COVID-19 in Korea: Success Based on Past Failure*

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Abstract

This paper analyzes how the Republic of Korea (Korea) halted the massive transmission of COVID-19 in just two months. The quarantine was achieved successfully without any need for a national lockdown because, simply, Korean citizens actively followed quarantine guidelines. During the 2015 Middle East Respiratory Syndrome (MERS) outbreak, the country recognized the importance of an early response in the form of a systematic approach and adopted the necessary procedures. Comparing the spread of COVID-19 among different countries, Korea demonstrated several distinct characteristics. First, the duration of the coronavirus crisis was relatively short, and Korea was able to flatten the coronavirus curve in a brief period. Second, Korea blocked expanded transmission of the virus without implementing a national lockdown. Third, the coronavirus pandemic did not lead to economic panic. Korea, which had developed an institutional response to infectious diseases prior to COVID-19, used a strategy of balancing quarantine measures with economic policies. The paper summarizes the specific measures Korea implemented to overcome COVID-19, and discusses the sustainability of the economy after overcoming the virus.

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1. Introduction

As of 6 August 2020, the number of COVID-19 cases and deaths in Korea were 14,499 and 302, respectively. One can recognize Korea's successful response to COVID-19 by comparing its performance with those of OECD members with similar population sizes, such as the United Kingdom, France, Spain, and Italy (Table 1). Korea's mortality ratio per capita (per population size) does not even reach one-tenth of those of European countries. The country was able to drastically reduce its cases and flatten the coronavirus curve just two months after the first case was identified. Korea, originally viewed as the second most vulnerable country to the virus after China, has become an exemplary case in battling the coronavirus outbreak.

Korea suffered about 900 daily cases during its worst spike. As Korea's daily case count dropped to just one digit by mid-April, 58 days after the nation's first case, the Korean government decided to shift from strong social distancing to an "everyday life quarantine" (ELQ) system,[1] considering the adverse effects on the national economy. The government was convinced that despite the possibility of community transmission from certain institutes or gatherings, the Korean medical system could cope sufficiently. While maintaining measures such as wearing face masks, Koreans returned to their daily lives except for attendance at sports stadiums, concert halls, universities, large bars, and other "high-risk" facilities. Although this may be the authors' subjective judgment, nearly 95 percent of the country's economic activities before COVID-19 have been recovered.

As Korea reduced the possibility of infection through large-scale testing, contact tracing, and mandated self-isolation in the early phase of the outbreak, the country was able to manage the transmission of COVID-19 more rapidly than other countries (WHO 2020; OECD 2020b). The 3T (tracing, testing, and treating) strategy has been the key to Korea's success in the fight against COVID-19. Although it may sound easy to accept, 3T is difficult to implement in practice, which is why many countries have chosen national lockdowns and border closures instead.

COVID-19 testing requires testing kits, medical devices, and a professional labor force; to detect someone who is exposed to the virus, a legal and technical system that can collect necessary information is essential. To isolate confirmed cases and treat patients in intensive care units, negative pressure rooms and safe facilities are needed. Korea already had most of the fundamental infrastructure necessary to implement 3T, due to the country's failure to properly deal with MERS in 2015. As such, Korea's case shows the importance of an early phase response, a legal system for collecting and sharing information, and the public's voluntary cooperation.

1 This allows people to return to their daily lives and routines under less restrictive guidelines.

Table 1. Statistics on COVID-19 for selected countries (unit: cases)

	Korea	France	Italy	Spain	UK
Cases – cumulative total	14,499	180,037	248,419	302,814	306,297
New cases in last 24 hours	43	965	190	1,178	670
Death – cumulative total	302	30,176	35,171	28,498	46,299
Death in last 24 hours	0	1	5	0	89

Source: *WHO Coronavirus Disease (COVID-19) Dashboard (6 August 2020).*

Korea has effectively dealt with COVID-19 transmission in terms of hardware and software. Moreover, Koreans have confidence in their government to make reasonable decisions, as evidenced by their cooperation with government guidelines. Although Korea experienced its worst outbreaks during February and March, the country did not implement sweeping lockdowns like other countries. Instead, the Korean government appealed to the public to participate in a more intense round of social distancing. By doing so, economic activities were sapped, but Korea never enforced a complete halt on its economic ecosystem.

Section 2 of this paper presents the trends in COVID-19 cases in Korea, and Section 3 summarizes how Korea contained COVID-19. In particular, we discuss Korea's failure to respond to MERS in 2015, after which it developed its present legal and technical system to fight contagious diseases efficiently. Section 4 discusses the effects of COVID-19 on the Korean economy and outlines the economic risks the country faces. A brief conclusion follows in Section 5.

2. COVID-19 in Korea: Overall trends and evaluation

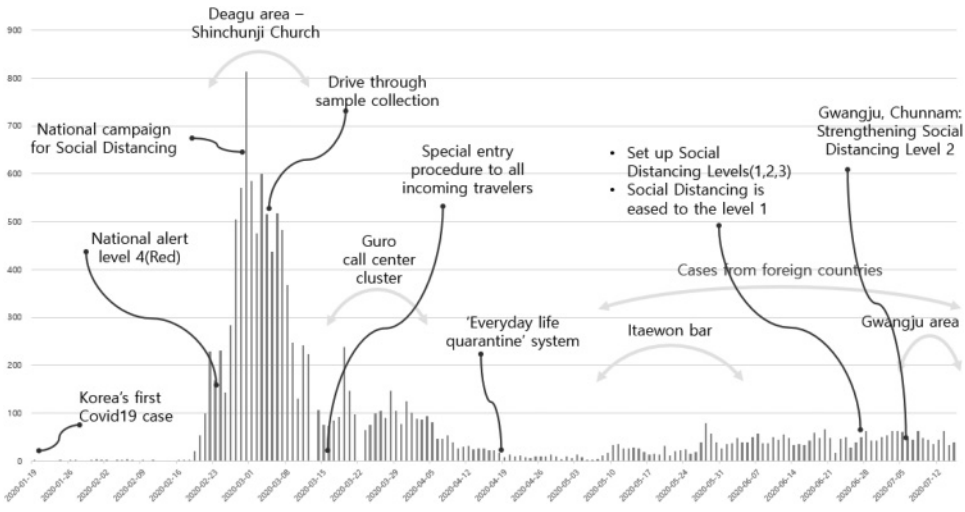
2.1 An exemplary response to COVID-19 in two months

It was assumed that Korea would be in danger of having the second most coronavirus cases after China.[2] Indeed, the number of cases that occurred since the nation's first case on 20 January drastically increased, skyrocketing to hundreds of daily cases after a huge community transmission at Shincheonji Church of Jesus (a cult group according to the government).[3] Most countries around the world stopped permitting flights from Korea in early March. As large-scale testing and management of confirmed cases were fully implemented, transmission began to weaken in mid-March. Although the total number of cases reached 10,000 by 3 April, the number of daily cases soon dropped to below 50, leading the infection curve to form an inflection point and plateau (Figure 1). Further, as the number of recoveries from confirmed cases increased, the pressure on the nation's medical system was largely reduced.

