ECONOMIC IMPACT OF COVID-19 ON THREE ASIAN TIGERS

EDITORS

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About ACI

The Asia Competitiveness Institute (ACI) was established in August 2006 as a Research Centre at the Lee Kuan Yew School of Public Policy (LKYSPP), National University of Singapore (NUS). It aims to build the intellectual leadership and network for understanding and developing competitiveness in the Asia region. ACI seeks to contribute to the enhancement of inclusive growth, living standards, and institutional governance through competitiveness research on sub-national economies in Asia. It identifies mitigating issues and challenges for potential public policy interventions through close collaboration with regional governments, business corporations, policy think-tanks, and academics. ACI's three key research pillars include (I) Sub-national economy level competitiveness analysis; (II) The development of digital economy and its implications in 16 Asia economies; and (III) Singapore's long-term growth strategies and public policy analysis.

ACI's value propositions may be encapsulated in its acronym:
Analytical inputs to initiate policies for policy-makers and business leaders in Asia
Capacity building to enable others through improvement in productivity and efficiency
Intellectual leadership to create pragmatic models of competitiveness and inclusive growth

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- ACI endeavours to articulate sound recommendations, promote discussion, and shape research agenda in the arena of public policy amongst Asian governments.
- ACI undertakes evidence-based analysis of public policy issues and decisions, in order to provide assessment of their effectiveness as well as economic and societal impact.

Founding Patron

Founding Patron   **Mr George Yeo**
Visiting Scholar, Lee Kuan Yew School of Public Policy, National University of Singapore & Former Minister of Foreign Affairs, Singapore

Asia Competitiveness Institute

Director: **Professor Paul Cheung (From April 2020)**

Preface

The COVID-19 pandemic has presented unprecedented challenges to policy makers. At the time of writing this preface, the global confirmed cases have exceeded 120 million, with more than 2.6 million deaths. The economic repercussion of this health crisis was a drastic contraction in global GDP. Containment measures implemented by governments led to significant contractions in employment and economic activities. Balancing public health and economic growth has never been more difficult and complicated.

Since the onset of COVID-19, the Asia Competitiveness Institute has devoted its research to the economic impact in the region. In this book, we present a selection of research papers that was done in the first year of the pandemic. A broad range of topics are covered. From the macroeconomic perspective, through a forward-looking framework, our research examines economic dynamics in Singapore and Hong Kong and identifies key factors for economic resilience in Taiwan. On more specific issues, we examine how the "circuit breaker" – a *de facto* lockdown measure in Singapore – has affected tourism arrivals, air pollution and job market dynamics in Singapore.

This book also features state-of-the-art techniques that derive insights from real-time data. Timely analyses of data are critical for policy makers in formulating policies. The pandemic has further put big data analytics into extensive use. Recognizing the importance of data-driven insights, researchers at ACI have also employed advanced techniques, such as text mining, in identifying economic trends. Through the interplay of high-quality real-time data, sophisticated analytical tools, and sound economic intuitions, we provide recommendations on future policy designs.

This book serves as a valuable reference for both policy makers and academics. For the Asian countries, it is a recount of experience after two major pandemics of SARS and COVID-19. For the rest of the world, it is a collection of experiences, worthy of greater scrutiny in preparation for future pandemic events. For the academics, it provides an interesting spectrum of future research topics. I look forward to greater research collaboration on this challenging research agenda.

Professor Paul Cheung
Director, ACI
Lee Kuan Yew School of Public Policy
National University of Singapore

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Editor Bios

Tilak Abeysinghe is currently a Senior Research Adviser at the Asia Competitiveness Institute (ACI), Lee Kuan Yew School of Public Policy, National University of Singapore and Research Director of the Gamani Corea Foundation, Colombo. He was a visiting professor in the Department of Economics, NUS, before retiring in July 2019 after 31 years. He served as the Director of the Singapore Centre for Applied and Policy Economics and was an Executive Committee member of the Department of Economics. He held other important administrative responsibilities at NUS such as Deputy/Acting Headship, Director of Economics Graduate Program and member of the Faculty Tenure and Promotion Committee. He was also a visiting professor at Kyoto University and Peradeniya University. He coordinated the keenly awaited monthly newspaper column in The Straits Times, "Ask NUS economists". He obtained his PhD in Economics/Econometrics from the University of Manitoba and worked for the United States Agency for International Development (Colombo) before joining NUS in 1988. His research interests lie in a range of theoretical and applied econometric topics that include the Singapore economy, housing affordability, stress and cancer and quantitative health research. He has published in various reputable international journals such as the Journal of Econometrics and the NBER paper series. A major line of his research has been the econometric modelling of the Singapore economy, forecasting and policy analyses. As the coordinator of the Econometric Studies Unit since 1992, he has built a number of econometric models, one of which appears in the Routledge book, The Singapore Economy: An Econometric Perspective. Policy analyses based on these models have appeared in news media frequently. He has supervised a large number of PhD, Masters and Honours students.

