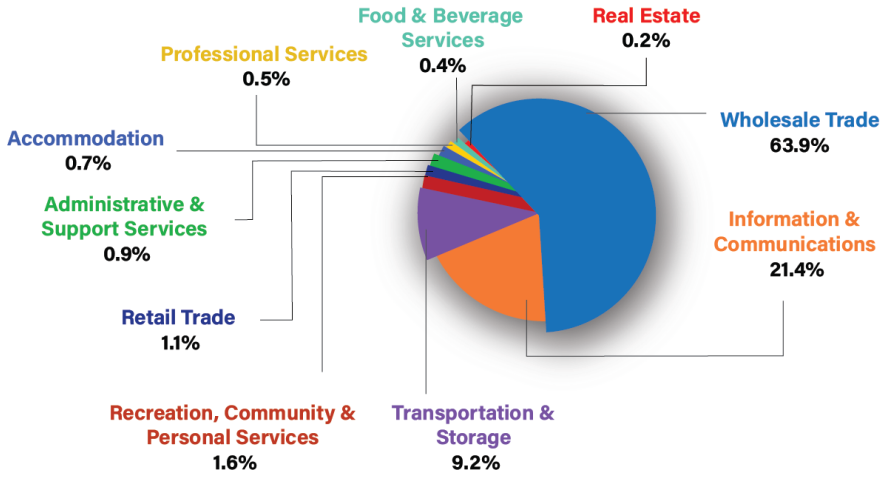
That said, manual monitoring and intervention are still integral to the deployment of a ML process, as they help the process adapt to real world issues, and ensure accuracy and usefulness of the outputs.

E-commerce Revenue of the Services Sector

The total e-commerce revenue[1] of the Services Sector[2] in Singapore was $260.9 billion in 2019, accounting for 7.1% of total Services Sector's operating receipts.

The Wholesale Trade, Information & Communications and Transportation & Storage industries accounted for more than 90% of the overall sector's e-commerce revenue in 2019.

Share of E-commerce Revenue by Industry, 2019

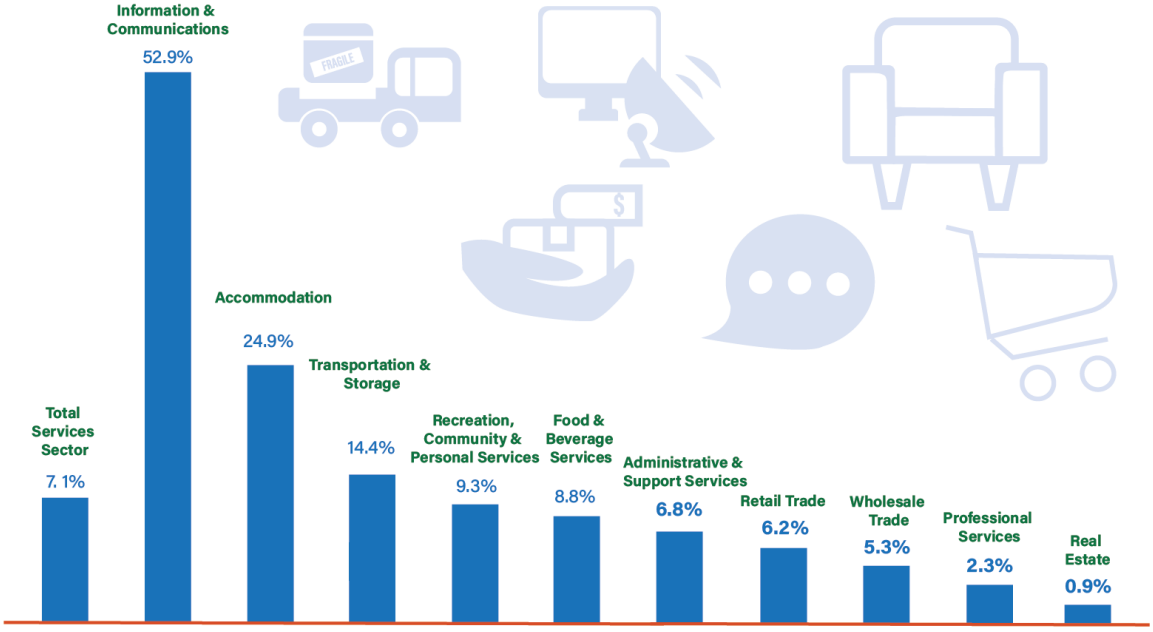


[1] Refers to the revenue earned from the sale of goods and services whereby the company receives orders or agrees on the price and terms of sale via online means, e.g. through company's website, third-party websites, mobile applications, extranet or electronic data interchange (e.g. GeBIZ in Singapore's context). It excludes agreement through telephone calls, facsimile and emails. Payment and delivery may or may not be made online.