2 Regarding this, refer to Ferrier, Kyle. 2020. Coronavirus Now Poised for Outsized Impact in Korea. *The Diplomat*. Available at https://thediplomat.com/2020/02/coronavirus-now-poised-for-outsized-impact-in-south-korea/. Accessed 30 April 2020.

3 The government of Korea describes it as a cult with 200,000 followers.

Figure 1. The trend in COVID-19 cases and major measures in Korea



Source: *Authors' drawing based on the WHO COVID-19 database, various sources for Korea's responses to COVID-19.*

In addition to a plateau in its successful early phase, Korea has also recorded the lowest COVID-19 mortality rate in the world. As of 15 July, the number of worldwide COVID-19 cases was 13,465,440, and the total number of deaths was 581,405. The total average number of cases and deaths per 1 million people of the worldwide population were 1,727 and 74.6, respectively. For Korea, cases and deaths per 1 million people were 264 and 6, respectively (COVID-19 Statistics of the WorldMeter). The percentage of Korea's confirmed cases per 1 million people was as low as 15 percent of the global average and its mortality rate was 8 percent of the world's average. With regard to this, the BBC (Bicker 2020) reported on 12 March that the death rate for coronavirus in Korea was much lower than world average. Overall, Korea has responded to COVID-19 well. Specifically, the country's classification of patients, distribution of medical devices, and superiority of its medical system have greatly reduced the number of fatalities. As 80 percent of COVID-19 deaths can be attributed to elderly people aged over 70 years with chronic diseases, high risk groups were prioritized for admittance to intensive care first. This rule was set in the early days of COVID-19 spread.

The rest of the world was watching. There were significant news stories from around the world calling Korea a success story in battling COVID-19. Korea's 3T system was heralded and other countries began implementing it soon thereafter (Bicker 2020; McCurry 2020; Zastrow 2020).

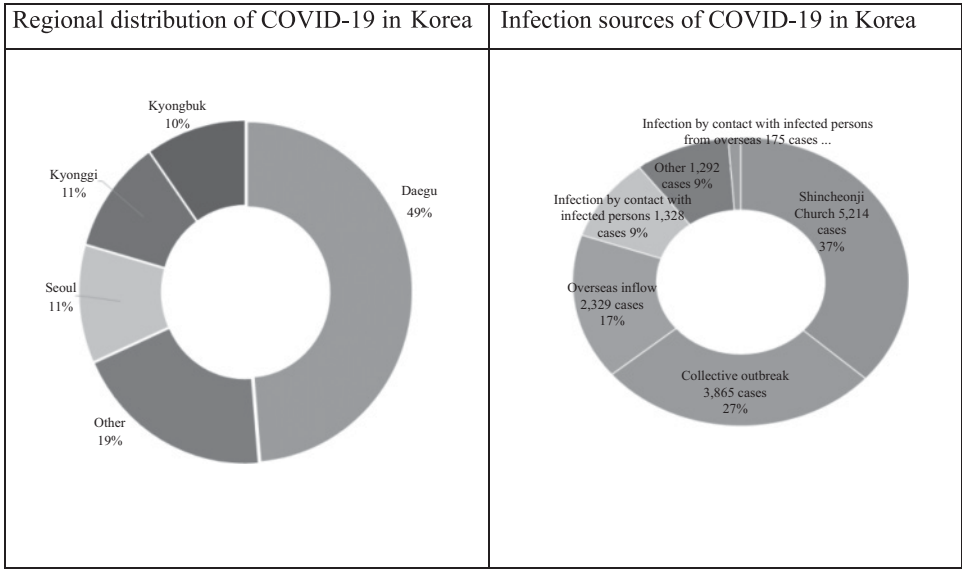
2.2 Massive community transmission of Shincheonji Church

A person of Chinese nationality who flew from Wuhan, China, became the first positive COVID-19 case in Korea on 20 January. Until mid-February, only one to two people who had previously visited China were testing positive per day, ultimately reaching 30 confirmed cases in a month after the first case. At that time, most confirmed cases had occurred in Seoul and its nearby cities, with no cases found in Daegu City or Gyeongbuk Province (shortened as Daegu area). However, things drastically changed as the country's 31st confirmed case surfaced in Daegu on 18 February. It was unclear how "Patient 31" became infected, and even with COVID-19 symptoms, she rejected doctors' advice to get tested. In addition, it was confirmed that she violated self-isolation rules by attending services at the Daegu branch of the Shincheonji Church of Jesus. Thus, the country's public health authorities initiated a close investigation in consideration of the possibility of community transmission. After determining that the Shincheonji Church had certain activities in Wuhan, China, before and after the outbreak in Wuhan, public health authorities quickly decided that quarantining the Daegu area was necessary.

Public health authorities had difficulty locating members of the Shincheonji Church, as worshipers were not cooperative due to their sect's secretive characteristics and propensity to congregate with thousands of worshippers in enclosed spaces. Once a lawsuit was filed against the Shincheonji Church for violating quarantine rules, the religious group started to cooperate, and a systematic investigation was initiated. The result was an outpouring of "clusters" of confirmed cases. From this, the originally reported number of 30 cases as of 18 February spiked to 1,000 in just eight days, and the number of deaths also increased over ten days. After two weeks, the number of cases reached 5,000. Although the numbers of cases in Iran, Italy, Spain, and the United States were also greatly increasing during this period, Korea had the second most cases after China, and at some point during this period, the number of cases per capita even reached the world's highest.

Even though the Shincheonji Church had branches across the nation, the Daegu branch of the Church, which was deeply associated with activities in Wuhan, reported most of the confirmed cases. For this, the government implemented strict social distancing rules for the Daegu area, which has a population of around 5 million. As new cases exploded in the region, the government pleaded with the public in Daegu to avoid visiting other regions as well as within the region unless urgently necessary. Moreover, the government raised the COVID-19 alert to the highest level and designated Daegu as a "special disaster zone" to facilitate the central government's budget and labor force more smoothly. At this level, public institutions were locked down and gatherings were prohibited. Civilians were encouraged to refrain from non-essential outings or activities but were not legally mandated to. However, citizens of Daegu actively participated in the government's guidelines to stop the transmission of COVID-19.

Figure 2. Regional distribution and infection sources of COVID-19 in Korea (29 July 2020)



Source: *Drawing based on the data by the Korea Center for Disease Control (KCDC).*

As 3T actively ensued for Shincheonji Church members, the workload borne by the health authorities and professionals was drastically increased. Volunteer health professionals across the country gathered in Daegu, and Korean doctors designed the now world-famous drive-through testing as well as walk-through testing centers. These new testing measures actively reduce the danger of health professionals getting infected and also groundbreakingly increase the speed of testing. Many countries, such as the United States and more, have adopted and been operating this testing method in their own countries. On 3 March, public health authorities completed testing Shincheonji Church members with symptoms among a total of 194,000 Church members that had their identities verified. The rate of confirmed cases among the Shincheonji Church members was 62 percent, which was 36 times higher than the rate in other regions (1.7 percent). As of 29 July, the regional ratio for confirmed cases in Daegu area constituted 49 percent (cumulative) of Korea as a whole, and the ratio of infection routes for the Shincheonji Church was 37 percent (Figure 2).