Xie Taojun is a Senior Research Fellow at ACI, Lee Kuan Yew School of Public Policy, NUS. He obtained a PhD in Economics from Nanyang Technological University. At ACI, he oversees the annual cost of living indices for expatriates and ordinary residents in over 100 cities around the world. Taojun's research focuses on macroeconomic implications of the digital economy. He has published in refereed journals including *Economic Policy*, *Economic Modelling*, *Journal of Asian Economics*, and *Emerging Market Finance and Trade*.

Acknowledgements

1   Introduction

Tilak Abeysinghe and Xie Taojun

It has been a year since the onset of COVID-19. Governments around the world have undergone an unprecedented challenge in trying to contain the pandemic while minimising the economic costs. Policy responses have been vastly different across countries, from strict quarantine measures in China, to minimal economic intervention in Sweden. Despite varying degrees of stringency, these containment measures have brought us to the status quo – a contraction of global GDP and a shift in economic activity among economic sectors. The global economy is now at a unique starting point entering the third decade of the 21st century.

Having been through the SARS[1] episode in 2002-2003, some East and Southeast Asian economies have appeared to withstand the COVID-19 pandemic well. As of end of March 2021, the death toll was 10 in Taiwan, 30 in Singapore, and 203 in Hong Kong. As the rest of the world wrestles with the second or even the third wave of the pandemic, these economies are contemplating exit plans from their lockdown measures. The resilience that these economies, especially Taiwan, have shown is believed to be a result of the lessons learned from the SARS episode in 2002-2003, and the swift policy responses that the governments implemented in the current episode.

Since the early stage of the pandemic, the Asia Competitiveness Institute (ACI) has devoted its research efforts to assess the economic impact of COVID-19 on some East and Southeast Asian economies. This book is a selection of research papers on this issue as we mark the anniversary of this research agenda. It covers two broad topics, each forming a part of the book. In part I, a forward-looking framework is used to study sectoral dynamics in Singapore, Hong Kong, and Taiwan.

As the data analytical tools and their use have proliferated, ACI has also committed to providing timely policy recommendations using high-frequency real-time data. In Part II of the book, state-of-the-art data analytical tools are used to derive real-time insights from data. These insights provide useful information for tackling environmental issues, job market dynamics, and exit plans from the lockdown measures.

This book serves as a useful reference for policy makers and academics around the world. Asia's unique experience in both the SARS and COVID-19 episodes helps

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[1]SARS stands for severe acute respiratory syndrome.

policy makers reflect on the effectiveness of the policies. The topics raised in this book also provide new perspectives for academics in their future research. As we enter the second quarter of 2021, ACI will continue its endeavours in this research area.

The remainder of this chapter provides an overview of the articles in this book.

Part I: Sectoral Dynamics in Singapore, Hong Kong and Taiwan during COVID-19

The initial pattern of the spread of Covid-19 led some to say that it was 'a rich man's disease'. It was initially a high-class import, brought in mostly by well-off international travellers, then spreading in wealthier districts and neighbourhoods of different countries (Bengali et al., 2020; Plümper and Neumayer, 2020). But now we know, it does not care about rags and riches.

Nevertheless, it is worth shedding some light on the question to highlight some issues. Just by looking at the number of infected cases reported across the world it appears that the rich countries in the Western block were hit the hardest. A plot of cross-country data, extracted from online sources on Mar 1, 2021, at a time when cases in rich countries were subsiding, shows a close relationship between per capita income and the number of infected cases per million population of a country (Figure 1.1a). What is ignored here is that rich countries also performed more tests, in general, than the poor countries (Figure 1.1b). For example, as of March 1, 2021, tiny Singapore that ranked 96 in terms of total cases had performed nearly 1.3 million tests per million population whereas India, ranked 2nd in terms of total cases, had performed only about 156,000 tests per million. In fact, a regression estimate shows that a one percent increase in tests per million increases the cases detected by one percent.

