
Economics of COVID-19 in Korea: Quarantine measures vs. herd immunity

As of the end of 2020, the cumulative number of COVID-19 cases in Korea was about 63,000, ranking 86th in the world. Among countries with a population of over 50 million in the world, there are no cases of successful quarantine such as Korea. The economic growth rate in 2020 was forecasted to be -1.9% (IMF 2020), the highest among OECD countries. This paper reviews the spread of COVID-19 and measures taken to combat the coronavirus in Korea in 2020 and analyzes how COVID-19 has impacted the Korean economy in terms of its exports, production and GDP. Despite the successful quarantine, policy considerations were insufficient to form herd immunity through vaccination. Hence the study also examines the ramifications of delayed formation of herd immunity.

A finales de 2020 el número acumulativo de casos de COVID-19 en Corea era de 63.000, ocupando el puesto 86 en el mundo. En países con una población de más de 50 millones de habitantes no hubo casos de cuarentena tan exitosos como el de Corea. La tasa de crecimiento económico en 2020 fue de -1,9% (IMF 2020), la más alta entre los países miembros de la OCDE. Este artículo analiza la propagación de la COVID-19 y las medidas tomadas para combatir el coronavirus en Corea durante el año 2020, y cómo la COVID-19 ha afectado a la economía de Corea en lo que se refiere a la exportación, producción y PIB. A pesar de que la cuarentena resultó exitosa, las medidas adoptadas fueron insuficientes para crear la inmunidad de grupo a través de la vacunación. Este artículo también examina las implicaciones de alcanzar la inmunidad de grupo tardamente.

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* Spanish versión available at <https://euskadi.eus/ekonomiaz>

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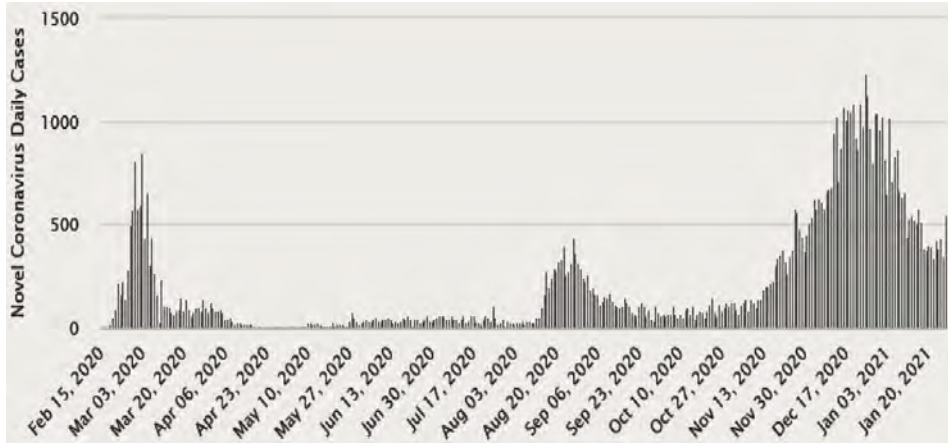
1. INTRODUCTION

The first identified outbreak of COVID-19 in Wuhan, China, at the end of 2019, was spread to the Republic of Korea (Korea, hereafter) in January 2020, one month after the first outbreak. By the end of February 2020, Korea was identified as a country with the second-highest danger of COVID-19 after China, and countries around the world had banned flights arriving from Korea (Lim *et al.*, 2021). However, after two months, the international media began evaluating Korea as an exemplary country for successfully com-

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bating COVID-19 (OECD 2020). Korea overcame the second wave of the coronavirus outbreak that had occurred last summer. The third wave since the last mid-November, was spreading faster and greater regions of cases than the first two waves.

Figure 1. **KOREA'S TRENDS FOR COVID-19 CASES**



Source: WorldOMeter (retrieved January 26, 2021).

As the end of 2020, Korea's accumulated number of cases is about 63,000, which is the 86th in the world. The numbers of positive cases and fatalities are very small compared to those countries with similar sizes of populations, as seen in Table 1. Thus, there is no doubt that Korea is a successful case for combating COVID-19. Nevertheless, such extreme conviction is causing a national failure. An unreasonable effort to re-activate the economy in spite of high infection risk is one example of the causes. The Korean government has not demonstrated an effort to adopt a strategy that fundamentally corresponds to the coronavirus crisis by building herd immunity through vaccines.

