Economic Impacts of SARS/MERS/COVID-19 in Asian Countries

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This paper surveys the recent literature on the economic impacts of SARS, MERS, and COVID-19, which Asian countries have experienced in the past two decades. In particular, we provide a detailed summary of how each of the past infectious diseases has impacted on the Asian economies and the extent of that impact. This paper also documents how the governments of Asian countries have responded to the COVID-19 shocks with their economic policies, and discusses the effectiveness of these economic policies to mitigate the COVID-19 shocks on their economies.

Key words: Asia, COVID-19, economic impacts, literature review, MERS, SARS

JEL codes: E00, I14, I15, I18

1. Introduction

Starting in 2019, a new coronavirus that originated in Wuhan, Hubei Province, China, has quickly spread around the world. Almost all the countries in the world have been severely affected, and are still managing to contain the virus until the distribution of the vaccine is completed. Strong interventions such as lockdowns have been implemented, at the expense of economic activity. For Asian economies, however, the coronavirus is not the first infectious disease that has challenged their economies. Asian countries have already experienced SARS and MERS and have overcome the damage caused to their economies by these infectious diseases.

The purpose of this paper is to summarize the economic impact of SARS, MERS, and COVID-19 that Asian countries have experienced, based on the existing literature. In particular, this paper provides a detailed summary of how each of the past infectious diseases has impacted on the Asian economies and the extent of that impact. We then discuss how the governments of the Asian countries have responded to COVID-19 through their economic policies, and which of the policies were effective.

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In this paper, we focus on why COVID-19 has caused more serious economic damage than SARS and MERS. To provide an answer, we first examine the channels through which pandemic shocks affect the economies. We highlight the fact that COVID-19 caused significant supply shocks due to non-pharmaceutical interventions such as lockdowns, while SARS and MERS mainly caused demand shocks.

How can we interpret such non-pharmaceutical interventions in economics? To answer this question, this paper introduces the so-called SIR-macro model, which combines epidemiological and macroeconomic models. With this model, we study the trade-off between the economy and public health. We then review the latest papers that apply this model to Asian economies. Some of these papers are indeed helping countries to plan their infectious disease control measures.

In the third section of this paper, we visit empirical studies of how the SARS, MERS, and COVID-19 shocks affected the economy through the channels described above. We find that the economic impacts of COVID-19 are large for Asian economies. Also, many papers in the literature find that their negative effects are not uniform across firms, workers, and households. We thus review those papers, which document the heterogeneous impacts of COVID-19 shocks.

In the final section of this paper, we examine the economic policies that are, in theory, effective in response to the COVID-19 shocks. We also document that, responding to COVID-19 shocks, the governments in Asian countries greatly increased their fiscal expenditures, implementing a variety of economic policies. We then briefly review the papers that evaluate the economic policies taken by Asian countries.

There are already several excellent reviews in the literature on COVID-19 and its impact on the economy. Baldwin and Mauro (2020) is an eminent introduction to the literature, with a comprehensive collection of 14 papers on various topics on COVID-19 and economies. Brodeur et al. (2020) have also reviewed recent papers in this literature. Unlike these two references, this paper is a survey of COVID-19 and economies, with a particular focus on Asian countries.

2. Pandemic Shocks

There is a broad agreement in the literature that SARS, MARS, and COVID-19 had significant impacts on the Asian economies. As summarized in Table 1, the SARS, MARS, and COVID-19 pandemics widely spread in Asian countries and caused a large number of cases and deaths, which turned into significant economic losses in those countries. On the other hand, the pathways of their economic impacts do not seem to have been the same. Therefore, in this section, we examine how infectious diseases affect the economy by examining the episodes of SARS, MERS, and COVID-19.

2.1 How have pandemic shocks affected the Asian economies?

We first look at SARS, MERS, and COVID-19 episodes to understand the general idea of how each pandemic affected the Asian economies.
Keogh-Brown and Smith (2008) undertake a cross-country panel data analysis for a set of countries affected by SARS, and examine how it impacted on several economic measures in these countries. They find that there were significant economic effects of SARS due to reductions in consumer spending on hotels, and restaurants. In the case of SARS, thus, the shocks seem to be more related to the demand side. Fernandes and Tang (2020) examine transaction-level trade data for Chinese firms and find that firms in regions with local transmission of SARS experienced lower import and export growth. The vast majority of the losses caused by SARS were experienced in China and Hong Kong, with more minor effects in Canada and Singapore.