Korea's model for fighting COVID-19 would not have been successful if such immediate investigation and coronavirus testing of the Shincheonji Church members in Daegu did not take place. Within one month, the Daegu area had over 8,000 confirmed cases. As a

result, Korea faced arduous times as medical facilities were strained, leading to the death of a patient who was waiting to be hospitalized. In the early phase of the outbreak, Korean hospitals were able to fully hospitalize all patients infected with COVID-19. However, as cases surged in the Daegu area near the end of February, the medical system was brought to the brink of collapse due to the lack of negative pressure rooms and ventilators. Still, hospitals were able to offer free treatment for all patients. Free treatment was made available in Korea so that low-income groups would not avoid testing due to the pressure of medical costs and end up becoming a source of transmission.

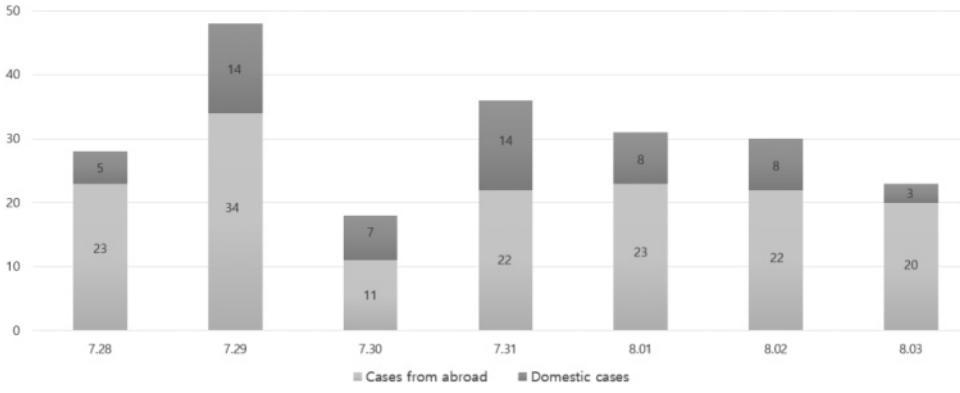
On 1 March, public health authorities comprehensively modified guidelines on hospitalization to minimize the number of fatalities, with hospitalization priority based on age, illness, and health conditions. Patients were classified into four stages (mild, moderate, serious, and extremely serious). The health professionals and authorities hospitalized urgent patients first, which was a major factor in lowering the number of deaths. In this way, Korea was able to maintain its COVID-19 death rate to be the world's lowest.

2.3 Present situation: "Everyday life quarantine" persists

The number of COVID-19 cases in Korea drastically surged during the months of February and March but was largely reduced by April and May. Nevertheless, growth trends returned in June and July. From the end of February to the beginning of April when the number of cases surged, Korea's Center for Disease Control (KCDC) announced guidelines for people to work from home. Further, KCDC requested the public to reduce non-essential outings and to wear masks when going outside. There was no national lockdown but only a request to avoid outdoor activities to stop transmission. On 18 April, two months after the initial outbreak, the Korean government made the decision to shift to the ELQ policy to minimize the economic losses caused by the pandemic. As of 3 August, the cumulative number of confirmed patients was 14,389, of which 13,280 were cured, and 808 patients were being treated (or quarantined). The number of newly confirmed cases established the previous day was 23, and 20 of them involved foreigners who had been infected with COVID-19 from abroad and then entered Korea.

Korea has continuously allowed foreign entry under certain conditions, except during a brief period when the number of cases within Korea surged. With its huge dependence on trade, Korea remains severely concerned with other countries' decisions to ban entry due to the virus. Korea is a country that has implemented the most passive entry regulations in the world; in the early phase of transmission, the country banned entry from Wuhan and intensified its management of foreign entry, but never completely blocked foreign entry as many other countries have. Even the entry ban on those entering from China was rescinded after a short while under certain conditions. Since 1 April, all people entering Korea have been required to self-isolate for two weeks, regardless of their departure points

Figure 3. Recent trend in COVID-19 cases in Korea



Source: *COVID-19 data (4 August 2020).*

and nationalities. Recently, the Korean government has required those who enter from "high-risk" countries to have polymerase chain reaction (PCR) test certificates, in addition to undergoing the two-week self-isolation. In July, Korea introduced a procedure for business travelers from China to be exempted from the quarantine requirement and is in the process of discussing similar procedures with Indonesia.

By the end of July, Korea's number of newly confirmed cases ranged from about 18–48 daily, and more cases were found among those who entered the country from abroad than among domestic residents. To make sure that overseas entrants do not leave their homes or quarantine facilities without permission, public officials would randomly check on them twice a day, and information and communication technology (ICT) has been adopted as well. Those who leave the quarantine area without permission are legally charged without exception based on the guidelines for disease prevention; perpetrators are also subject to fines or imprisonment, and foreign nationals face deportation.

The ELQ policy is a measure that minimizes restraints on economic activities with the condition of wearing face masks and social distancing. Considering that COVID-19 has not been exterminated, transmission of the disease will inevitably increase when contact between people is more frequent. Despite the fear of small-group transmission, the ELQ system was viewed as unavoidable considering continuing economic losses. There were some incidents of small-group transmissions at bars, call centers, e-commerce businesses, and tutoring institutes, and partial measures to curtail transmissions were taken for essential places. For this, the government has requested the public's cooperation, and additional measures at the national level have been implemented. As the number of cases in the

Gwangju area increased in July, measures to strengthen social distancing at the regional level have been undertaken but are ready to be eased if cases go down.[4]

As COVID-19 cases are continuing to occur in many regions (albeit in small groups) and the number of overseas entrants keeps increasing, it is questionable whether ELQ can persist. There are also prospects of a second wave of COVID-19 in the fall and winter. Public health authorities believe that another enormous outbreak of COVID-19, such as the Shincheonji Church outbreak in Daegu, is highly unlikely, and that even if the number of cases starts to increase, the already-established infrastructure would be able to deal with the problem. On 16 July, six months after the initial outbreak, JunWok Kwon, head of the National Health Institute, told a media briefing that "ending COVID-19 is only a wishful expectation and only through social distancing, wearing masks, and personal hygiene can we restrain and manage the scale of virus cases."[5]

3. Previous experience and early stage planning

Although generally 3T has been emphasized to have played the most critical role in overcoming COVID-19, the national response in the pandemic's early phase as well as the public's cooperation in combatting COVID-19 were vital factors. Korea had learned from its MERS outbreak in 2015 that stopping the transmission of COVID-19 in the early stage is crucial.