What has become the main component behind Korea's successful countermeasure against COVID-19 is the '3T', which means Test, Treatment, and Tracing. Since Koreans actively engaged in wearing masks and social distancing² has managed to avoid a nationwide lockdown and curbed the spread of the virus in its early phase (Cheong, 2020; Kim, 2020; Ritholtz, 2020). Therefore, the production activities in Korea were less affected compared to other countries, and despite some partial encumbrance, the nation's economic activities continued without any dramatic strug-

² In the beginning of 2020, Korea's social distancing system consisted of two stages, but later the health authority subdivided it into three stages and eventually five stages. In each stage, the Korean government allowed more detailed measures to be able to cope with national situations.

gles. The government of Korea spent an enormous amount of the national budget for COVID-19 emergency financing in order to reduce economic depression.³ As a result, Korea's economic growth rate for 2020 is expected to be -1.1%, which is the most decent estimate among the OECD member countries.

In Chapter 2, this paper reviews the spread of COVID-19 and measures taken to combat the infection in Korea during the year 2020. In Chapter 3, the authors analyze how COVID-19 has impacted the Korean economy in terms of its exports and production by major industries. Then, Chapter 4 seeks to discuss the prospects for Korea's economic growth by linking it with the issue of the possible timing of COVID-19 herd immunity. Finally, the concluding chapter draws lessons earned from Korea's COVID-19 experience as well as implications.

2. THE SPREAD OF COVID-19 AND PREVENTIVE MEASURES IN KOREA

Korea can be seen as a successful case for combating COVID-19. As Table 1 shows, Korea has the world's lowest number of fatalities from COVID-19, an exemplary case for effectively curbing the spread of infection without a nationwide lockdown. Upon the government's preventive measures, Koreans actively participated in wearing masks, washing hands, and social distancing. However, the Korean government mainly focused on overcoming COVID-19 through preventive measures, and not sufficiently on building herd immunity through vaccination.

2.1. COVID-19 pandemic in Korea

In 2020, there were three waves of the spread of COVID-19, as seen in Figure 1. From the end of February to (the) early March, there was the first wave. At the end of August, the second wave occurred, and in mid-November, the third wave. The first wave seriously endangered Korea, making it a country with the second-most COVID-19 cases after China, which attracted global attention. Then, the second wave remained merely a domestic problem with an insignificant number of cases when considered from an international point of view. At this time, in places like Europe or the United States, more than 30-40 thousand cases occurred every day, while Korea had less than 500 cases on a daily basis. The third wave in mid-November of 2020 had rapidly increasing cases, ultimately reaching 1,237 cases on December 25th. This third wave happened internationally, as the United States had more than 200,000 cases a day, and some of the major European countries had 50,000 daily cases. Nevertheless, Korea, which had previous two experiences in combating the

³ Korean government rolled out bold policy responses valued at 310 trillion Korean currency (KRW) (US\$262.7 billion, 16.6% of 2020 GDP, which is \$1,586 billion), including emergency relief payments distributed to all citizens, a package program to stabilize people's livelihoods and finances and new hope funds for microbusiness owners in 2020. A total of 310 trillion KRW worth of coronavirus packages is equivalent to 60.5% of Korea's total government budget (512 trillion KRW) in 2020.

coronavirus, intensified the nation's preventive measures in order to reduce its 1,000 daily cases for about a month. In mid-January, the nation's daily cases were less than 500.

Table 1. **TOP 10 COUNTRIES WITH HIGHEST NUMBER OF COVID-19 POSITIVE CASES**

Rank	Country	Total cases	Deaths	Population	Total cases per million population	Deaths per million population	GDP growth(2020, projections)
							%
Unit: thousand persons						persons	%
1	USA	20,904	358	331,986	62	1,080	-4.3
2	India	10,324	149	1,386,864	7	108	-10.3
3	Brazil	7,716	195	213,324	36	918	-5.8
4	Russia	3,212	58	145,966	22	397	-4.1
5	France	2,643	64	65,346	40	993	-9.8
6	UK	2,599	74	68,066	38	1,096	-9.8
7	Turkey	2,232	21	84,797	26	251	-5.0
8	Italy	2,141	74	60,416	35	1,241	-10.6
9	Spain	1,936	50	46,763	41	1,087	-12.8
10	Germany	1,771	34	83,920	21	414	-6.0
~	~	~	~	~	~	~	~
86	S. Korea	63	0.1	51,291	1	19	-1.9

Source: Assembled base on the data of the WorldOMeter and IMF (2020)'s World Economic Outlook.