The economic impacts of MERS on Asia were limited to South Korea. Similar to SARS, the shocks seem to be more related to the demand side. The shocks mainly hit the tourism industry including accommodation, food and beverage, and transportation sectors, because of the decrease in tourists (Joo et al., 2019). In addition, consumer spending in the retail, restaurant, and food services sectors that require traditional, face-to-face shopping decreased dramatically, while there was an increase in e-commerce spending (Jung et al., 2016).

In contrast to SARS and MERS, the supply shock seems to have played a major role as well as the demand shock in the case of COVID-19. This is empirically supported in the USA, where this supply shock has had a significant impact on the economy. Brinca et al. (2020) and Bekaert et al. (2020) report that roughly two-thirds of the decline in total hours worked in the USA in March and April 2020 can be explained by supply-side factors.2

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1 Data sources: World Health Organization (2003) for SARS, World Health Organization (2020) for MERS, and Worldometer (2021) for COVID-19 as of July 7, 2021.

### Table 1 Numbers of infections and deaths for SARS/MERS/COVID-19 in Asia

|                | SARS | MERS | COVID-19          |
|----------------|------|------|-------------------|
| Number of cases| 7777 | 2517 | 56,862,228        |
| Number of deaths| 729 | 876 | 808,259          |
| Time period    | 2002–2003 | 2012– | 2019– |
| Affected countries | China, Hong Kong, Macao, Taiwan, Kuwait, Malaysia, Mongolia, Philippines, Republic of Korea, Russia, Singapore, Thailand, Viet Nam | Bahrain, China, Iran, Jordan, Kuwait, Lebanon, Malaysia, Oman, Philippines, Qatar, Saudi Arabia, South Korea, Thailand, Tunisia, Turkey, United Arab Emirates, Yemen | Almost all countries in Asia |

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While the analysis for Asian countries is limited, Watanabe (2020) studies whether the economic shock caused by the spread of a new coronavirus was caused by demand-side or supply-side factors for Japan. He reports that the demand shock had a relatively larger effect in Japan, unlike in the USA or the UK. Aum et al. (2020) estimate the causal effect of the outbreak on the labor market with a difference-in-differences approach using the fact that Korea did not implement a lockdown. They find that a one per thousand increase in infections causes a 2% to 3% drop in local employment, suggesting that at most half of the job losses in the USA and UK can be attributed to lockdowns and the rest of the job losses are due to people’s fear of infection.\(^3\)

2.2 The SIR-macro model
In the case of COVID-19, the supply side is the key to understanding the economic impacts of pandemic shocks. In particular, non-pharmaceutical interventions such as lockdowns and self-restraint requests by the government play a significant role in restricting the labor supply of households.\(^4\) Is there any rationale for such a government policy? In this section, we study an economic framework to understand non-pharmaceutical interventions.

During the COVID-19 crisis, there has been a great advance in the economics literature on the so-called, SIR-macro model. The SIR-macro model introduces an epidemic model into a macroeconomic framework and describes the trade-off between the number of deaths due to infectious diseases and economic losses. A government’s non-pharmaceutical interventions such as a containment policy improve social welfare in this model because they internalize the externalities of the spread of the disease due to economic activity.\(^5\)

We introduce one of the most popular baseline models, created by Eichenbaum et al. (2020a). The core part is called the SIR created by Kermack and McKendrick (1927). Its purpose is to analyze the dynamics of infectious diseases. Eichenbaum et al. (2020a) combine it with a macroeconomic model with no capital accumulation and individuals with different histories of viral infections.\(^6\)

Consider an infinite period economy. In period \(t\), people are divided into four groups according to their viral infection history: the susceptible \(S_t\), the infected \(I_t\), the recovered \(R_t\), and the deceased \(D_t\). We assume that the total population is \(S_t + I_t + R_t + D_t = 1\). Each individual is belonging to the group \(i \in \{S_t, I_t, R_t\}\) and assumed to obtain the following utility from consumption \(C_t\) and labor supply \(N_t\),

\[
U = \sum_{t=0}^{\infty} \beta^t u(C_t, N_t). \tag{1}
\]

The budget constraint faced by each individual is as follows:
Here, \( w_t \) represents wages as in the standard macro model, and \( \mu_t \) represents the strength of the containment policy that restricts economic activity.

The government manipulates this containment policy \( \mu_t \) to control economic activity and prevent the spread of the infectious virus, which is a particularly important aspect of this model. The containment policy \( \mu_t \) is a form of taxation that suppresses economic activity in society, for example, the larger the value of \( \mu_t \), the more people will refrain from consuming, and as a result, production in the economy will be suppressed. For simplicity, we assume that the government revenue collected by \( \mu_t \) is equally transferred to each individual by \( \Gamma_t \) in the form of a lump-sum income transfer.