[2] Exclude Financial & Insurance Services and Public Administration Activities

Among the services industries, the Information & Communications industry recorded the largest e-commerce share to its industry's operating receipts at 52.9% in 2019. This was due mainly to web portal services such as online marketplaces and search engines.

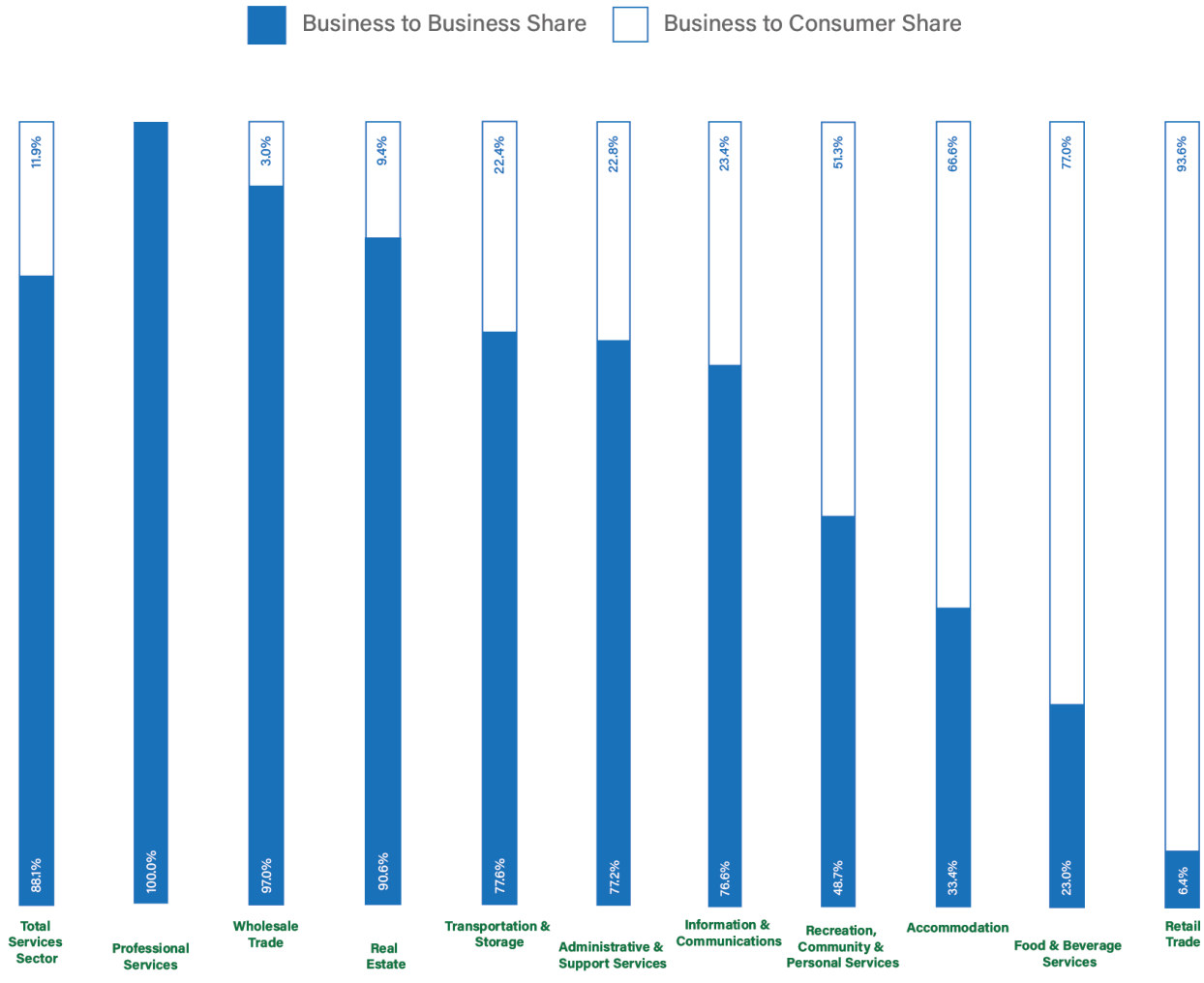
Percentage Share of E-commerce Revenue to Industry's Operating Reciepts, 2019



E-commerce revenue of the Services Sector was mainly contributed by Business to Business transactions. In 2019, Business to Business transactions accounted for 88.1% of all e-commerce revenue.