3.1 Traumatic failure experience with MERS and follow-up actions

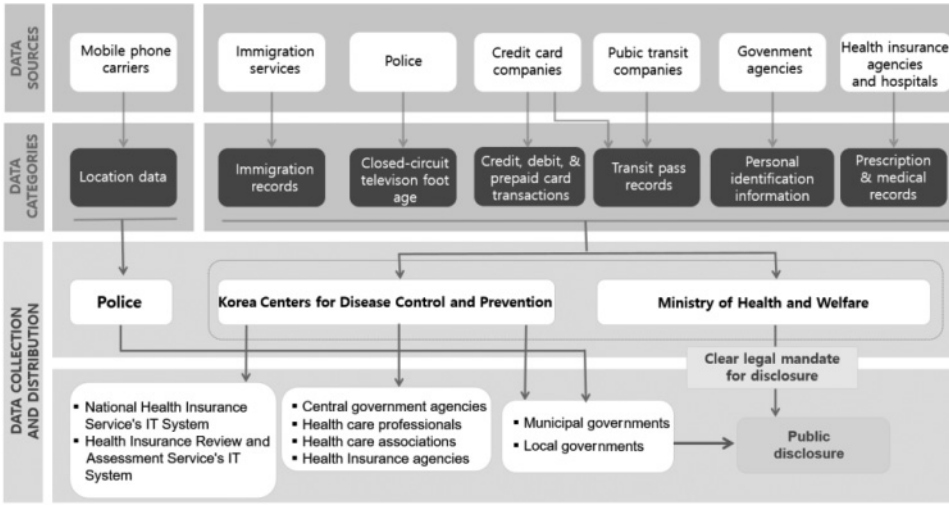
MERS was introduced in Korea when the first infected passenger flew from Bahrain on 20 May 2015. Not long after, Korea became the country with the second highest number of MERS cases after Saudi Arabia, where the virus was first reported. After the first reported case in Korea, 36 people died in two months, and 186 people were infected. At its peak, overseas tourists in Korea decreased to about half from the previous year. The economic effect on production due to the MERS outbreak was estimated to be roughly US$ 8.7 billion in terms of loss (Kim et al. 2017). Although this is no match for the losses caused by COVID-19, it was a considerable shock at the time.

The absence of an early phase response, the suppression of information disclosure, and a facile quarantine system were determined to be the major reasons behind the rapid spread of MERS in Korea. In particular, failing to disclose information when cases were in the

4 A similar situation occurred in mid-August in Seoul and nearby areas, and the quarantine authorities partially reinforced social distancing.

5 Park, Jinwoo. 2020. [Half Year With COVID-19] Repetition of Trend and Dormancy. . . The Completely Changed Daily Lives "it is not over until it is over." *ChosunBiz*. Available at https://biz.chosun.com/site/data/html_dir/2020/07/16/2020071601945.html?utm_source=naver&utm_medium=original&utm_campaign=biz. Accessed 3 August 2020.

Figure 4. The system of virus contact tracing in Korea



Source: *Park et al. (2020).*

early phase caused rapid spread, ultimately leading to a situation in which citizens were unprepared. The problems of a weak government response and social trust issues were recognized as well.[6] MERS offered an invaluable lesson in terms of emergency response not only for individual hospitals but also the nation's public health system. In the early phase, the government must have been aware of MERS, but because no legitimate system for information sharing existed at the time, public health authorities might have thought that the disease could be quietly eradicated on its own several months later.

After eradicating MERS, Korea modified its laws to not repeat the same mistake: the government made release of information mandatory by revising the Contagious Disease Prevention and Control Act (CDPCA) and granted the Ministry of Health and Welfare (MOHW) the right to trace and manage individuals with a disease, as summarized by Figure 4. "Under the current CDPCA, public agencies including the MOHW and KCDC can, at the outbreak of a serious infectious disease, collect, profile, and share seven categories of data for virus contact tracing—the CDPCA was given authority to override certain provisions of the Personal Information Protection Act and other privacy laws" (Park et al. 2020). An academic conference hosted by Seoul National University on 29 May revealed that "the

6 Lee, Sangyi. 2015. [Opinion] The Essence of the MERS Outbreak. *Kyunghyang Sinmun*. Available at http://news.khan.co.kr/kh_news/khan_art_view.html?artid=201506112118575#csidx3f6502f24985c28bfb358e4debad122. Accessed 26 March 2020.

most systematic white paper, which is approximately 1,000 pages, on the terrible failure in managing MERS in Korean history was created, and the benefits from it are relished by the current administration."[7] This system has been efficiently operationalized for the prevention of COVID-19 transmission and eventually led to the stoppage of any large-scale infections in roughly 20 days.

3.2 Public's voluntary participation

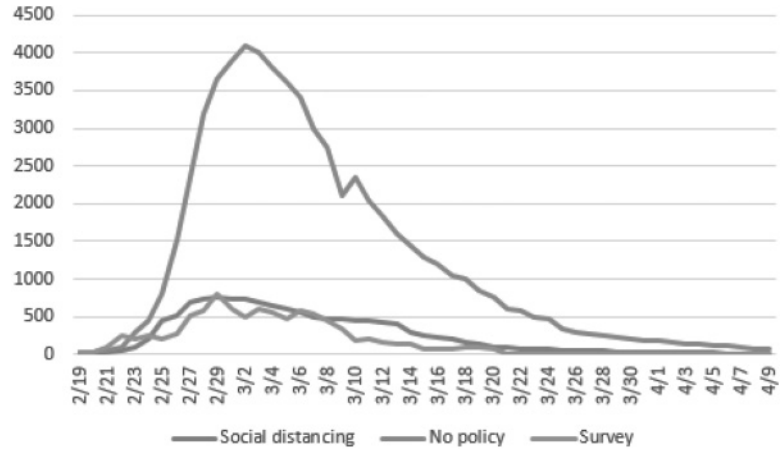
In Korea during winter, people tend to wear masks to keep warm, and patients with flu or cough are also encouraged to wear masks. During the MERS outbreak, numerous cases occurred from simply not wearing masks, and this became a lesson in the importance of mask-wearing to prevent infectious diseases. Moreover, as fine dust pollution became more serious in the country, Koreans began to wear masks on a daily basis. Therefore, when the government required people to wear masks as a response to prevent transmission of COVID-19, Koreans were able to adjust easily. Protests or lawsuits against wearing masks in some countries such as the United States and some European countries are nowhere to be found in Korea.[8] Although it has become more burdensome to wear a mask due to the hotter weather in summer, Korea still obligates all people who use public transportation or public facilities (including companies) to wear a mask. Wearing a mask is understood as a fundamental way to avoid doing harm to others.

