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Asia Competitiveness Institute

ACI Research Paper #02-2020

Resilience of the Taiwan Economy During the First Phase of Corona Onslaught

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November 2020

Please cite this article as:

Abeysinghe, Tilak and Kway Guan Tan, "Resilience of the Taiwan Economy During the First Phase of Corona Onslaught", Research Paper #02-2020, *Asia Competitiveness Institute Research Paper Series (November 2020).*

Resilience of the Taiwan Economy During the First Phase of Corona Onslaught

Tilak Abeysinghe and Tan Kway Guan
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November 2020

1. Introduction

Taiwan offers an exceptional case study for the pandemic containment and economic resilience. As of November 16, 2020, Taiwan recorded only 600 cases of Covid-19 infections (with only sporadic imported cases still being detected) and 7 deaths and ranked among the lowest out of 216 countries in terms of number of infections and deaths.

The policies adopted by Taiwan to contain the COVID-19 pandemic are not necessarily unique. The policies include border controls, contact tracing, physical distancing, usage of masks, and preemptive quarantines. As with other East Asian countries, Taiwan also has an established culture of mask usage prior to the outbreak. Major obstacle some countries faced was the unwillingness of the mass to wear masks. Access to masks for all residents was implemented as early as February, well in advance of WHO recommendations for universal mask usage. This was supported by policies to ensure production and distribution. The notable exception in Taiwan policy package is the avoidance of complete lockdowns.

Taiwan did not wipe out the memory of SARS outbreak in 2003 and H1N1 outbreak in 2009. Instead Taiwan stayed prepared with response policies and relevant healthcare institutions, infrastructure, and legislation. This includes dedicated threat response agencies like the Center for Disease Control and National Health Command Centre with established alert and disease surveillance systems. The pandemic preparedness of Taiwan prior to the outbreak of COVID-19 gave Taiwan a critical advantage in early response to COVID-19.

The Taiwanese pandemic response stands out because of the promptness of its responses. Pandemic control policies began in Taiwan far earlier than in other countries. Notably, border management measures including health screenings and travel advisories began on December 31, 2019, the day the WHO was informed of the outbreak in Wuhan. Border management measures were escalated as the global situation worsened. Quarantining of inbound travelers has been in place since January 9, 2020, initially for inbound travelers from Wuhan and

widened to other countries as the pandemic spread. Existing contact tracing systems were deployed as early as January 26, 2020.[1]

What is even more noteworthy is that many sectors of the Taiwanese economy have so far weathered the pandemic impact reasonably well. As a globalized economy, how Taiwan insulated itself from the global economic impact of the pandemic is a question worth investigating in detail. With the resurgence of the pandemic in different countries with no end yet in sight it is hard to say that Taiwan is fully out of the woods by now. The main objective of this exercise is to examine 15 major sectors of the Taiwanese economy and study how some sectors forged ahead during the first phase of the pandemic.

2. Methodology

The forward-looking econometric methodology used in the analysis is very similar to our studies on Singapore and Hong Kong (Abeysinghe and Tan, 2020a, 2020b). We do not repeat the mathematical details of the methodology here. The key difference is the use of input-output tables in this exercise. The major steps are summarized below.

1. Quarterly value-added data from 1982Q1 to 2020Q2 by sector (at 2016 constant prices) is obtained from the Statistical Bureau of Taiwan. In the analysis two other variables are also used, visitor arrivals to Taiwan (VISITOR) and export share weighted GDP of Taiwan's major trading partners (FORGDP; ASEAN5 (Malaysia, Indonesia, Philippines, Singapore, Thailand), China (mainland), Hong Kong, Japan, South Korea, USA, and the rest of OECD as a group). All the variables are seasonally adjusted and converted to quarter-on-quarter growth rates.
2. The model consists of 15 equations, one for each sector. The sectors are interdependent. The intervention variable is the Covid-19 shock represented by a binary dummy variable.
3. Sectoral growth interdependence is estimated from pre-crisis data (quarterly data up to 2019Q4). A regression for a given sector uses the weighted sum of the growth rates of the remaining sectors as a regressor. In this exercise the weight matrix for all the sectors is computed from Taiwan input-output table for 2016. This avoids the statistical

[1] For a number of authoritative opinion pieces on Taiwan's Covid-19 policy response see Lin et al. (2020), Po-Chang Lee et al. (2020), Sheng-Fan et al. (2020), Summers et al. (2020), and Ministry of Health and Welfare (2020).

adjustments required in the previous methodology. The computation of weights involves aggregating the intermediate inputs and outputs into the 15 sectors of interest. Once aggregated, the intermediate inputs by sector as a proportion of gross value added for all 15 sectors are calculated. The weights of each sector are then the proportion of inputs from all other sectors, scaled to sum to one.