A better indicator, therefore, is the relationship between per capita income and Covid-19 cases per a given number of tests. Figure 1.2 shows the scatter plot of per capita income and cases per 1000 tests. Now the plot is very informative. Many rich countries, those with per capita income US\$ 20,000 or more reported less than 100 cases per 1000 tests. In contrast, a very large group of low-income countries (those below US\$ 20,000) have reported cases more than 100. Even if it was a rich to poor spread, general observations indicate that as with the previous pandemics it is the poor countries and poor people in both rich and poor countries who had to bear the brunt of the burden of the disease. Therefore, country-specific studies assessing both the health and economic impact of the pandemic play a crucial role in policy formulations.

Given the stark choice between saving lives with no certainty vs saving livelihoods with some certainty, many Asian countries opted for the former and acted early. Some countries tried to do both initially and failed on both counts. Many countries, for a lack of choice, were forced to adopt measures to control the spread of Covid-19 blindfolded. After one year, we are now getting to know the heavy economic cost of these control measures. With some data available, we can now examine the impact
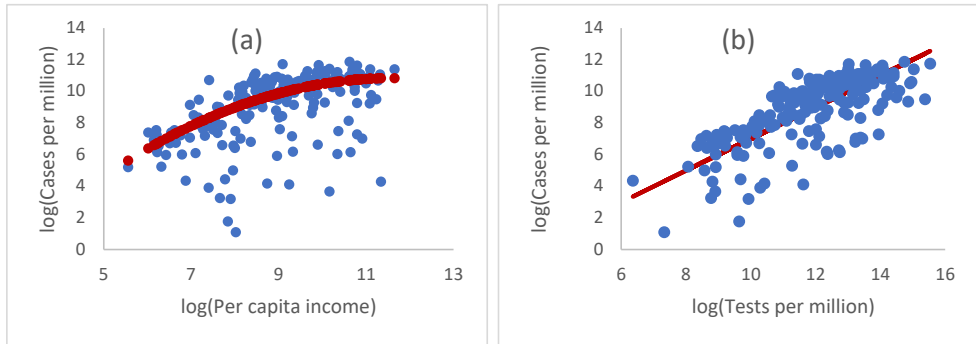
Source: Author's calculations, Worldometers, Wikipedia
Figure 1.1: (a) Per capta income and Covid-19 cases, (b) Tests and cases per million.
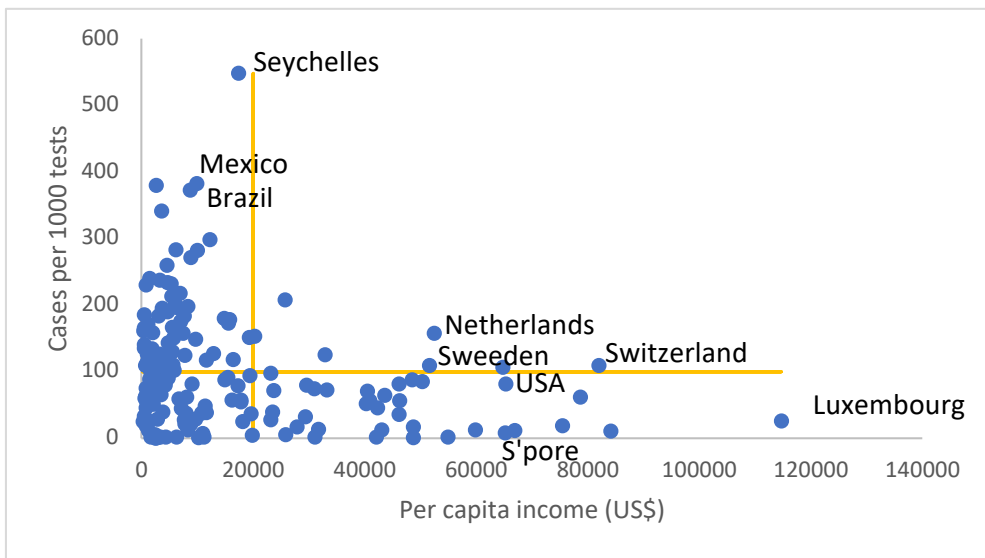
Source: Author's calculations
Figure 1.2: Per capita income and Covid-19 cases per 1000 tests.

of Covid-19 on different segments of the economy and society. This is how a typical analysis takes place. This is a type of 'post-mortem' analysis: the effect is known, look for the cause or causes.