By implementing strict isolation rules on those with COVID-19 and/or who have been in contact with COVID-19, coercive restriction rules on public movement were not necessary. The lockdown measures that many countries have chosen to implement were simply not needed in Korea. Instead, the Korean government applied social distancing rules with different levels of intensity. In the early phase of the outbreak, the government enacted strict rules so that people did not gather as much and also emphasized a two-meter social distancing rule. The response consisted of three stages: When the country was experiencing a large spike in coronavirus, Stage 3 was implemented, then as the number of cases flattened out, the government implemented the Stage 1 ELQ system. Stage 1 is implemented when a small-scale trend sporadically goes through a repetition of expansion and relaxation at levels that the medical system can manage. Stage 2 is when COVID-19 continuously spreads in a region, going above the level that the medical system can manage. Stage 3 means a large-scale trend that rapidly spreads with numerous group infections within the region.

7 Kang, Jongmin. 2020. COVID-19 Response, a Lesson from the Terrible MERS Outbreak. *Newsis*. Available at https://newsis.com/view/?id=NISX20200529_0001041986&cID=10201&pID=10200. Accessed 11 August 2020.

8 When the Governor of Atlanta in the United States forced people to wear masks, some filed a lawsuit against it: Romo, Vanessa. 2020. Governor Drops Lawsuit Against Atlanta Mayor Over Masks, But Fight May Not Be Over. *National Public Radio*. Available at https://www.npr.org/sections/coronavirus-live-updates/2020/08/13/902347003/governor-drops-lawsuit-against-atlanta-mayor-over-masks-but-fight-may-not-be-ove. Accessed 12 October 2020.

Figure 5. Effectiveness of social distancing (*x*-axis: date, *y*-axis: newly confirmed cases)



Source: *Computation Science Research Center (2020), KIST.*

As COVID-19 spreads through contact, social distancing certainly helped to contain transmission. In March 2020, the Korea Institute of Science and Technology (KIST) used the Individual Simulation for Transfer Phenomena, its own modeling method, to conduct a big data simulation of the movement of around 50 million Koreans. The results showed that if social distancing measures had not been implemented in late February, the number of new cases daily would have soared to approximately 4,000 cases, which would be similar to Italy or Spain.[9] According to the study, restricting meetings to six to seven people a day would have the effect of reducing the rate of infection to approximately one-tenth of that when no measures are taken. Further, strict social distancing rules, such as limiting meetings to an average of two to three people a day, could reduce the rate of infection nearly by one-fifteenth (Figure 5).[10]

3.3 Korea's medical treatment and ICT infrastructure

UNESCO (2020) summarized Korea's approach to COVID-19 as "1) rigorously trace prospective cases, 2) test for free, and 3) treat everyone for free, regardless of nationality." Korea also established standards for hospitalization. High-risk groups such as elderly or critical patients were classified as a priority for intensive care units. Non-medical facilities

9 Ryu, Joonyoung. 2020. Korea, if No 'Social Distancing'. . . Likely to Have an Explosion of Cases Like Italy. *Money Today*. Available at https://news.mt.co.kr/mtview.php?no=2020033118335193172. Accessed 25 May 2020.

10 Donga Science. 2020. If Korea Didn't Take Social Distancing, It Would Have Become the Second Italy. First analysis result of KIST Supercom. Available at http://dongascience.donga.com/news/view/35628. Accessed 25 May 2020.

were made available for patients with less severe symptoms to avoid any shortage of hospital beds. Throughout this process, artificial intelligence (AI) and ICT were widely used.

To resolve the trend of confirmed cases comprehensively, ICT infrastructure including AI is a prerequisite. The legal right for Korean public health authorities to use ICT for this purpose is a differentiating factor from other countries. Of course, the efficiency of 3T is significant as well. The ability to identify individuals who have been infected with COVID-19, then to isolate them to prevent spread of the virus to others is the key to combating the virus. Although the issue of how to identify and diagnose infected persons remains important, a professional labor force of health specialists and the adequate procurement of testing kits are indispensable components. Korea was able to solve these issues within a short period.

Despite the nation's competence in those areas, the sudden increase in cases among Shincheonji Church members drove Korea's regional medical system to near breakdown. However, through drive-through testing, proper classification of patients, and the timely large-scale production of testing kits, Korea was able to conduct the highest number of tests daily worldwide.[11] Since roughly ten years ago, Korea has been investing in its biomedical industry. Some firms such as Celltrion have developed into global biomedical companies, and other firms with the capacity to manufacture medicine have developed COVID-19 testing kits and operated mass production systems. KogeneBiotech, founded in 2000, specializes in molecular diagnostic reagents and developed testing kits for COVID-19 by 4 February, only three weeks after the release of the COVID-19 genetic sequence (MOEF 2020). Consequently, the number of companies that produce testing kits has expanded to five. As these companies operate production systems that surpass Korea's domestic demand, they have begun exporting.

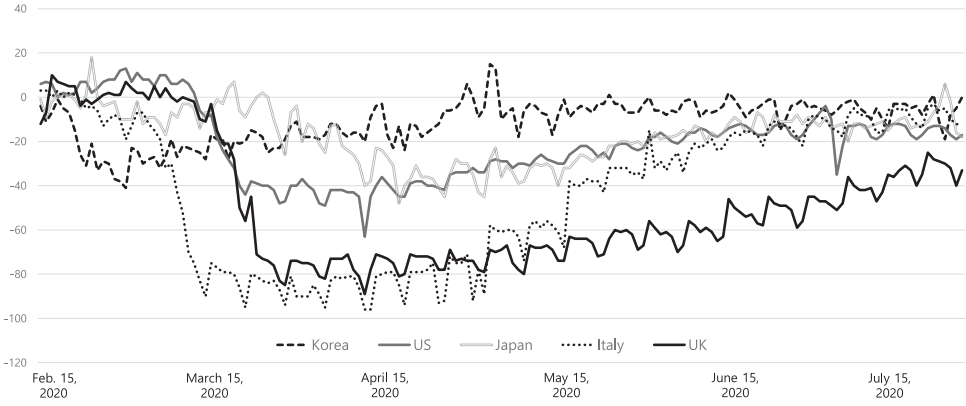
Korea was able to prevent the transmission of COVID-19 by using the nation's superior ICT and infrastructure (MOEF 2020) and is now widely distributing an English report titled "Flattening the Curve on COVID-19: How Korea Responded to a Pandemic Using ICT." The report states that the entire 3T process, the identification of cases and dangerous regions, and the prioritization of treatment decisions were all done through AI and ICT technology. For reference, Heilweil (2020) explained that AI and ICT could play critical roles in distinguishing confirmed cases in early phase.

4. Economic effects of COVID-19

Comparing the spread of COVID-19 by country, Korea displays several distinct characteristics. First, the duration of the COVID-19 crisis was relatively brief, and its curve was

11 "The Koreans continue to test on average 12,000 people per day, while as of 15 March, the United States had tested 22,714 people total" (Kim 2020).