4. Using data up to 2019Q4 each sector growth rate is regressed on two of its own lags, weighted sum of the growth rates of all the other sectors with two lags, VISITOR and FORGDP growth. Dummy variables were also tried to account for economic downturns caused by events like 2001 recession, the SARS outbreak in 2003 and the global financial crisis in 2008. These regressions provide pre-crisis estimates to capture the interdependence of the sectors.
5. For the Covid-19 intervention dummy variable the parameters are calibrated. For this all the equations are arranged in the vector autoregression (VAR) format with VISITOR and FORGDP as exogenous variables. With data available up to 2020Q2, forecasts for Q3 and Q4 for sectoral growth rates are generated using the full model. For this we need to set the growth rates of VISITOR and FORGDP to some values. In 2020Q1 visitor arrivals to Taiwan dropped by 53% over the previous quarter and by 99% in Q2. Given the travel restrictions and fear of travel it is reasonable to assume zero growth of VISISTOR for the rest of year. Setting forecast growth rates for FORGDP is a wild guess. In 2020Q1 FORGDP contracted by 5.7% over the previous quarter but expanded by 0.1% in the second quarter. Over the years China has become the largest trading partner of Taiwan with an export share of 44% in 2019. As a result, Taiwan's FORGDP fluctuates largely to the tune of China's growth performance. Despite the severe contraction of many OECD countries, because of the China factor we set the growth of Taiwan's FORGDP to zero for the rest of the year.
6. With sectoral growth values for all the four quarters of 2020 each sector growth rate is regressed on its own two lags and the intervention dummy with three lags to calibrate the parameter values for the four quarters of 2020.
7. After obtaining all the parameter values to capture sectoral interdependence and the intervention effect (300 in total), impulse responses are generated from the full VAR model to estimate the growth effects of the Covid-19 shock. The impulse responses can be accumulated to assess the potential impact of the Covid-19 shock under different scenarios.

3. Sector shares and growth performance

The composition of GDP by sector in 2019 is displayed in Figure 1. The economy of Taiwan is heavily manufacturing based, comprising approximately 33% of real GDP. The next largest sector is wholesale and retail trade which is about half the size of manufacturing. Even in Singapore these are the two dominant sectors; but manufacturing share in Singapore is much smaller with about 20% of GDP. In Hong Kong wholesale & retail trade is the dominant sector with a GDP share of about 20% and manufacturing constitutes a negligible proportion. Taiwan is also a very open economy with international trade share of GDP exceeding 100%.

Figure 1. GDP share of value added of different sectors in 2019 (%)