Yet, what we need are tools to assess potential outcomes at the beginning of events like Covid-19. This is similar to what is done in an experimental setting: in such settings, the cause is known, assess the effect. However, in experiments, the exact dosage of the treatment (cause) is known. In situations like Covid-19, the causes may be known, but the dosage cannot be quantified easily. This is where the scenario analysis comes in. The objective is to examine potential outcomes under different scenarios and provide a warning to policy makers to take corrective actions: save the patient before it is too late.

International institutions like the World Bank (2020), International Monetary Fund (2020), and International Labor Organization (2020) provided early warnings on the economic fallout of the pandemic. These were, however, too aggregate, focusing mostly on regions. In this exercise, we have attempted to prepare the ground for developing forward-looking econometric methodologies to examine how different sectors of an economy may be affected by events like Covid-19, before relevant data become available.

Chapter 2 presents the forward-looking econometric methodology that was used in the sectoral analysis in the next three chapters on Singapore, Hong Kong and Taiwan. The key ingredients of the methodology are:

1. Intervention analysis, Covid-19 is the intervention (dummy) variable,

2. Vector autogression (VAR) to account for sectoral interdependence,

3. A weight matrix to overcome the dimensionality issue of VAR models; weights are estimated using input-output tables or sectoral value added data,

4. Sectoral interdependence estimated using pre-crisis data,

5. Intervention effect calibrated using sectoral forecasts from the VAR model using two exogenous variables, growth rates of visitor arrivals (VISITOR) and export-share weighted GDP growth of the trading partners (FORGDP),

6. Impulse response analysis with respect to the intervention variable under different scenarios with direct and indirect growth impact on each sector computed separately.

Chapter 3 on Singapore was completed in April 2020, after the first wave of the pandemic, and Chapter 4 on Hong Kong was completed in June 2020, as the second wave was just beginning to unfold. Except for some information on visitor arrivals, no other Covid-19 related economic data were available for these studies. Ex-post examination of these two studies provides an interesting contrast. Therefore, the two chapters are summarised together.

The largest sector in Singapore is manufacturing. In Hong Kong, manufacturing has shrunk to become the second smallest sector. The smallest sector is other goods

industries that include agriculture, forestry, fishing, mining and quarrying. In Singapore, this sector is negligible, therefore not included in the sectoral analysis. Five major service sectors are dominant in both the economies. A problematic category is ownership of dwellings (or premises). The home ownership rate in Singapore is about 90% whereas, in Hong Kong, it is less than 50%. Nevertheless, Singapore's GDP share of this sector is substantially lower than that of Hong Kong. The difference is probably due to imputed rent on owner-occupied dwellings. In Singapore, even in areas like Woodlands, the imputed rent could be $1000, less than the market rate. In Hong Kong, a larger proportion of dwellings is rented at market rates, which is clearly higher than Singapore's imputed rent. These differences affect the value-added calculations. In Singapore, ownership of dwellings is excluded from the sectoral classification. Therefore, the sectoral analysis of the exercise includes 10 sectors in Singapore and 12 sectors in Hong Kong.

Regression estimates clearly show the dependence of each sector on other sectors. Many sectors also depend on FORGDP and VISITOR. These estimates, however, capture only the direct dependence. Key results from the impulse response analysis, that account for both direct and indirect dependence, are given below.

Under the optimistic scenario, where Covid-19 withers away after three quarters, all sectors show the possibility of a V-shape of U-shape recovery within six to 12 quarters. Although the direct impact of Covid-19 restrictions is dominant initially for some sectors like transportation & storage, it is the indirect impact that drags the sectors later into a prolonged downturn. Understandably, because of travel restrictions, the direct impact is most dominant in the accommodation & food services sector. Some sectors show vastly different growth dynamics in the two economies, for example, the construction and utilities sectors. Under the pessimistic scenario, where Covid-19 waves keep recurring, an L-drag in the negative territory for all sectors is possible.

Ex-post comparison of the projections from the impulse response analysis with actual data available for the first three quarters of 2020 was added to each chapter in March 2021. This has thrown up a very interesting contrast. The objective of this type of projections is to elicit policy responses that avoid adverse outcomes. Interestingly, the Singapore results for sectors are in line with a V-shape recovery. However, actual performance was better than projected, showing the impact of policy support. The official estimate of GDP growth for 2020 was -5.4%, compared to the projected contraction of approximately -5.3%.