Figure 6. The trend in population movement by country after COVID-19



Source: *Drawing based on data from Google (2020).*

Note: *This shows the rate of change in the volume of population mobility compared to one month prior to the outbreak of COVID-19. Population mobility means the number of cases in population mobility from retail and recreation facilities.*

flattened in a short period. Second, although Korea had the second most cases after China in February and early March, the country successfully blocked the transmission of the virus without a national lockdown. Third, the COVID-19 pandemic did not lead to economic panic. The OECD (2020a) predicted that private consumption in G7 countries would decrease by one-third due to lockdown measures, but this did not happen in Korea despite reduced consumption.

4.1 Population movements and economic activities after COVID-19

Google's COVID-19 community mobility data (Figure 6) shows the data for population mobility in retail and recreation facilities. Comparing the trends in population mobility in countries affected by COVID-19, Korea's volume of population mobility was sharply reduced about one month earlier than the United States, Japan, the United Kingdom, Italy, and so forth. However, the nation's volume of population mobility displayed a relatively rapid recovery soon thereafter. This is because Korea's sharp decline in population mobility compared to other countries was due to the massive infection at the Shincheonji Church in Daegu, as discussed in Section 2.

Population mobility in European countries, including Italy, Germany, France, and the United Kingdom, was largely reduced from March to May, and the rates of reduction in the United States and Japan were also much higher compared to Korea. Korea's population mobility sharply declined in the second week of February; for Italy, this occurred in the second week of March, which was about one month later than Korea; for the United States and Germany, the third week of March; for Japan, the fourth week of March. The reduction of

population mobility for those countries was delayed by about one month compared to Korea. However, the virus widely and silently spread in Japan, Europe, and the United States during this time.

Korea's preventive measures were concentrated in the Daegu area, where a massive group infection occurred, and nationwide countermeasures involved a voluntary quarantine system, including contact tracing, observation, compliance with preventive regulations, and self-isolation upon exposure. However, because other countries implemented systems mainly focused on a comprehensive lockdown of facilities and restricted mobility, their reductions in population mobility were much greater than Korea. For instance, in Italy, a national lockdown from March to April stopped population mobility by nearly 100 percent and paralyzed the national economy.

For Korea, due to difficulties in disinfecting facilities and procuring parts and supplies, the operation of factories was stopped temporarily, and restriction measures were implemented at large-scale facilities such as churches, concert halls, and sports stadiums. Due to the dwindling number of customers and safety concerns, many restaurants had to close in February and March, but most have reopened as of early April. At the time of writing, social life in Korea has normalized to the extent that even senior citizen centers were allowed to reopen on 3 August. Using a mask while maintaining social distancing is not an issue in Korea. Thus, the negative impact of COVID-19 on the Korean economy has been relatively lower compared with other countries. This can also be observed by examining the trend in population movement by country in Figure 6.

4.2 Effects on economic activity

The shrinking domestic economy due to COVID-19 has decreased aggregate demand (KDI 2020a,b; KIET 2020). The KDI (2020) predicted that consumption would be reduced due to the public's concerns over infection and also warned of an economic crisis and financial crunch. Based on this, the Korean government offered COVID-19 relief payments and induced expansion of consumption by alleviating quarantine guidelines. As shown in Figure 6, although the volume of population mobility sharply decreased in the early phase of the COVID-19 outbreak, the economy has been going through recovery, and economic activities have been revitalized. According to the "Report of Investigation in Prospects of Small and Medium-sized Enterprises (SMEs)" released by the Korea Federation of Small and Medium-sized Businesses (2020), after the Small Business Health Index (SBHI), which covers all industries, recorded its lowest point total last May, it gradually improved in June and July (Table 2). Despite the recovery of domestic sales to pre-pandemic levels, the reduction of exports due to the deterioration of foreign markets has led to poor performance of companies. In this sense, corporations' business outlook is unlikely to return to pre-pandemic levels for the time being, and the index of industry production faces difficulty as well.

Table 2. Prospects for business outlook of SMEs by month (SBHI)

Classification	July 2019 (A)	February 2020	March	April	May	June (B)	July (C)	Last month (C − B)	Year-on-year (C − A)
Business outlook for all industries SBHI	82.0	81.2	78.5	60.6	60.0	63.1	68.0	4.9	△14.0

Source: *Korea Federation of Small and Medium-sized Businesses (2020, 9).*

Table 3. Korean trend of industrial production index in first half-year of 2020

Month of 2020	January	February	March	April[p]	May[p]	June[p]
Index	−0.1	−3.4	−0.2	−2.9	−1.2	4.2

Source: *Statistics Korea (2020), "Industrial activity trends from January to June."*

Note: *"p" implies prediction.*

According to Statistics Korea (2020), the industrial production index—which had decreased consistently until May—was 68.3 percent in June, showing a 4.2 percent increase compared with the previous month (Table 3). Mainly driven by the Korean government's emergency COVID-19 relief support, such spending contributed to business revitalization in service sectors such as hotels, restaurants, wholesale and retail businesses, and more, whereas manufacturing production has been slower to recover.

The economic effects of COVID-19 have taken various forms, such as a shrinking domestic market, reductions in exports, restriction of supply networks, and more. For Korean companies with their high dependence on exports, other countries' reduction in demand is the most serious threat of COVID-19, rather than a contraction of the domestic market (Korea International Trade Association 2020; Business and Industry Advisory Committee [BIAC] 2020). The World Trade Organization (2020), analyzing the effects of COVID-19, has predicted that the size of global trade could be reduced by around 13 percent–32 percent compared to last year. According to a survey by BIAC (2020), almost all responders predicted that exports and corporate investments will decrease in the next 12 months, with 55 percent of responders predicting a steep reduction for exports especially.

Each country's reduction in exports due to the fall in global demand has consequently triggered further decline in trade and investment, ultimately leading to increases in tariff and non-tariff barriers, uncertainty toward policies and regulations, and persistent trade tensions as deleterious factors (BIAC 2020). However, the KIET (2020) assessed the contracting domestic market to be the biggest outcome of COVID-19, "setback in the supply network" as the second biggest one, and then reduction in exports as the third. The KDI (2020a) predicted that the stagnation of major industries such as automobiles, petroleum products, and semiconductors in the first quarter will continue. Korea's exports continue to face reduced foreign demand due to the effects of COVID-19. The value of the nation's exports in

June totaled US$ 39 billion, which was 10 percent lower than in June 2019, yet the rate of export reduction was reduced by half compared with the 20 percent reduction in exports in April and May.

Although the Korean economy has been undergoing gradual recovery from the effects of COVID-19, prospects remain bleak. This is because the Korean economy had already entered a recession prior to the outbreak of COVID-19. As it has become certain that pandemic shocks will continue to hit the economy hard, the Korean government, in an attempt to stymie the acceleration of an economic recession, has implemented an unprecedented amount of emergency fiscal spending and expanded the supply of financial liquidity.