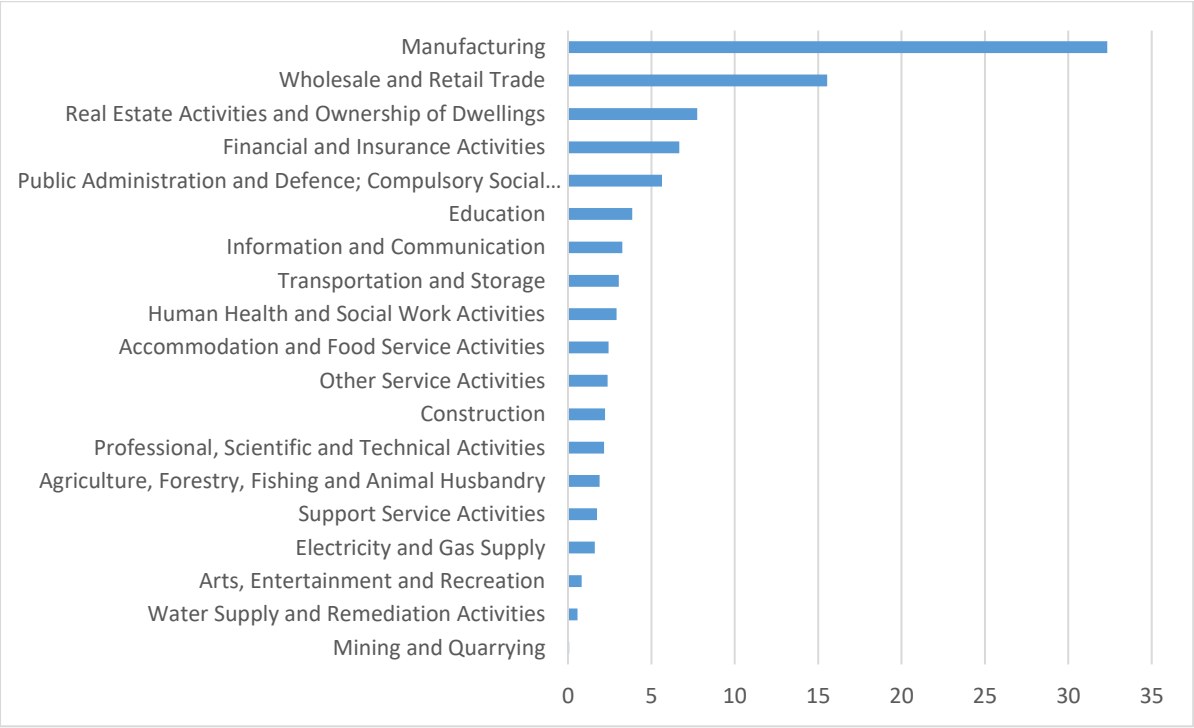


Table 1 shows the performance of the economy while the fight against Covid-19 was going on. The table shows the year-on-year and quarter-on-quarter growth rates using seasonally adjusted data for the first two quarters of 2020. The sectors that contracted the most are those which were directly affected by the closure of borders and the crowd management policies. The badly affected sectors are: transportation & storage, accommodation & food services, arts, entertainment & recreation. These sectors are also sensitive to tourists from mainland China who tend to buy electronic products and F&B products in large numbers. In 2015 mainland tourists accounted for 40% of the total that contracted to about 23% by 2019 due to political issues. The slow growth of mainland tourists already had some effects on these sectors that was further worsened by the Covid-19 restrictions. The other sectors have weathered the Covid-19

restrictions very well relative to many other countries. In particular, despite the international openness, the Manufacturing sector has performed remarkably well though the sector contracted mildly in 2020Q2 on a Q-o-Q basis. This resilience is what is of particular interest in general.

Table 1. Growth rates by sector for 2020 Q1 and Q2

	Y-o-Y		Q-o-Q	
	Q1	Q2	Q1	Q2
Agriculture, Forestry, Fishing and Animal Husbandry	-0.91	2.33	2.35	-2.38
Mining and Quarrying	4.07	4.64	-1.44	0.44
Manufacturing	6.56	3.48	1.60	-0.16
Electricity and Gas Supply	3.07	0.18	0.92	-0.46
Water Supply and Remediation Activities	1.16	3.52	0.80	1.10
Construction	3.54	4.37	0.90	1.02
Wholesale and Retail Trade	2.77	0.78	-0.05	-0.03
Transportation and Storage	-10.17	-23.73	-11.91	-15.48
Accommodation and Food Service Activities	-10.90	-15.20	-12.87	-2.56
Information and Communication	3.83	4.19	0.18	1.24
Financial and Insurance Activities	6.10	2.16	0.77	-0.27
Real Estate Activities and Ownership of Dwellings	1.20	1.12	0.46	0.08
Professional, Scientific and Technical Activities	-1.76	-3.34	-1.37	-0.52
Support Service Activities	-1.02	-6.35	-2.24	-2.96
Public Administration and Defence；Compulsory Social Security	2.39	1.72	0.57	0.36
Education	0.62	-0.21	0.06	0.02
Human Health and Social Work Activities	0.87	-2.20	-0.93	-0.93
Arts, Entertainment and Recreation	-4.33	-20.53	-2.58	-18.23
Other Service Activities	-1.98	-4.46	-2.18	-2.00
GDP	2.20	-0.58	-0.37	-1.01

Note: Seasonal adjustment is done by authors using X13 ARIMA.
Blue indicates positive growth; yellow indicates negative growth.

4. Resilience

4.1 Regression estimates

In the above presentation Figure 1 and Table 1 list 19 sectors. For the regression analysis we condense them into 15 sectors by aggregating electricity, gas, and water into the utilities sectors, real estate, professional services, and support services into the business services sector, and arts, entertainment, recreation, and other services to the other services sector.

Table 2 presents the regression estimates with highlighted figures indicating statistically significant ones at the standard levels of significance. These are from pre-crisis data that end in 2019Q4. Note that the regression estimates capture only the direct impact. The indirect

impact will be discussed in the next sub-section. Some noteworthy observations from the table are the following.

1. Sectoral interdependence is very clear from the coefficients of the Y* variables, which represent the weighted sum of growth rates of the remaining sectors. Although some of these coefficients are negative their sum is positive. This indicates that the sectors reinforce each other's growth.
2. FORGDP shows a statistically significant coefficient only in the manufacturing sector. Nevertheless, we retained this in sectors where a positive coefficient appears. In contrast to these coefficients the manufacturing coefficient is very large. This captures the exposure of the manufacturing sector to the world. Despite this exposure the manufacturing sector did not contract much in 2020Q2 (see Table 1). This resilience will be discussed further.
3. As expected, VISITOR impact is most felt in the accommodation and food services sector followed by transportation and communications and wholesale and retail trade sectors.

Table 2. Regression estimates

	AGRI	MINQ	MANUF	UTIL	CONS	WSRT	TRANS	ACCOM
Constant	-0.17171	-2.06332	-0.31307	1.38343	-1.54370	-0.37835	-0.78173	0.21383
Y(-1)	**-0.28377**	-0.05056	-0.18461	**-0.43264**	**-0.25442**	**-0.26544**	-0.02933	-0.07702
Y(-2)	-0.13327	0.05083	**-0.21252**	**-0.21793**	-0.15161	-0.13297	-0.09969	**-0.22507**
Y*	0.10962	**0.75841**	**0.23128**	**0.21170**	**0.32021**	**0.45121**	**0.33628**	**0.07003**
Y*(-1)	0.14812	0.32988	**0.47632**	**0.43988**	**0.42889**	**0.47299**	0.07811	0.14914
Y*(-2)	0.01594	-0.05973	0.10745	0.11216	**0.32815**	0.12545	0.12666	0.18207
FORGDP	-	-	**1.83081**	-	-	0.28382	0.54363	0.01076
VISITOR	-	-	-	-	-	**0.01969**	**0.02670**	**0.09213**