At the end of 2020, the countries with the most COVID-19 cases included the United States, India, Brazil, Russia, and France; Korea was ranked as the 86th. Korea's total COVID-19 cases and fatalities are 63,244 and 962 respectively, and when these numbers are calculated as per one million population, the number of positive cases and fatalities equal to 1,233 and 19, respectively. Thus, despite the three waves of infection within the country, Korea could still be seen as an exemplary nation for successfully preventing the spread of COVID-19.

The GDP of many European countries has shrunk by more than 10%, and the US recorded the worst economic performance since World War II, as shown in the far right column of Table 1. In Korea, the people actively participated in the govern-

ment's quarantine measures, and it was possible to prevent a situation where economic activities were completely suspended, Korea's GDP loss in 2020 was significantly lower than in other countries. Due to social distancing, private consumption in Korea in 2020 decreased by -5.0% compared to the same period previous year, and construction investment and exports fell -0.1% and -0.5%, respectively, lowering GDP. But facility investment to support digital non-face-to-face activities increased by 6.8%, reducing GDP loss.

2.2. Korea's 3T in fighting infectious diseases

A noble infectious disease broke out in Wuhan, China, and many countries banned flights from the city of Wuhan, then from the entire mainland China. However, due to its close economic relationship, Korea had hesitated in banning the flights from Wuhan, and meanwhile, the first COVID-19 positive case was confirmed in Korea then. At this time, tens of flights from Wuhan arrived in Korea, and the believers of a cult called the Shincheonji church who had been missionaries in Wuhan, China, became the center of the major outbreak of COVID-19 in Korea.

As the major outbreak caused by the Shincheonji church was taking place, the Korean public health authorities immediately began to take preventive measures. In 2015, the MERS (Middle East Respiratory Syndrome) sparked in Korea, and the subsequent failure to prevent the disease created important lessons (Lim *et al.*, 2021; Kim *et al.*, 2017). It turned out that the damage of the MERS was greater in Korea than Saudi Arabia, where the disease first started. The person infected with MERS moved around multiple large hospitals in Seoul, Korea, and this eventually deteriorated the situation to where the Korean medical system almost broke down.

With the lessons learned from the MERS experience, Korea reformed relevant legislatures. When an infectious disease breaks out, the public health authorities are conferred with the right to test and trace the virus, as well as to forcefully isolate one with the disease or who is under risk of infection (Park *et al.*, 2020). In other words, if there is an individual infected with a certain infectious disease, the nation's public health authorities can figure out the places that person went, his or her smartphone records, and the credit card records so that the infected individual and potential persons of infection can be effectively traced. Korea is a country with a high level of privacy protection, but regarding the prevention of infectious diseases, such measures for are allowed as an exception.

Any country can overcome COVID-19 if they carry out the '3T' successfully. However, if personal information is not allowed to be transferred to the public health authorities, a systematic tracing is impossible. In fact, since Korea had reformed its legislation after the MERS failure, the country could curb the first wave of COVID-19 easily and effectively in 2020, not to mention the implementation of the '3T.'

Moreover, every Korean citizen has a national medical insurance. As the biomedical industry is highly developed, treatment of the infected patients and development of testing capacities are exceptionally capable, which ultimately reduced the number of COVID-19 fatalities in Korea. Just 2-3 weeks after the first case was confirmed in Korea, multiple biomedical companies in Korea developed a testing system, and in early 2020, these COVID-19 testing systems were successfully able to be exported to other countries around the world.

Despite the second spread in the last summer due to the vacation season, Korea was able to curb the further spread of the virus without major challenges. Since then, the Korean government has been prioritizing its economic recovery. The entertainment and theater industries that had been largely shut down due to social distancing guidelines were reactivated. The government has purchased various coupons for culture and sports, and distributed them to its people across the country.

The World Health Organization (WHO) has warned of another possible wave of the spread of COVID-19 in the winter, but such warning could not be a priority over the nation's aim for economic recovery. When the third wave hit the country, the government raised the level of social distancing from stage 1 to stage 2.5, then eventually eased to a stage 1.5 (2.0 for Seoul and its suburbs) February 2021.