Nevertheless, it remains difficult to overcome the negative effects of COVID-19. Korea's average 2020 economic growth rate according to 11 global investment institutions is −0.9 percent, and a recent OECD (2020b) report predicts −0.8 percent in case of one-time pandemic and −2.0 percent under the second one. The KERI (2020) was the first domestic research institution to make a prediction about the nation's growth rate and forecasted that the Korean economy would deteriorate with an economic growth rate of −2.3 percent in 2020. The IMF (2020) forecasted the growth rate of Korea this year to be −1.2 percent in April but lowered the rate to −2.1 percent in June.

4.3 Macroeconomic risks

4.3.1 Management of national debt and fiscal stability To respond to the economic downturn caused by COVID-19, the Korean government spent a total of 275 trillion won (US$ 231 billion) in addition to the existing budget in the first half of 2020 through a four-step support plan and three additional budgets. This is undoubtedly a huge amount, equivalent to 54 percent of the Korean government's 2020 budget of US$ 431 billion. There is certainly justification for the government's need for urgent fiscal expenditures, but there are questions about whether such expenditures are valid in situations where it is difficult to predict the multiplier effects of the fiscal expansion. Critics argue that the government's economic stimulus policy will not necessarily achieve the desired outcomes, as consumer sentiment has contracted due to the coronavirus crisis. Even more, there is the concern that such fiscal expansion could lead to an even worse economic crisis.

Until recently, Korea was characterized by better fiscal soundness than other OECD countries, but it recorded a large deficit this year. If COVID-19 is prolonged, the national debt-to-GDP ratio will skyrocket. According to the KERI (2020), the fiscal deficit/GDP ratio exceeds −3 percent and the national debt/GDP ratio exceeds 40 percent. The national debt ratio will increase to 38.1 percent by the end of 2020 (36.6 percent by the end of 2019), and is expected to reach 39.1 percent in 2021 if the government maintains the current trend of spending (Table 4).

Table 4. Trend and prospects for Korea's national debt

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2030	2040	2050
National debt (trillion won)	680.7	723.8	788.2	843.5	897.1	962.8	1,029	1,097	1,165	1,233	1,240	1,930	2,863
Share of GDP (%)	36.0	36.6	38.1	39.1	39.9	41.0	42.0	43.0	43.8	44.6	48.3	63.2	82.9

Source: *NABO (2018).*

For reference, the EU's fiscal rules are set at 20 percent, but Korea has settled at 40 percent considering the welfare and financial burdens of its aging population and the future costs of potential unification with North Korea. Most developed countries cover not only government-guaranteed debts but also public sector debts, which have occurred in lieu of state functions, in accordance with the IMF's Government Financial Statistics Manual. However, it has been pointed out that Korea only counts the direct debt of the country, and so its actual national debt is much higher.[12] A few years ago, the ratio of national debt (IMF standards, broad) exceeded 100 percent, but there was no active discussion of fiscal rules to reduce the national debt (KERI 2020). It is obvious that the fiscal crisis will be accelerated in Korea since the GDP growth rate is falling and the labor force is shrinking. Before worsening and exploding into a fiscal crisis as in Southern Europe or South America, expenditures must be subject to strict fiscal discipline linked with tax revenues. Because huge cash distribution during the COVID-19 crisis is likely to accelerate the fiscal crisis, it is necessary to introduce fiscal consolidation devices such as legislation to maintain a healthy fiscal status.

4.3.2 Stability of financial market It goes without saying that proper foreign exchange reserves play an important role in stabilizing exchange rates and the foreign currency fund market. Maintaining the current account surplus and foreign exchange reserves at stable levels through stable operation of the macroeconomy, in addition to establishing a global financial safety net such as signing currency swap agreements between central banks, establishing a regional safety net, and stabilizing capital inflow and outflows, is a way to prevent crises in advance. Korea has a bilateral currency swap agreement with eight countries and one multilateral currency swap agreement (CMIM), but it needs to expand these efforts to ensure financial stability. The U.S.–Korea currency swap was approved by the United States in March, when the international financial market was shaken by the pandemic, and was recently extended to one year, although it initially had a six-month term (Table 5).

In terms of foreign currency liquidity, it is necessary to expand the amount of foreign currency reserves in consideration of various factors, such as the size of foreign currency reserves in Korea, the amount of foreign investment funds that may be escaping, and the

12 Kim, Woojung. 2020. National Debt Ratio 40%, Higher than 100% According to the IMF Guideline. *Shin Dong-A*. Available at https://shindonga.donga.com/3/all/13/2074508/1. Accessed 29 May 2020.

Table 5. A summary of Korea's currency swap agreements

	Amount	Effective date	Maturity
Canada	Unlimited	2017.11.15	—
US	60 billion US dollar	2020.3.19	2021.3.19
Switzerland	10 billion Swiss franc	2018.2.20	2021.3.1
China	360 billion yuan	2017.10.11	2020.10.10
Australia	12 billion Australian dollar	2020.2.6	2023.2.5
Malaysia	15 billion ringgit	2020.2.3	2023.2.2
Indonesia	115 trillion rupiah	2020.3.6	2023.3.5
UAE	20 billion dirham	2020.4.13	2022.4.12
CMIM	38.4 billion US dollar		

Source: *Reports by various newspapers.*

Note: *CMIM = Chiang Mai Initiative Multilateralization.*

amount of daily imports for normal operation of the Korean economy. It is necessary to pursue measures to prevent foreign investment funds from leaking within a short period, seek ways to automatically extend the already signed U.S.–Korea currency swap, and negotiate a currency swap agreement with Japan as soon as possible. If COVID-19 is prolonged and the U.S.–China conflict intensifies, the instability of the global economy will continue. To avoid a foreign exchange crisis again, it is necessary to make every effort to manage the current account balance by securing foreign currency liquidity and stable operation of the macroeconomy. In addition, because the IMF has limitations in responding to the financial crisis, it is necessary to expand the regional financial safety net at the East Asian level.

4.3.3 Reforms on labor market The United States and Japan can expect that their governments' reshoring support policies will be effective for returning companies due to the scale of their domestic markets, but Korea's domestic business environment is not as favorable, thus their reshoring policy may not be as successful. In addition to high labor costs, many companies are finding it difficult to outsource their labor force due to strong unions and various regulations.

On the other hand, the reshoring of high-tech industries to Korea is promising. For its economy to create a new growth momentum, Korea must be transformed into a world-class high-tech industrial production base by reshoring and accepting global companies. The development of the digital industry, including big data, artificial intelligence, and high-speed communication, which is the basis of the non-contact, non-face-to-face industry, is essential, and digitalizing indirect social overhead capital is also important. In this regard, the "Digital New Deal" policy announced by the Korean government in July is timely, and many companies are expected to participate.

For the Korean New Deal policy to see results, it is necessary to reinforce the details of the Korean government's reshoring support policy and reform the labor market. It is necessary for Korea to promote its reshoring policy, but its tax benefits are weaker than in the United

States and Japan. Further, the excessive preconditions placed on companies to receive government support will make reshoring difficult. Moreover, businesses have pointed out that the minimum wage has increased by 32.8 percent in the past three years, which has made it difficult for companies to return to Korea. To fully achieve the effect of reshoring and the Digital New Deal policy, it is necessary to improve the investment environment, including labor flexibility, regulatory reform, and corporate tax reductions.