	INF	FIN	BIZS	PUBAD	EDU	HEALTH	OTHER
Constant	1.19457	0.20483	0.55094	0.48360	0.76641	0.80442	0.75198
Y(-1)	-0.04019	**-0.31908**	0.13113	**-0.22001**	**-0.28926**	**-0.31494**	**-0.27050**
Y(-2)	-0.01488	-0.03224	**0.24109**	0.04578	**0.16854**	-0.17810	-0.08643
Y*	0.26851	0.130284	**0.16320**	0.13296	**0.20559**	**0.15262**	**0.28719**
Y*(-1)	-0.03701	-0.37237	0.04292	-0.01078	0.08794	-0.08108	**-0.22841**
Y*(-2)	0.01375	0.25107	0.03554	0.11289	0.10599	0.05695	**0.17823**
FORGDP	-	0.60588	-	-	-	-	-
VISITOR	0.01389	-	-	-	-	-	-

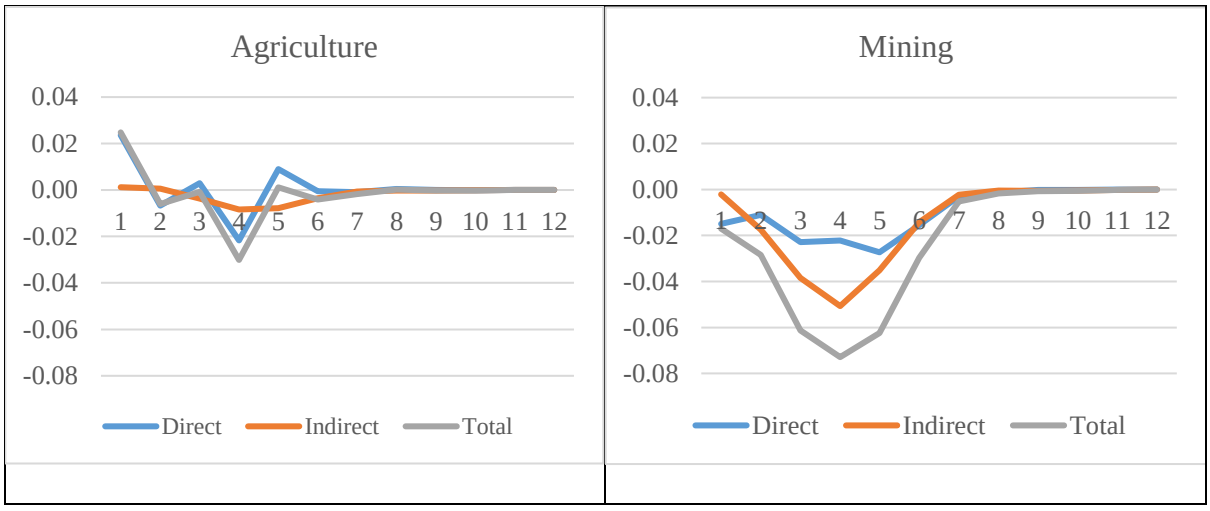
Note: Highlighted are the estimates that are statistically significant at the standard levels. Empty cells indicate a dropped variable because of a negative estimate. Y refers to the growth rate of the relevant sector, Y* is the weighted sum of growth rates of other sectors, FORGDP is export-share weighted growth rate of Taiwan's trading partners, VISITOR is growth rate of visitor arrivals to Taiwan. Sample period ends in 2019Q4.

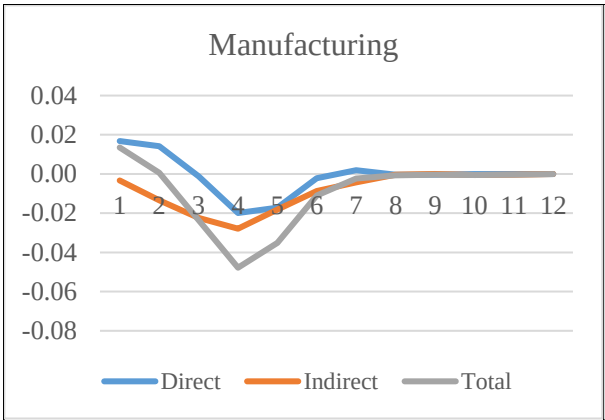
4.2 Covid-19 impact: Impulse response (growth effect) analysis