Unlike Singapore, events in Hong Kong, including the resurgence of pandemic waves, have clearly departed from the scenarios underpinning the projections. Instead of a V-shape recovery, many sectors of Hong Kong show a zig-zag growth pattern over the first three quarters of 2020. The first quarter contraction in many sectors was much deeper than projected. This led to an up-down growth pattern over the second and third quarters, partly due to the base effect. The official estimate of GDP growth for 2020 was -6.1%. In contrast, the study projected a contraction of -4.7%. The experience of Hong Kong has demonstrated that an effective containment of the pandemic is absolutely essential for faster economic recovery.

The Taiwan study in Chapter 5 was conducted in November 2020 with the advantage of having Covid-19 period economic data for the first half of 2020. Taiwan turns out to be a very interesting case study because of the remarkable resilience of the economy to the pandemic. Taiwan is a manufacturing dominated economy that caters to both domestic and foreign markets. In all, 15 sectors were included in the model. A key departure of this study from the previous two is the use of Input-Output tables to work out the weight matrix that was needed in the VAR methodology.

Regression estimates show sectoral interdependence but, unlike Singapore and Hong Kong, direct dependence of Taiwan's sectors on FORGDP and VISITOR is not as prominent, except for manufacturing, which shows a strong dependence on FORGDP. Impulse response analysis shows that all sectors may fully recover within six to eight quarters, even without any stimulus measures. Many sectors display resilience with only slight downturns and even show modest positive growth, including the key manufacturing sector. The sectors that suffered most are those that are dependent on visitor arrivals. The resilience of Taiwan's economy is attributed to its swift and effective containment of the pandemic and an economic structure that allowed its key manufacturing sector to be largely insulated from global disruptions. Section 4.3 of Chapter 5 discusses in detail the sources of its resilience.

Part II: Data-driven insights on COVID-19-related issues

The COVID-19 pandemic has multiplied data intensive analyses. Working from home, contactless payments, and business collaborations are not possible without the support of information technology and data. For policy-making purposes, timely data is useful in responding promptly to unprecedented events like COVID-19. The governments' efforts to update COVID-19-related statistics frequently helps the public understand the development of the disease in real time. In the private sector, Google, for instance, supplies daily data of human flow at various destinations around the world. This data provides policy makers with essential information in designing the containment measures and monitoring their effectiveness.

As a think tank, ACI has also committed to provide timely policy recommendations. The second part of the book pertains to more specific issues related to the COVID-19 pandemic, based on insights from data. Leveraging on ACI's comparative advantage in building data analytical frameworks and sound economic intuitions, researchers make use of high-frequency and high-quality data to derive policy recommendations. Papers in this part touch on the performance of the tourism sector, air pollution, and job market dynamics, after COVID-19 and the implementation of policies related to it.

Chapter 6 analyses the impact of COVID-19 on the tourism industry and related employment. The tourism industry is perhaps the hardest hit during the COVID-19 pandemic. Governments have advised citizens not to travel, and implemented stringent quarantine measures on foreign visitors, leading to a direct impact on the travel-related sectors, including transport and hotels. As production linkages exist among

sectors of the economy, the impact on the tourism industry is likely to spillover to other sectors. In this chapter, the authors estimate the spillover effects based on Singapore's input-output table. The scenario analysis suggests that government spending would be most effective in reducing job losses in the accommodation & food services sector, and that reopening business travel to Southeast Asian countries would maximise economic benefits while minimising health risks from imported cases.

Chapter 7 studies the impact of reduced human flow on air quality. The "circuit breaker"- the term favoured by the Singapore government for curbing mobility - effectively restricted people's movements. This has an implication for the environment as vehicular usage has been significantly reduced. In this chapter, the authors use high-frequency, real-time data on human mobility to find out the extent to which the reduced human mobility contributed to better air quality. The authors find that as workplace mobility decreases 10 percentage points, the $PM_{2.5}$ concentration will decrease by about 0.1 to $0.2\mu g/m^3$. They also find that air pollution in Hong Kong is not significantly affected by mobility restrictions, since no movement control measures have been imposed.

Chapter 8 employs text mining techniques to study the effects of policy announcements on job searches. The author discusses what the findings suggest, including how stay-home mandates, while necessary to flatten the curve, potentially create additional shocks to the labour supply, which are more hidden than the demand side.

Going forward

This book is part of ACI's ongoing research on the economic impact of COVID-19 in East and Southeast Asia. Papers in this book mainly focus on the early impact, before the release of official data. The research agenda is still ongoing. As we enter the second quarter of 2021, and as countries are figuring out solutions for policy coordinations, more pressing policy issues will emerge. ACI will continue focusing on analyzing the economic impact on the regional economies as they find their way to recovery.