5. Conclusion

The reason why the containment of COVID-19 in Korean was successfully achieved without an economic blockade was thanks to Koreans actively following quarantine guidelines. During the 2015 MERS outbreak, the importance of an early response and systematic approach was recognized. All citizens realize that observing the government's quarantine guidelines is the shortest path to crisis resolution. Even after switching to the ELQ system in early May, quarantine measures have been largely adhered to.

Upon examining the spread of coronavirus in Korea since June, although domestic community infections in churches and shopping malls have certainly occurred, such as the outbreak of a group infection in Seoul and nearby cities in mid-August, the health care system has not been overwhelmed because the case numbers have remained low. However, the continued entry of COVID-19 patients into the country from abroad remains a problem. Although all entrants are tested at their country of departure and have no symptoms at time of entry, oftentimes a few of them have tested positive during their two weeks of quarantine. Korea is continuing to struggle with developing guidelines for the entry of foreigners. Korea, which has a high degree of trade dependence, wants to set the good example of allowing foreigners to enter the country, arguing that other countries should lift their travel restrictions under certain requirements.

Overcoming COVID-19 is the biggest policy challenge right now, and attention should be paid to the sustainability of the economy after overcoming the virus. Korea will definitely have to address economic problems such as its increasing national debt and the lack of foreign currency liquidity in the future. Recognizing this, the Korean government passed the Digital New Deal industrial policy in July, which plans to invest one-third of its annual budget. Although it is intended to create new growth engines and jobs through financial expenditure, it is a pity that there is no intention among policymakers to reform labor-related regulations, which have been massively criticized by global companies. A rigid labor market and excessive regulations will prevent the reshoring of Korean companies back home while further incentivizing companies to move abroad. In short, Korea has succeeded in combating COVID-19, but it has not been able to avoid the pitfalls of "financial addiction" and "large government."

References

Bicker, Laura. 2020. Coronavirus in South Korea: How "Trace, Test and Treat" May Be Saving Lives. *British Broadcasting Corporation (BBC).* Available at https://www.bbc.com/news/world-asia-51836898. Accessed 23 May 2020.

Business and Industry Advisory Committee (BIAC). 2020. Views from the Frontline. *Economic Policy Survey.* Paris: Business at OECD.

Google. 2020. COVID-19 Community Mobility Reports. Available at: google.com/covid19/mobility. Accessed 10 September 2020.

Heilweil, Rebecca. 2020. Scientists Are Identifying Potential Treatments for Coronavirus via Artificial Intelligence. Available at https://www.vox.com/recode/2020/2/7/21125959/artificial-intelligence-coronavirus-benevolent-ai-treatment. Last accessed January 2021.

IMF. 2020. IMF Managing Director Kristalina Georgievaa Statement Following a G20 Ministerial Call on the Coronavirus Emergency. Press Release No. 20/98, 23 March 2020. Washington, DC: International Monetary Fund.

KDI. 2020a. *KDI Monthly Economic Trends.* July 2020. Sejong: Korea Development Institute.

KDI. 2020b. *KDI Economic Outlook.* Vol. *37* No. 1. Sejong: Korea Development Institute.

KIET. 2020. COVID-19's Impact on the Domestic Industry. *KIET Industrial Economic Review*. April 2020. Sejong: Korea Institute for Industrial Economics & Trade.

Kim, Hani. 2020. The sociopolitical context of the COVID-19 response in South Korea. *BMJ Global Health 5*(5):e002714.

Kim, K. H., T. E. Tandi, J. W.Choi, J. M. Moon, and M. S. Kim. 2017. Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Outbreak in South Korea, 2015: Epidemiology, Characteristics and Public Health Implications. *Journal of Hospital Infection 95*(2):207–213.

Korea Economic Research Institute (KERI). 2020. Fiscal Rules Should Be Set In Order To Suppress Rising National Debt. *Press Briefing,* 29 July 2020. Seoul: Korea Economic Research Institute.

Korea Federation of Small and Medium-sized Businesses. 2020. *SME Economic Survey,* June. Seoul: Korea Federation of Small and Medium-sized Businesses.

Korea International Trade Association (KITA). 2020. Korea's Response To The Reorganization Of Global Supply Chain. *Trade Focus 28*. Seoul: KITA.

McCurry, Justin. 2020. Test, Trace, Contain: How South Korea Flattened Its Coronavirus Curve. *The Guardian*. Available at https://www.theguardian.com/world/2020/apr/23/test-trace-contain-how-south-korea-flattened-its-coronavirus-curve. Accessed 3 August 2020.

Ministry of Economy and Finance (MOEF). 2020. Flattening the Curve on COVID-19: How Korea Responded to a Pandemic Using ICT. Sejong: Government of the Republic of Korea.

National Assembly Budget Office (NABO). 2018. Prospects for Long-Term Fiscal Status. *NABO Bulletin*. Seoul: Korea's National Assembly.

OECD. 2020a. OECD Economic Surveys - Korea. Available at https://www.oecd-ilibrary.org/economics/oecd-economic-surveys-korea_19990707. Accessed 13 August 2020.

OECD. 2020b. COVID-19 and Global Value Chains: Policy Options to Build More Resilient Production Networks. Available at http://www.oecd.org/coronavirus/policy-responses/covid-19-and-global-value-chains-policy-options-to-build-more-resilient-production-networks-04934ef4/ Accessed. 3 August 2020.

Park, Sangchul, Gina Jeehyun Choi, and Ko Haksoo. 2020. Information Technology–Based Tracing Strategy in Response to COVID-19 in South Korea-Privacy Controversies. *JAMA. 323*(21):2129–2130.

Statistics Korea. 2020. Industrial Activity Trends from January to June. Daejon: Statistics Korea.

UNESCO. 2020. How the Republic of Korea Flattened the COVID-19 Curve: Openness, Transparency and Democracy. Available at https://en.unesco.org/news/how-republic-korea-flattened-covid-19-curve-openness-transparency-and-democracy. Accessed 6 July 2020.

World Health Organization (WHO). 2020. Country Profile: Republic of Korea. Available at https://www.who.int/countries/kor/en/Accessed. 1 April 2020.

World Trade Organization. 2020. Trade Set to Plunge as COVID-19 pandemic upends global economy. Available at https://www.wto.org/english/news_e/pres20_e/pr855_e.htm. Accessed 6 August 2020.

Zastrow, Mark. 2020. How South Korea Prevented a Coronavirus Disaster—And Why the Battle Isn't Over. *National Geographic*. Available at https://www.nationalgeographic.com/science/2020/05/how-south-korea-prevented-coronavirus-disaster-why-battle-is-not-over/. Accessed 22 May 2020.