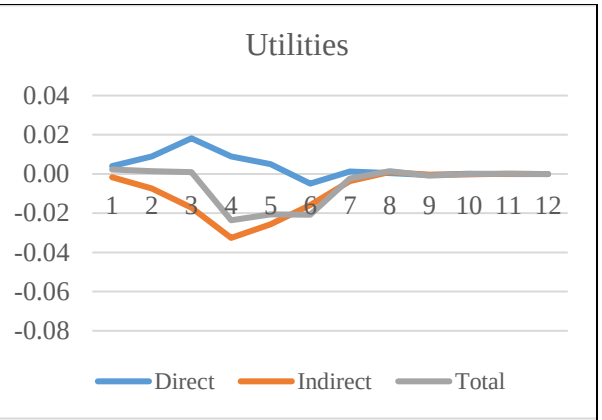
Figure 2 plots the baseline growth effects (direct, indirect, total) on the 15 sectors; percentage point responses to one percentage point Covid-19 growth shock. These are based on the assumption that the Covid-19 outbreak stays confined to 2020 and there will be no resurgence subsequently. Note that the vertical axis is kept to the same scale in all graphs except for transport sector and accommodation & food sector, for easy comparison of the amplitude of the downturn across sectors. These baseline numbers can be multiplied by a desired number to magnify the effect. Table 3 presents the base numbers multiplied by 10 and accumulated over one-year and two-year periods. Key observations of this analysis are summarized below.

1. All the sectors show the potential for full recovery within 6 to 8 quarters without any stimulus measures.
2. Many sectors show resilience with possibly mild downturns including manufacturing which is highly related to FORGDP. Information & communication, finance & insurance, business services, public administration & defence, healthcare, and education are likely to stay flat or mildly positive (Table 3).
3. The sectors that are most affected are obviously transportation & storage, accommodation & food services, the sectors that directly depend on visitor arrivals.