Industries in which majority of e-commerce revenue came from Business to Business transactions were Professional Services, Wholesale Trade, Real Estate, Transportation & Storage, Administrative & Support Services and Information & Communications as their clients tend to be from businesses. On the other hand, consumer-facing industries such as Recreation, Community & Personal Services, Accommodation, Food & Beverage Services and Retail Trade generated majority of their e-commerce revenue from Business to Consumer transactions.

E-commerce Revenue by Type of Transaction, 2019



Inaugural Meeting of the DOS Advisory Panel

The DOS Advisory Panel was established in 2021 to guide the Department's strategic direction, amidst the changing data and technology landscape, and ensure that DOS remains relevant and responsive to the diverse needs of data users.

The inaugural meeting of the DOS Advisory Panel was convened virtually on 7 and 8 September 2021 with the welcome address delivered by the Permanent Secretary of the Singapore Ministry of Trade and Industry (MTI), Mr Gabriel Lim.

The DOS Advisory Panel is chaired by the Singapore Chief Statistician, Ms Wong Wee Kim, and comprises the following local and international members who are experts in the fields of statistics, data science and technology:

Mr Sameer Gupta
Chief Analytics Officer, DBS Bank, Singapore

Prof Ng See-Kiong
Professor of Practice, School of Computing
Director, Translational Research,
Institute of Data Science,
National University of Singapore
Director, AI Technology, AI Singapore

Dr Tom Smith
Managing Director, Data Science Campus,
Office of National Statistics, United Kingdom

Prof Bertrand Loison
Vice Director General and
Head of Data Science Competence Centre
Swiss Federal Statistical Office, Switzerland

Mr Gary Dunnet
Deputy Chief Methodologist,
Statistics New Zealand, New Zealand

The overall theme of the inaugural meeting was 'Digitalisation Across the Data Value Chain', which encompassed data collection, data processing and integration, data compilation, data analyses, and data dissemination and engagement, along with the scaling-up of capabilities in National Statistical Offices (NSOs) to implement digital transformation. The focus of the meeting was on:

- Gathering insights on the application of digital technologies and processes;
- Identifying practices that facilitate effective deployment of digital tools across the data value chain; and
- Anticipating and addressing challenges in implementing DOS's digitalisation strategy.

The advisory panel covered the following topics:

- Redefining the value proposition of NSOs in an ever-changing data landscape with evolving users' needs, including shifts in data needs, integrating data from a range of administrative and survey sources, enhancing communication capabilities and the use of digital tools;
- Sharing expertise on new data competencies in various fields along with the impact of digitalisation and advanced technology applications, such as the use of Big data, administrative sources, machine learning, etc.; and
- Sharing expertise on developing capabilities in respective fields as well as the future of the workforce in NSOs, e.g. scaling up statistical capabilities and digital-related skills, and challenges posed in the digitalisation process.

DOS expresses our appreciation to all panel members for the fruitful discussions, and looks forward to the second meeting of the DOS Advisory Panel in 2022.

IN CELEBRATION OF OUR 100TH ANNIVERSARY

The Singapore Department of Statistics (DOS) turns 100 in 2021. We remain committed to delivering insightful statistics and trusted statistical services that empower decision making in this century and beyond.

Watch the video and journey with us as we look back at our key milestones in celebration of our centennial anniversary.

https://www.youtube.com/watch?v=8Nwd8-k2tYk

Need help in understanding and exploring data?

Check out the Visualising Data page and let us help you navigate the world of statistics.

Infographics

SINGAPORE ECONOMY

An animated overview of the Singapore economy, presenting the latest Gross Domestic Product, growth and industry breakdown, latest data and partners in investments in Singapore and abroad, profile of enterprises, and latest data and partners in trade in goods and services.

Interactive Dashboards

POPULATION TRENDS DASHBOARD

The interactive dashboard presents various demographic statistics in a consolidated dashboard and allows you to explore data trends in Population, Households and Housing, Family Formation and Dissolution, Fertility, and Mortality.

Videographics

PRICE CHANGES AND THE CONSUMER PRICE INDEX

This video explains that the Consumer Price Index (CPI) reflects the average price changes across various items and outlets, and that individual experiences may differ depending on the items consumed.

CONTENTS

DEPARTMENT OF STATISTICS SINGAPORE
Empowering You with Trusted Data

Statistics Singapore Newsletter Issue 2, 2021

The Statistics Singapore Newsletter is issued twice a year by the Singapore Department of Statistics.

It aims to inform readers on recent statistical findings as well as latest information on statistical methodologies, processes, products and services.

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