An essential part of this model is the part that describes the infectious dynamics of the population, called the SIR, described below.

\[
\begin{align*}
\text{(Susceptible)} \quad S_{t+1} &= S_t - T_t \\
\text{(Infected)} \quad I_{t+1} &= I_t + T_t - (\pi_r + \pi_d)I_t \\
\text{(Recovered)} \quad R_{t+1} &= R_t + \pi_r I_t \\
\text{(Deceased)} \quad D_{t+1} &= D_t + \pi_d I_t
\end{align*}
\]

In Equation (3), the number of susceptible persons in \( t + 1 \) period \( S_{t+1} \) is expressed as the number of susceptible persons in \( t \) period \( S_t \) minus the number of newly infected persons \( T_t \). In Equation (4), the number of infected persons \( I_{t+1} \) in period \( t + 1 \) is expressed as the number of infected persons \( I_t \) in period \( t \) plus the number of newly infected persons \( T_t \) and minus the number of newly recovered persons \( \pi_r I_t \) and deceased persons \( \pi_d I_t \), where \( \pi_r \) and \( \pi_d \) are the probability that an infected person will recover and die, respectively. In Equation (5) (or (6)) the number of recovered individuals \( R_{t+1} \) (the number of deaths \( D_{t+1} \)) in period \( t + 1 \) equal to the number of recovered \( R_t \) (the number of deaths \( D_t \)) in period \( t \) plus the number of newly recovered \( \pi_r I_t \) (the number of deaths \( \pi_d I_t \)).

The key here is the movement of the number of newly infected people. The number of newly infected \( T_t \) depends on three terms the cross term of total consumption of the susceptible and infected \((S_tC_i^t)(I_tC_i^t)\), the cross term of total working hours between susceptible and infected \((S_tN_i^t)(I_tN_i^t)\), and the cross term of the total number of susceptible and infected \((S_t)(I_t)\). \( \pi_1, \pi_2 \) and \( \pi_3 \) are the parameters that determine the impact of each term on the determination of the number of new infections.

\[
T_t = \pi_1 (S_tC_i^t)(I_tC_i^t) + \pi_2 (S_tN_i^t)(I_tN_i^t) + \pi_3 (S_t)(I_t)
\]
In the standard SIR model in the epidemic literature, $\pi_1 = \pi_2 = 0$ in Equation (7). The number of newly infected $T_t$ depends only on the cross term $(S_t)(I_t)$ of the total number of uninfected and infected. However, in the SIR-macro model, the cross term of total consumption of the susceptible and infected, $(S_t C_s^t)(I_t C_t^t)$, and the cross term of total working hours, $(S_t N_s^t)(I_t N_t^t)$, affect the number of newly infected. In other words, the SIR-macro model assumes that infectious diseases spread through people’s consumption behavior and labor market activities.

The assumption that infectious diseases spread through consumption and labor supply also defines negative externalities in an individual’s economic activities, which are particularly important for the governments to determine containment policies. That is, economic activities such as consumption and labor supply that involve close contact with others increase the utility of each individual, but they also have the potential to spread infection. Therefore, in order to mitigate this negative externality, the government’s interventions that restrain people’s consumption and labor are justified. Here, $\mu_t$ in Equation (2) serves as a so-called Pigouvian tax to internalize the externality, making people pay higher prices for consumption and labor that spread the infection.

In this model, how should the government change its containment policy $\mu_t$ in order to maximize social welfare as the infectious disease spreads? First, as in the usual SIR model, the number of infected people increases with time, peaks when a certain number of people become immune, and then decreases. The optimal containment policy is to increase $\mu_t$ along with the number of infected people in order to reduce the number of infections and deaths. The cost of reducing the number of infections and deaths is a decline in aggregate consumption and working hours. In other words, in this SIR-macro model, the optimal policy is to sacrifice economic activity in order to maximize social welfare, reducing the damage from infection.7

2.3 Applications of the SIR-macro model to Asian countries

While there are many papers that apply the SIR-macro model to the USA, there are only a limited number of applications of it to Asian countries. The SIR-macro model is particularly useful to determine the timing and duration of a lockdown policy. Furthermore, the SIR-model also allows us to analyze the effectiveness of alternative policies such as testing and individual containment policies.