Figure 2. Direct and indirect growth impact of Covid-19 shock on sectors

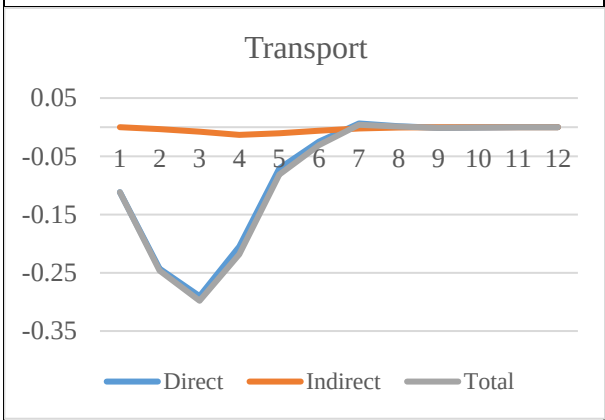


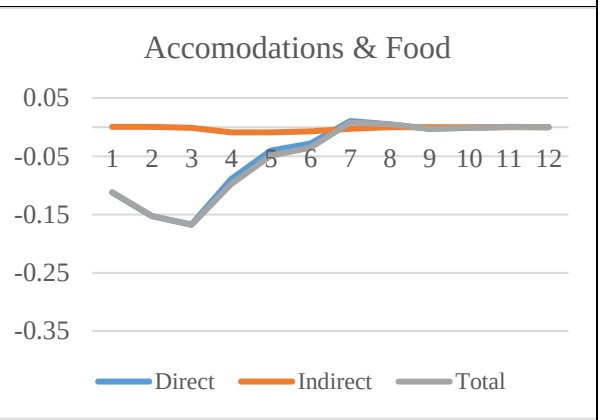

Manufacturing
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total

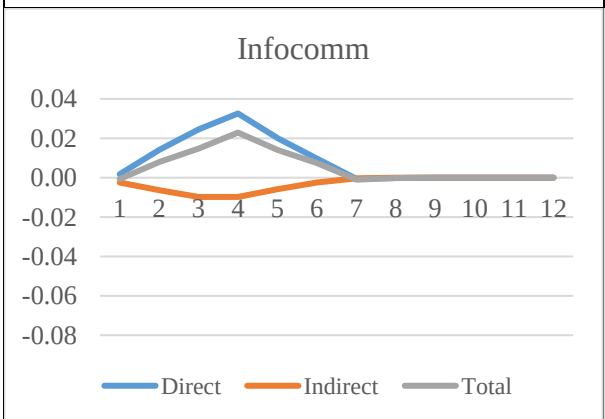

Utilities
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total

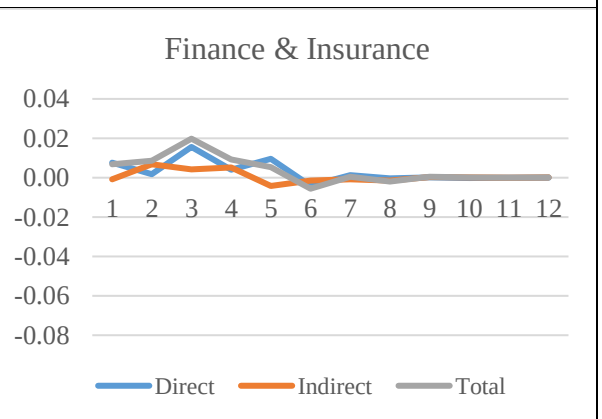

Construction
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total

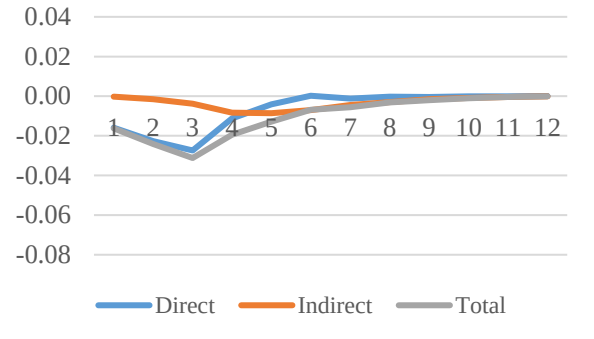

Wholesale & Retail
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total

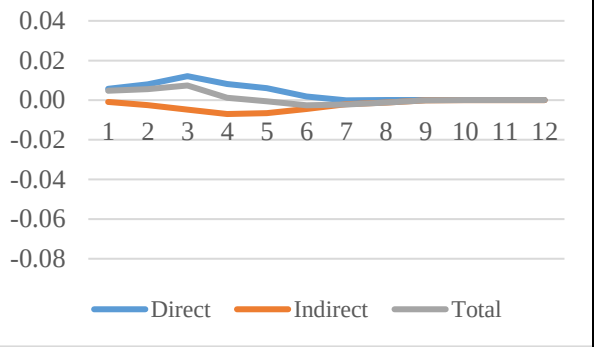

Transport
0.05
-0.05
-0.15
-0.25
-0.35
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total

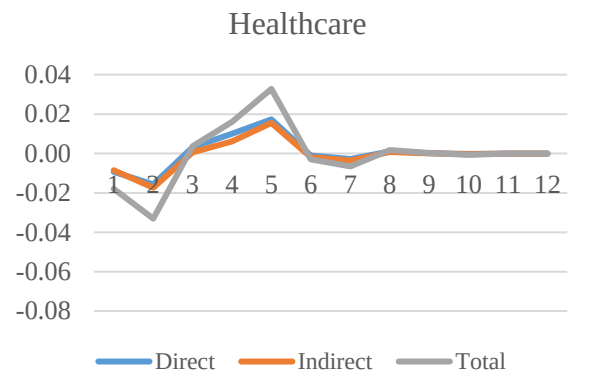

Accomodations & Food
0.05
-0.05
-0.15
-0.25
-0.35
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total

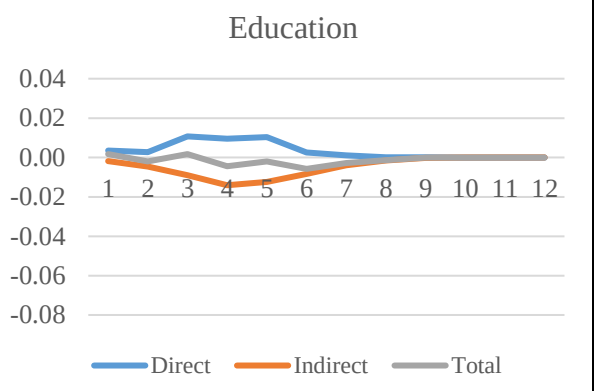

Infocomm
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total


Finance & Insurance
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total


Business Services
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total


Public Administration
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total


Healthcare
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total


Education
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total

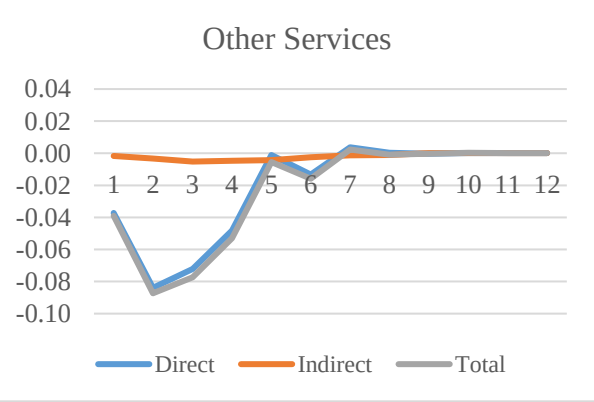

Other Services
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
1 2 3 4 5 6 7 8 9 10 11 12
Direct
Indirect
Total

Table 3. Baseline growth numbers multiplied by 10 and accumulated

	After one year	After two years
Agriculture	-0.03	-0.05
Mining & Quarrying	-0.86	-0.91
Manufacturing	-0.32	-0.35
Utilities	-0.18	-0.20
Construction	-0.41	-0.42
Wholesale & Retail Trade	-0.60	-0.63
Transport & Storage	-3.33	-3.29
Accommodation & Food	-2.13	-2.05
Information & Comm	0.23	0.22
Finance & Insurance	0.14	0.14
Business Services	-0.33	-0.39
Public Admin & Defence	0.07	0.05
Health & Social Work	0.02	-0.02
Education	-0.01	-0.04
Other Services	-0.95	-0.93