The authority realigned social distancing system in order to appropriately respond to the progress of the pandemic. Korea's social distancing guidelines have a total of five stages (stages 1, 1.5, 2, 2.5 and 3). Stage 1 means social distancing, and stage 1.5 applies preventive quarantine measures in the operation of multiple events such as church services, gym and etc. Stage 2 bans multiple events as well as non-work-related private meetings in groups of more than five people. Under stage 2.5, when the region-wide pandemic is in full swing, quarantine measures for all facilities are strengthened. Stage 3, which is the most intensive one, would have a complete nationwide lockdown except for essential workers.

2.3. Delay in purchasing vaccines

International organizations, including the International Monetary Fund (IMF), view that the global economy will experience a positive growth in 2021. Dr. Anthony Fauci, in an interview on January 11th, 2021, stated that concerts and theater performances could return in fall of 2021.⁴ Even in 2021, it seems that many countries would not lift the lockdown measures due to COVID-19, thus protectionism and nationalism which had been present prior to the pandemic would be further intensified.

In 2021, the Korean economy will also be on a rocky road unlike optimistic prospects. Some of the major institutions, such as the Ministry of Finance and

4 This can be found at the New York Times (2021).

Economy, the Bank of Korea, IMF, OECD, and more, have reported Korea's 2021 economic growth rate to be 2.8~3.2%. By only looking at such measures, it can be understood that the Korean economy could recover to the level prior to COVID-19. Yet, if the vaccination program faces an obstacle and subsequently building the herd immunity is delayed, the actual economic growth rate can be decreased to a large extent.

At the end of 2020, some developed countries, including the United States, have begun the COVID-19 vaccination program, but Korea took slightly delayed actions and eventually signed the contract for purchasing the vaccines at the beginning of 2021. When the Korean opposition party and the media criticized the current administration's indolent countermeasure, the government claimed that instead of a hesitant move toward vaccines, they seek to purchase the vaccines with the highest safety level, after the results are confirmed in other countries. As the coronavirus variant with 70% transmissibility broke out in the United Kingdom, some worry that the vaccines may not be effective. However, as the Korean people condemned the government for the delayed purchase of vaccines, the government has signed contracts with several domestic pharmaceutical companies.

The Korean government had originally believed that social distancing guidelines could ultimately lead the country to overcome the pandemic. Yet, it certainly overlooked the fact that people were already getting fatigued with the prolonged self-preventive measures and social distancing guidelines. Further, since the COVID-19 preventive system was relaxed as the economic recovery had been prioritized, new outbreaks happened. People began to blame the government. Having prioritized the preventive measures over vaccines in overcoming COVID-19, President Moon's administration has overlooked the importance of the vaccination program, absorbed in the nation's early success in the beginning of 2020. Moreover, the public health government officials were fearful of being submitted to audit and disciplinary measures, leading to timid countermeasures (Newsis, 2021). Countries around the world are already in the process of the vaccination program, but it seems that Korea will begin its program in around mid-2021.

3. THE EFFECTS OF COVID-19

COVID-19 has caused a serious shock in both supply and demand sides, and all economies around the globe have been affected. In responding to social-distancing guidelines and partial lockdowns, digitalization is being accelerated. As the 'untact (contact-free)' consumption has become a norm, expansion of untact distribution channels, such as e-commerce, acceleration of online consumption, and working from home are becoming even more prominent. In addition to reducing aggregate demand, the disruption of global logistics and business transactions has also largely affected global trade.

3.1. The Effects on Korea's trade

To respond to the COVID-19 pandemic, most countries have adopted border closures. The result was a decrease in income due to reduced production and employment, an increase in trade costs and logistics fees across borders, a decrease in face-to-face businesses, etc. took place, ultimately leading to reduced demand for domestic goods and imported goods. Since the WHO declared a pandemic last March, the World Trade Organization (WTO) had anticipated that the global trade could decrease by 32% under the worst case.⁵ In specific, as the lockdowns in the United States and Europe extend, it is viewed that the global trade volume will further decrease.

COVID-19 has exposed a serious problem of the weak connections of the global value chain (GVC). As production and exportation/importation of intermediate goods and final goods were disrupted, the GVC, of which its production stages are distributed in multiple countries, could not function. For Korea, which used to be supplied from Wuhan where COVID-19 was detected, failed to be delivered with goods. Under this situation, Korea's automobile industries had to halt their factory operations for about a month. Moreover, as some ports were shut down, cargo ships could not move freely, leading to an increase in logistics fees, a delay in supplying parts and exporting final goods, and ultimately to a serious confusion in the Korean corporations' GVC (Baldwin and Tomiura 2020).