2.3.1 Trade-off between health and the economy

Using a SIR-macro model, Chudik et al. (2020) simulate the trade-off between the epidemic and recession curves under a number of different social distancing and economic participation scenarios for China. They show that mandating social distancing is very effective at flattening the epidemic curve but is costly in terms of employment loss. They argue that, if targeted toward individuals most likely to spread the infection, the employment loss can be somewhat reduced.
Fujii and Nakata (2021) examine alternative scenarios for ending the state of emergency in Japan using a SIR-macro model. They update their analysis weekly showing the trade-off between the epidemic and economic losses. Their model is relatively simpler than Eichenbaum et al. (2020a), as it omits household consumption and labor supply decisions.

With a SIR-macro model similar to Eichenbaum et al. (2020a), Kubota (2021) analyzes Japan’s second state of emergency policy, starting on January 2021. He derives an implication, similar to Fujii and Nakata (2021), that the Japanese government should extend this lockdown long enough to avoid another future lockdown, given the country’s medical capacity.

Hoshi et al. (2021b) is a unique study that estimates the trade-off between job losses and the spread of COVID-19 in Japan. They consider the optimization problem of a social planner in a SIR-macro model who maximizes the sum of the discounted utilities given the resource and technological constraints on consumption and mortality by choosing the sequence of people’s mobilities. They derive an empirical specification from the social planner’s resource constraint and estimate how job losses and the case growth rate are related to people’s mobility using Japanese prefecture-level panel data.

2.3.2 Testing and individual containment policies

The magnitude of the economic costs of the non-pharmacological intervention policies enforced in a society as a whole is incalculable. For example, in April 2020, the unemployment rate in the USA stood at 14.7%. Even if not all of that was due to the lockdown, it is not hard to imagine that a certain number of workers lost their jobs after being locked out of stores and workplaces closed by strict containment policies. Thus, if tests could be used to efficiently identify asymptomatically infected people and isolate them individually, it might be possible to mitigate the trade-off between economic activity and infectious damage.

In fact, some Asian countries have countered COVID-19 by expanding testing systems and individual containment policies for infected people as an alternative to strict lockdowns. Hamano et al. (2020) analyze a quarantine policy for Japan, assuming that there exists misperception about the number of infections in the SIR-macro model. They show that a quarantine possibly improves both the health of the population and the economy in a setup that is similar to previous studies.

Aum et al. (2021) extend the model of Eichenbaum et al. (2020a) to incorporate individuals’ occupational choices and work-from-home decisions to maximize income and minimize their fear of infection. In their model, occupations differ by wage, infection risk, and productivity loss when working from home. They calibrate their model to South Korea and the UK to compare South Korea’s intensive testing and quarantine policy against the lockdown of the UK. They argue that South Korea’s policies would have worked equally well in the UK, dramatically reducing both deaths and gross domestic product (GDP) losses.
3. Economic Impacts

In this section, we look at the economic impacts of SARS, MERS, and COVID-19 in Asian countries. While all of their impacts are significant, the economic impacts of SARS and MERS are concentrated in a limited number of countries. On the other hand, COVID-19 has generated large economic losses to the whole Asian economy.

### 3.1 Aggregate impacts of SARS and MERS

As documented in Keogh-Brown and Smith (2008), the economic losses of SARS were concentrated in China, Hong Kong, and Singapore as shown in Table 2. China and Hong Kong experienced a significant drop in their GDP in the second quarter of 2003 by 3% and 4.75%, respectively. These drops are due to losses in the tourism, food, and travel industries, and also a reduction in foreign direct investment. Hai et al. (2004) report a significant loss in China’s tourism revenue due to a decrease in foreign visitors. Singapore’s tourism industry was also hit severely by SARS which leads to a GDP loss of 1% in 2003.

Table 2 shows the economic losses of the MERS, which were mainly concentrated in South Korea. The shocks are on its tourism industry including the accommodation, food and beverage, and transportation sectors (Joo et al., 2019), and also in the retail, restaurants, and food services due to a drop in consumer spending (Jung et al., 2016). The losses amounted to 0.7% of GDP in 2015.