4.3 Sources of Resilience

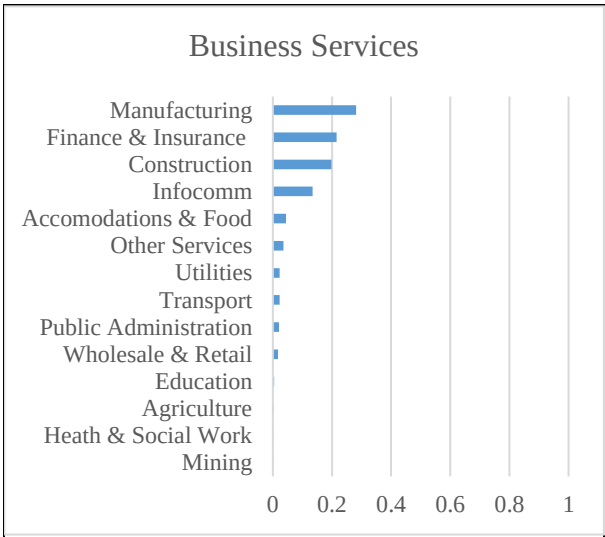
Figure 3 presents the sector weights from the 2016 input-output table that were used in the previous computations. What is so prominent is the dominance of manufacturing weight in almost all the sectors. Even education and healthcare and tourism dependent transport and accommodation sectors show strong manufacturing presence. This is likely to be a result of the dominance of electronics in Taiwan manufacturing.

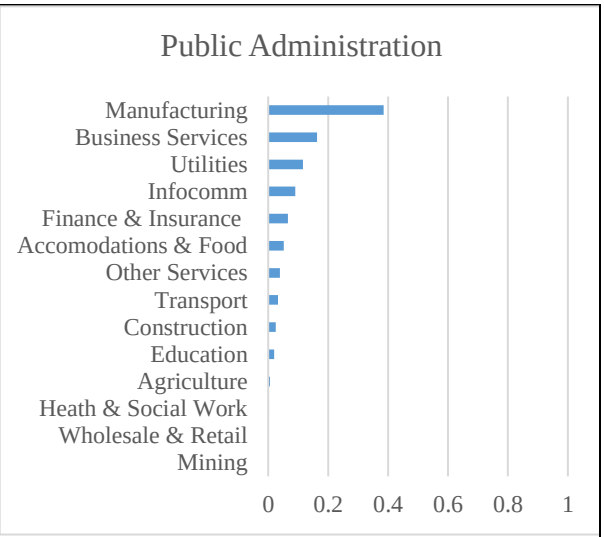
Despite the manufacturing sector's exposure to the global economy, the resilience across sectors seems to be a result of two interwoven factors, 1. China effect and 2. manufacturing market diversification. External shocks are transmitted primarily through FORGDP and VISITOR. As we saw earlier, the contraction of FORGDP is highly mitigated by the relatively good performance of the Chinese economy that accounts for the largest weight (44%) in the FORGDP variable. As a result, the manufacturing sector contraction has been mild. There is another factor working in favour of the manufacturing sector. As of 2019, only about 50% of manufacturing output is exported with electronics taking the lion's share. The other 50% is locally consumed. As Figure 3 shows many resilient sectors are heavily linked to the manufacturing sector. Therefore, a virtuous feedback loop is in operation.

Furthermore, based on 2015 data from the OECD Trade in Value Added Database, the domestic value-added share of manufacturing exports for Taiwan (62.4%) is significantly higher than that of Singapore (50.0%) and Hong Kong (52.3%). Of the foreign value-added share of manufacturing exports, China (6.64%) is the largest followed by Japan (4.68%). The supply chain of Taiwan's manufacturing industry was thus largely insulated from external shocks as domestic industries are the main supplier and the major foreign supplier, China, was successful in containing the pandemic.

Figure 3. Sectoral weights from Input-Output table 2016


Construction
Manufacturing
Business Services
Mining
Finance & Insurance
Transport
Other Services
Public Administration
Infocomm
Utilities
Accomodations & Food
Agriculture
Wholesale & Retail
Education
Heath & Social Work
0 0.2 0.4 0.6 0.8 1
Wholesale & Retail
Business Services
Manufacturing
Accomodations & Food
Finance & Insurance
Infocomm
Utilities
Transport
Construction
Other Services
Public Administration
Agriculture
Education
Mining
Heath & Social Work
0 0.2 0.4 0.6 0.8 1
Transport
Manufacturing
Business Services
Finance & Insurance
Other Services
Accomodations & Food
Infocomm
Utilities
Construction
Wholesale & Retail
Public Administration
Education
Heath & Social Work
Mining
Agriculture
0 0.2 0.4 0.6 0.8 1
Accomodations & Food
Manufacturing
Business Services
Agriculture
Utilities
Infocomm
Finance & Insurance
Transport
Other Services
Construction
Wholesale & Retail
Public Administration
Education
Heath & Social Work
Mining
0 0.2 0.4 0.6 0.8 1
Infocomm
Manufacturing
Business Services
Wholesale & Retail
Construction
Utilities
Finance & Insurance
Other Services
Accomodations & Food
Transport
Public Administration
Education
Agriculture
Heath & Social Work
Mining
0 0.2 0.4 0.6 0.8 1
Finance & Insurance
Business Services
Infocomm
Manufacturing
Accomodations & Food
Transport
Public Administration
Other Services
Utilities
Construction
Education
Wholesale & Retail
Heath & Social Work
Mining
Agriculture
0 0.2 0.4 0.6 0.8 1