Table 2. KOREA'S EXPORTS AND IMPORTS IN 2020

(Unit: US\$ 1 billion, %)

	Korea ¹⁾			World ²⁾
	First half	Second half	Yearly	Yearly
Exports	240.58 (-11.3)	272.27 (+0.4)	512.85 (-5.4)	-9.6
Imports	229.86 (-9.0)	237.37 (-5.3)	467.23 (-7.2)	-10.6
Trade balance	10.72	34.90	45.62	

Note: 1) Estimates based on the records of customs offices.

2) Projections based on average of North America, South & Central America, Europe, Asia, and Other regions' exports and imports.

Source: Ministry of Trade, Industry and Energy (2021) and WTO Portal.

⁵ Trade set to plunge as COVID-19 pandemic upends global economy. (2020). Wto.org. https://www.wto.org/english/news_e/pres20_e/pr855_e.htm

In the first half of 2020, Korea's exports and imports fell by -11.3% and -9.0%, respectively, yet in the second half, its exports rose by 0.4% and imports decreased by -5.3%. Annually, the nation's exports recorded 5.4% and the imports -7.2%. The imports fell further than the exports, thus the trade balance improved by 45.62 billion dollars.

While the exports of the world's major countries have been largely attenuated, Korea's exports have put up a relatively good fight. WTO (2020) made a prediction that the global trade would decrease by -9.2% in the end of 2020. Given this, Korea's reduction rate of -8.2% can be analyzed as having a lesser shock than the world's average. The international exports have decreased by -9.6%, and among the world's top 10 trading countries, Korea's reduction in exports was small, ranking after China, the Netherlands and Hong Kong (Table 3). Considering that Hong Kong and the Netherlands to be excluded from comparison as they have high ratios of re-exportation⁶, Korea is a country with the second-least damage from COVID-19 after China. Based on the strict (national) lockdown measures within the two months in the beginning of 2020, China was successful in preventing the spread of COVID-19 and normalizing the economy soon.

Table 3. **THE WORLD'S TOP 10 EXPORTERS' RECORDS IN 2020
(JANUARY – OCTOBER)**

(Unit: %)

Hong Kong	China	Netherlands	Korea	Belgium	Germany	Italy	Japan	USA	France
+0.9	+0.4	-7.4	-8.2	-10.0	-10.4	-11.3	-11.7	-14.5	-17.7

Source: Ministry of Trade, Industry and Energy (2021).

3.2. Effects by industries

It is too early for the Korean companies as for COVID-19 to bring an impact to them in terms of the companies' countermeasures or concerns. However, globalization, which has been taking place for the last many decades, has begun to display different patterns since the global financial crisis in 2008. In the case of the United States, some signs of de-globalization were shown since the Trump administration took office. The breakout of COVID-19, which expedited protectionism and reshoring around the world, is expected to accelerate the anti-globalization. Despite the

⁶ The re-exportation ratios of Hong Kong and the Netherlands are 89% and 44%, respectively (Ministry of Trade, Industry and Energy, 2021).

lack of information due to the lengthy time it takes for corporations to make decisions for investments or reshoring, COVID-19 has been creating divergent patterns in Korea's many industries.

As social distancing becomes a norm, most service industries, including restaurants and theater, performance, and tourism, have experienced severe damage. Only the communication and online services that support untact activities have managed to use COVID-19 as an opportunity to boom. This would apply the same for all countries around the world. However, for manufacturing industries, there were differences between countries.

Table 4 reports monthly changes in manufacturing production in major countries in the world. Most countries around the globe have reported a huge drop in their manufacturing production. In January and February, China experienced a decrease of industrial production by -28% points yet managed to return to a plus since April. Such improvement was possible as China's socialist economic system drew the administrative power of its government to normalize the operations of its companies' manufacturing facilities. But it is difficult to expect such economic recovery for other countries.

Due to COVID-19, the international trade environment has been severely deteriorated, and the demand has surpassed the supply as production was curbed from lockdowns. For this, China took advantage of the chance to fill the gap. As seen in Table 4, countries other than China showed a decreased in production since last March when the WHO declared a pandemic. The most serious shock in production was in April for most countries. In April, India's manufacturing production was reduced by -73%, then the size of decrease slightly improved later. For the manufacturing industries of the European countries, such as, France, Germany, Italy and Spain, had similar patterns.