### 3.2 Aggregate impacts of COVID-19

The economic impacts of COVID-19 are large and for all Asian economies. It is evident in Figure 1 that, except for the Middle East region, the Asian economies had been on a steady growth path until 2019. In 2020, the COVID-19 shock had hit almost all

### Table 2 Economic impacts of SARS and MERS in Asia

|        | SARS          | MERS          |
|--------|---------------|---------------|
| GDP losses |               |               |
| China   | −3.00%        | −0.7%         |
|         | In 2003,      | In 2015,      |
|         | quarter 2     | whole year    |
| Hong Kong | −4.75%        |               |
|         | In 2003,      |               |
|         | quarter 2     |               |
| Singapore | −1.00%        |               |
|         | In 2003,      |               |
|         | whole year    |               |

Note: The GDP losses for SARS are based on the estimates in Keogh-Brown and Smith (2008). For MERS, there are no reliable estimates. The number for MERS is based on the South Korean government’s announced reduction of their economic growth forecast for 2015 to 3.1% from the 3.8% projected in the previous year (Jung et al., 2016).

GDP, gross domestic product.

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the regions in Asia and twisted their growth paths. On the other hand, according to the predictions by International Monetary Fund (2021b), the COVID-19 shock will be short in duration, with rapid recoveries expected in most of the regions in 2021. This is because the distribution of the vaccine will enable a restart of a lot of economic activities. Thus, the COVID-19 shock can be looked at as having large, short-time impacts on the Asian economies.

In terms of the prediction of the aggregate impacts of COVID-19 for Asian economies, there are a couple of papers in the earlier stage of the pandemic. McKibbin and Fernando (2020) have predicted the impacts of different scenarios on macroeconomic outcomes and financial markets using an open-economy computable general equilibrium model. Rees (2020) uses a multi-sector dynamic stochastic general equilibrium model to estimate the economic forces that explain the decline in economic activity in the United States, the Euro Area, Japan, and China in the first half of 2020. He then uses the model to project the trajectory of economic recovery. He finds that the USA, Euro Area, and Japan will each face a “98% economy” if half of the constraints faced by customer-facing service industries in the first half of 2020 persist, while the economic recovery in China is projected to occur more quickly.

3.3 Heterogeneous impacts of COVID-19 across workers
One thing we need to be especially careful about COVID-19 shocks is that their negative effects are not uniform across workers and households.
3.3.1 Work-from-home capability

Dingel and Neiman (2020) and Leibovici et al. (2020) recognize the importance of identifying occupations hit by COVID-19 shocks at the early stage of the pandemic and attempt to identify occupations at risk by applying the task approach developed in the field of labor economics. Their method is to classify jobs into those where the work can be undertaken from home (WFH) and those that cannot, based on the nature of their task. They use O*NET, a data set containing task information for each job in the USA. They predict that occupations such as construction workers, restaurant workers, and janitors are more exposed to risk.

Applying their work-from-home analysis to cross-country data, Dingel and Neiman (2020) study how the share of jobs that can be done at home is correlated with GDP per capita in 2019 adjusted for purchasing power parity. They find that the share is positively correlated with GDP per capita across countries as shown in Figure 2. This implies that the fractions of occupations that can be performed at home are larger in developed countries and that developing economies and emerging markets may face an even greater challenge in continuing to work during periods of stringent social distancing. The developing countries in Asia are indicated by the diamonds in Figure 2 that exhibit a relatively low share of work-from-home jobs.

Okubo (2020) uses a unique survey data set for Japan and shows which occupations are suited to work-from-home. He reports that the use of telework increased from 6% in January to 10% in March and reached 17% in June 2020. He also notes that the level is still remarkably lower in Japan than in other developed countries (e.g. 37% in Europe).

Morikawa (2020) uses data from his original survey in Japan conducted in June 2020. He studies the prevalence, frequency, and productivity of working-from-home practices during the COVID-19 pandemic in Japan. His results show that the mean work-from-home productivity relative to working at the usual workplace was about 60% to 70%, and it was lower for employees who started work-from-home practices only after the spread of the COVID-19 pandemic.

3.3.2 Heterogeneous impacts across workers

Mongey et al. (2020) took the analysis in Dingel and Neiman (2020) one step further and found that the types of jobs affected by the lockdown are concentrated in less-educated and lower-income groups, using the data from the Current Population Survey (CPS) and the Panel Study of Income Dynamics in the USA. They have also shown that the classification of affected jobs predicted by Dingel and Neiman (2020) is correct in the actual data by using the CPS hours of work data in March 2020.