Business Services
Manufacturing
Finance & Insurance
Construction
Infocomm
Accomodations & Food
Other Services
Utilities
Transport
Public Administration
Wholesale & Retail
Education
Agriculture
Heath & Social Work
Mining
0
0.2
0.4
0.6
0.8
1


Public Administration
Manufacturing
Business Services
Utilities
Infocomm
Finance & Insurance
Accomodations & Food
Other Services
Transport
Construction
Education
Agriculture
Heath & Social Work
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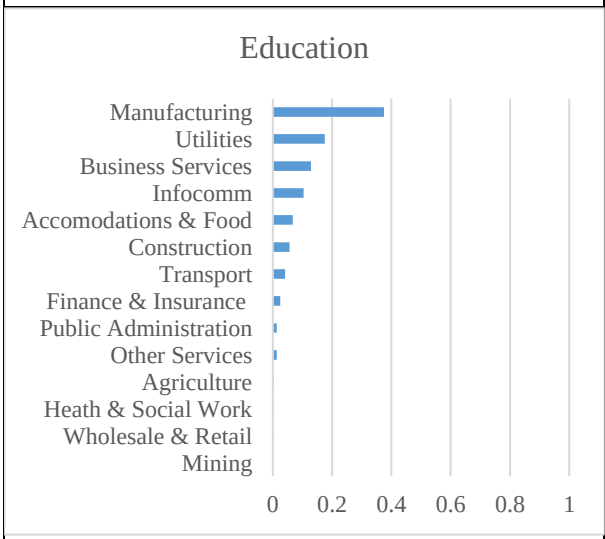
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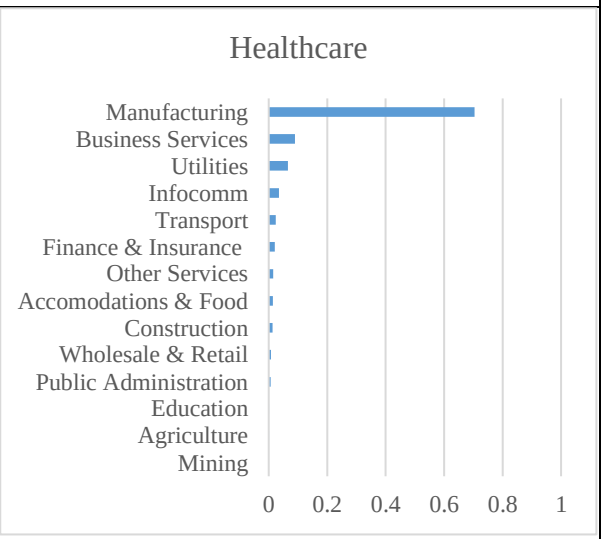
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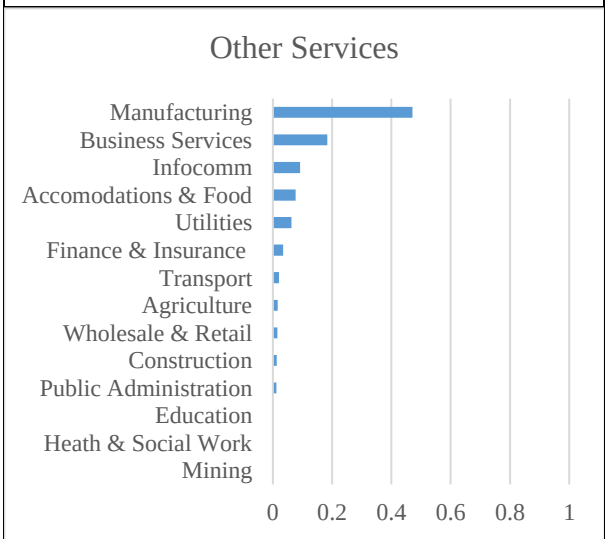
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5. Conclusion

The resilience of Taiwan's economy in response to COVID-19 arises from numerous factors, key among these factors is the successful containment of the pandemic. Taiwan's handling of the COVID-19 pandemic has been highly effective and characterised by its promptness which prevented a need for general lockdowns. This has enabled the economy of Taiwan to continue largely undisrupted.

The structure of Taiwanese economy further adds to this resilience. Manufacturing proved to be a key industry and is fundamental to the wider Taiwanese economy. It is both a major producer of intermediate inputs of much of the other sectors of the economy as well as a driver of growth. The supply chain of this key sector was fortunately largely insulated from disruption as the bulk of the supply chain is domestic and its major foreign partner, China, was also successful in containing the pandemic.

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