A number of studies find similar results for Asian countries. Kikuchi et al. (2021) is one of the earlier papers that documents heterogeneous changes in employment and earnings in response to the COVID-19 shocks, during the initial months after the onset of the pandemic in Japan. They find that the most severely hurt by the COVID-19 shocks has been a group of female, contingent, low-skilled workers, engaged in social and non-flexible jobs and without a spouse from a different group.
For Japan, Hoshi et al. (2021a) and Fukai et al. (2021) further investigate the labor markets with detailed microdata and document heterogeneous impacts among workers. Lekfuangfu et al. (2020) apply work-from-home indices to the labor force survey of Thailand, and find that low-income families tend to face a disproportionately larger risk of income/job loss from lockdown measures. Lee et al. (2020) use microdata on mostly poor and non-migrant workers in Delhi, India, and find that weekly income and days worked fell by 86.2% and 72.2%, respectively, by mid-May 2020.

The effects of COVID-19 are not just on individuals’ income and labor market status. Several studies find the effects have also changed individuals’ risk attitudes and behaviors in Asian countries. Bu et al. (2020) use variation in exposure across different Chinese cities and provinces to measure the impact of the COVID-19 pandemic on subjects’ willingness to take risks. They find that subjects’ allocations of wealth to hypothetical risky investments decrease monotonically based on the strength of their exposure to the pandemic. Mehrotra (2020) conducts an event study analysis that indicates a sustained decline in conflict after the first COVID-19 case is reported, driven by a decrease in religious conflict and public protests. Poblete-Cazenave (2020)
analyzes the effect of lockdowns on criminal activity in the state of Bihar, India, and finds that the lockdown decreases aggregate crime by 44%.

3.4 Firms, production networks, and international trades
The decline in demand caused by the COVID-19 shocks makes the survival of businesses, especially small and medium-sized businesses, significantly more challenging. The negative shocks are possibly further amplified through domestic and international production networks.

3.4.1 Firms facing COVID-19 shocks
In the early stage of the pandemic, Chetty et al. (2020) use transaction data for small and medium-sized businesses in the USA to show that the decline in consumption associated with the spread of COVID-19 had a significant negative impact on the continuation of small and medium-sized businesses and the employment of their employees.

There are a couple of studies that document the effects of COVID-19 shocks on firms in Japan during the pandemic. Kawaguchi et al. (2020) use differences in the timing of self-restraint requests by prefectures to show that the declaration of a state of emergency and the accompanying requests for self-restraint reduced the expectations of small business owners for the survival of their businesses. Miyakawa et al. (2021) similarly use data from Japan to show that the reduction in people’s mobility associated with the spread of COVID-19 increased firms’ exits by 20%.

In addition, a couple of studies from Japan confirm that firms are changing their behavior to adjust to COVID-19 shocks. Honda and Uesugi (2021), using quarterly data on publicly traded firms in Japan, find that the COVID-19 crisis has had a substantial impact on corporate cash management strategies and the results are consistent with the precautionary motive theory for cash holdings. Yamori and Aizawa (2021) investigate credit guarantee trends in relation to the first wave of the COVID-19 crisis and find that the spread of COVID-19 led to an increased use of credit guarantees. In terms of individual business types, there was a particularly marked rise in the usage of credit guarantees by companies in the restaurant industry, which has been catastrophically affected by the pandemic.

3.4.2 Production networks
The recent advances in the production network literature are useful to understand the spread of COVID-19 economic shocks across firms. Baqaee and Farhi (2020) provide a neo-classical model of non-linear production networks and show how non-linearities associated with complementarities in consumption and production amplify the effect of negative supply and demand shocks. Their quantitative results suggest that non-linearities may amplify the impact of the COVID-19 shock by between 20% and 100%, depending on the horizon of the analysis and the size of the underlying shocks.
There are a couple of empirical studies in Japan in the context of production networks. Inoue and Todo (2020) simulate an agent-based model to the actual supply chains of nearly 1.6 million firms in Japan and find that, when Tokyo is locked down for a month, the indirect effect on other regions, through production networks, would be twice as large as the direct effect on Tokyo, leading to a loss of 5.3% of its annual GDP. Inoue et al. (2020) further investigate this network effect by studying the role of upstreams and loops by decomposing supply-chain flows into potential and circular flow components.

In a somewhat different context, Murakami et al. (2020) explore the potential impacts of the COVID-19 pandemic on the welfare of remittance-dependent households using a dataset collected in heavily remittance-dependent regions in the Philippines prior to the outbreak. This study shows that people’s networks through family relationships could be a passthrough of economic shocks.

### 3.4.3 International trade

International trade is the channel that possibly spread COVID-19 shocks across firms in different regions. In the early stage of the pandemic, Baldwin and Tomiura (2020) summarize the possible negative impacts of COVID-19 on the world economy through the international trade system.

Hayakawa and Mukunoki (2021) use monthly data on worldwide trade from January to August in 2019 and 2020 and estimate the gravity equation by employing various variables as a proxy for the COVID-19 damage. They find significant negative effects of COVID-19 on the international trade of both exporting and importing countries. They also find heterogeneous effects across industries; negative effects on non-essential, durable products persist for a long time, whereas positive effects in industries providing medical products were observed.

In Asian countries, Friedt and Zhang (2020) investigate three different channels that affect Chinese exports: the domestic supply shock; the international demand shock; and the effects of the global value chain (GVC) contagion. They find that Chinese exports declined in response to the coronavirus outbreaks mainly through the impact of GVC contagion.

The COVID-19 economic shocks can also be spread through multi-national firms. Zhang (2021) uses aggregate-level data on Japanese multinational corporations in major host countries and regions and finds that lockdown and containment policies in host countries had large negative impacts on the sales and employment of Japanese multinational corporations.

### 4. The Economic Policy Response to COVID-19 Shocks

In response to the sheer magnitude of COVID-19 shocks, countries are implementing a variety of policy responses. These policy responses include (i) employment subsidies, (ii) extension/increase in unemployment benefits, (iii) increase in welfare payments/
coverage, (iv) unconditional/conditional cash transfers to workers/households, and (v) subsidies/loan-guarantees to (small) firms.

4.1 Theoretical backgrounds

4.1.1 The optimal policy response to supply shocks

Guerrieri et al. (2020) is one of the earlier papers that provides a theoretical framework to understand supply shocks in a multi-sector New-Keynesian model. They argue that the standard fiscal stimulus can be less effective than usual because the fact that some sectors are shut down mutes the Keynesian multiplier feedback. The optimal policy in their framework is closing down contact-intensive sectors and providing full insurance payments to affected workers, which can achieve the first-best allocation, despite the lower per-dollar potency of fiscal policy.

4.1.2 Lockdown and fiscal policies

Since non-pharmaceutical interventions are one of the sources of the supply shocks, there is an optimal combination of containment and fiscal policies. Kaplan et al. (2020) explore this path by using a SIR-macro model with occupational and sectoral heterogeneity. They evaluate the USA fiscal policy response implemented in the Spring of 2020 (CARES Act) and find that it succeeded in mitigating economic welfare losses by around 20% on average while leaving the cumulative death count effectively unchanged. They also find that the stimulus package made the economic consequences of the pandemic more unequal. This is because middle-income households gained little from the stimulus package but will face a higher future tax burden.

4.1.3 Employment subsidies or unemployment insurance?

There was a debate about whether the government should rely on, employment subsidies or unemployment insurance, in order to mitigate COVID-19 shocks to labor markets. Noting that the shocks caused by the current recession are temporary, Fujita et al. (2020) propose that employment subsidy policies should be used to maintain the employment relationship between firms and workers and to avoid losing the firm-specific human capital in the economy. On the contrary, if the shocks to specific occupations are prolonged or permanent, excessive employment subsidies may prevent workers from moving across occupations, leading to misallocation in labor markets. In fact, Giupponi and Landais (2018) use data from Italy to show that employment subsidies prevent workers from reallocating when shocks are prolonged.

4.2 Economic policy responses in Asian countries

Responding to COVID-19 shocks, the governments in Asian countries greatly increased their fiscal expenditures. On the other hand, the amount of fiscal expenditures varies across countries.
4.2.1 Variations in the fiscal responses in Asian countries

Figure 3 shows the amount of (i) (general) fiscal expenditures, (ii) health expenditures, and (iii) liquidity support to firms, relative to GDP, for each country. As this figure indicates, there is a great extent of variations across countries: Developed countries seem to spend more, and developing/emerging countries spend less. These variations potentially widen the inequality in the world, because those in poor countries are not likely to be supported by their government even if they are hit by COVID-19 shocks.

So, what are the determinants of the fiscal responses of governments? Balajee et al. (2020) study the fiscal response of governments around the world including Asian countries and its main determinants. They find that a country’s sovereign credit rating is one of the most critical factors determining its choices. Thus, living in a wealthier country that has a higher credit rating indeed helps the residents to ensure against COVID-19 shocks. By integrating a standard epidemiology model into a sovereign default model, Arellano et al. (2020) study how default risk impacts on the ability of these countries to respond to the epidemic. They find that the possibility of lockdown-induced debt crises, in turn, results in less aggressive lockdowns and a more severe health crisis. They argue that the social value of debt relief can be substantial because it can prevent the debt crisis and can save lives.
4.2.2 Evaluations of economic policies

There are still only a few papers for Asia that evaluate the effectiveness of the government’s policies during the pandemic. Kubota et al. (2020) is one of the few studies that documents households’ spending responses to a stimulus payment in Japan during the COVID-19 pandemic. The Japanese government launched a universal cash entitlement program offering a sizable lump sum of money to all residents to alleviate the financial burden of the pandemic on households. Using a unique panel of 2.8 million bank accounts, Kubota et al. (2020) find an immediate jump in spending during the week of payments, followed by moderately elevated levels of spending that persist for more than a month.\(^\text{12}\)

Kim and Lee (2020) analyze a South Korean program, which provided vouchers redeemable only at small local businesses, and find that, due to the program, over 30% of households across all income groups increased their food and overall household spending, but the usage restriction may have affected consumer choice as well as competition among businesses. They argue that, while the employment and sales of small businesses improved, the program’s fiscal sustainability is in question because of the large tax exemption.

Hoseini and Beck (2020) use monthly and daily transaction data from Iran to gauge the impact of government emergency loans on consumption patterns. They find that emergency loans are positively related to higher consumption of non-durable and semi-durable goods, suggesting that the emergency loans were predominantly used for their intended purpose.

In Japan, Kawaguchi et al. (2020) have been studying the impact of sustainability benefits and employment adjustment subsidies on the business survival expectations of small and medium firms. Hoshi et al. (2021c) conducted a firm-level survey, and show that firms that had low credit scores before the COVID-19 pandemic were more likely to apply for the government’s employment subsidy program. They discuss the possibilities of “zombification” of post-COVID-19 economies due to massive business support programs in developed countries, which cause a misallocation of capital and labor.

5. Conclusion

In this paper, we study the economic impacts of SARS, MERS, and COVID-19 that Asian countries have experienced, based on the existing literature. We find that non-pharmaceutical interventions and people’s fear of infections have played an important role during the COVID-19 pandemic, which have generated significant impacts on Asian economies. We also find that many Asian countries have significantly increased their fiscal expenditures during the pandemic. Some of them potentially have been effective in mitigating the effect of the COVID-19 shocks. Evaluations of the economic policies implemented in Asian countries during the pandemic are still left for future work.
Notes

1 Miyawaki and Tsugawa (2022) review the impacts of COVID-19 on population health in Asian countries. They address several important questions such as why the East and Southeast Asian countries have had a relatively lower number of cases of infections and death than the west.

2 These studies use data from the early stage of the COVID-19 pandemic to examine the supply and demand shocks. However, in the later stage of the pandemic, the identification of the two types of shocks would become harder as they could be potentially mixed and even amplify one another. Guerrieri et al. (2020) show that in a model with two goods, a negative supply shock has an impact on the economy analogous to a negative demand shock when the two goods are complementary.

3 Similarly, in South Korea, Kim et al. (2020) use monthly credit card data at the level of metropolitan cities and provinces to study changes in consumption patterns following the outbreak of COVID-19.

4 Kumar and Nataraj (2020) show that after the imposition of the national government’s lockdown policy, time spent at home increased significantly in India. Watanabe and Yabu (2020) show that, in Japan, the government’s announcements reinforced awareness and that people voluntarily refrained from going out.

5 Using panel data on 152 countries, Goldstein et al. (2021) find that lockdowns tend to significantly reduce the spread of the virus and the number of related deaths. Ghosh (2020) documents similar evidence using Indian data.

6 Atkeson (2020) is probably the first paper to use a SIR-type model to analyze the economic losses after a new coronavirus outbreak. Other studies that use SIR models to analyze economic losses include Alvarez et al. (2020) and Hall et al. (2020).

7 Other studies that have used the SIR-macro model include Krueger et al. (2020), Jones et al. (2020), Aum et al. (2021), and Kaplan et al. (2020).

8 See Berger et al. (2020), Brotherhood et al. (2020), and Eichenbaum et al. (2020b) for example.

9 The task approach was established in the field of labor economics by Autor et al. (2003).

10 The result in Figure 2 is almost the same even if we use current prices to convert GDPs to the US dollar.

11 Saltiel (2020) extends Dingel and Neiman’s (2020) analysis to cover more developing countries. In their study, Armenia, China, Georgia, Laos, and Vietnam are included from Asia.

12 Kaneda et al. (2021) use the data of personal finance management software and estimate households’ spending responses to a stimulus payment in Japan during the COVID-19 pandemic.

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