The Korean manufacturing industry demonstrated a divergent pattern. Despite the 3% decrease in production in January, Korea's production increased in February and March when COVID-19 was at its peak. From April to August, the nation's production was reduced, but the subsequent shock was not substantial. Except for the 11% decrease in May, Korea's monthly production experienced fluctuations between 5% and 11% without serious challenges. As a result, not only the impacts on Korea's exports, but also its GDP loss were relatively less severe.

As seen in Table 5, the manufacturing industries that experienced the greatest boom in 2020 include electronics and media equipment, pharmaceuticals and medical products, furniture, machinery, and equipment. To a certain extent, COVID-19 provided an opportunity to expand these sectors. As untact activities have rapidly increased, digitalization quickly followed in the footsteps. Subsequently, Korea's ICT companies experienced a conspicuous boom for the entire year. Moreover, Korea's furniture sector boomed as well, since more and more people stayed at home and became interested in decorating their houses. Further, investments in machin-

ery and facilities for producing pharmaceuticals and masks increased as well. As eating at home was recommended rather than eating out at restaurants, the demand for processed food also increased in multiple months.

Table 4. **MONTHLY CHANGES IN MANUFACTURING PRODUCTION BY COUNTRY IN 2020**

(unit: % point)

Country \ month	1	2	3	4	5	6	7	8	9	10
Brazil	1	0	-4	-30	-24	-9	-4	-2	5	1
China	-28	-28	-3	8	7	7	9	8	11	11
France	-3	-2	-19	-40	-31	-8	-12	-6	-3	-9
Germany	-4	-3	-10	-30	-30	-7	-12	-12	-5	-4
India	2	4	-29	-73	-45	-19	-14	-9	0	4
Italy	-3	-2	-33	-45	-33	-13	-10	-1	-2	-6
Japan	-3	-5	-6	-15	-26	-18	-17	-13	-9	-3
Korea	-3	11	9	-5	-11	-1	-2	-3	8	-2
Spain	-3	0	-17	-41	-37	-11	-8	-5	-1	-8
Turkey	8	12	-2	-38	-39	19	0	17	14	N/A
UK	-2	-2	-9	-30	-30	-11	-9	-9	-4	-9
United States	0	0	-6	-21	-17	-11	-7	-7	-6	-3

Note: Rate of monthly increase in production compared to the previous year.

Source: Calculated based on UNIDO Database for World Manufacturing Production.

Nevertheless, the rest of the sectors had to inevitably reduce their operations followed by the dramatic decrease in foreign demands as well as the domestic COVID-19 preventative guidelines. In particular, some of the labor-intensive industries, such as wearing apparels and leather products, were weakened to a large extent due to the decreased demand and social distancing. Also, Korea's automobile industry, which had experienced a difficulty with the failure of supplying parts in the beginning of 2020, had its domestic production contracted followed by the decreased foreign demands from April to August.

Table 5. **MONTHLY CHANGES IN KOREA'S
MANUFACTURING(SELECTED) PRODUCTION IN 2020**

(unit: %)

ISIC Description\month	1	2	3	4	5	6	7	8	9	10
Food products	-8	12	7	0	-6	6	1	-4	12	-7
Beverages	-10	4	-11	-9	-15	6	3	-5	4	-6
Wearing apparel	-9	-11	-29	-17	-18	-12	-20	-19	-19	-20
Leather and related products	-5	-3	-25	-28	-33	-22	-27	-26	-26	-13
Printing and media equipment	-10	6	-2	-5	-8	3	3	3	12	-1
Pharmaceuticals	6	24	18	2	10	23	30	14	21	-3
Basic metals	-10	6	-3	-8	-17	-15	-14	-7	0	-5
Fabricated metal products	-10	9	1	-8	-17	-9	-11	-14	-2	-13
Electronic and optical products	22	29	33	6	11	16	8	11	21	10
Electrical equipment	-7	6	4	-7	-16	1	-1	-4	12	-5
Machinery and equipment	-2	12	11	7	-4	8	11	3	9	-3
Motor vehicles, trailers	-20	-12	4	-20	-36	-13	-8	-9	13	-6
Furniture	0	25	12	7	0	12	-2	-1	18	4

Source: Calculated based on UNIDO Database for World Manufacturing Production.

Although Table 5 suggests the changes in manufacturing production by each month of 2020, it shows that COVID-19 will have a substantial long-term impact on Korea's manufacturing industries. According to the Korea Institute for Industrial Economics and Trade (KIET, 2020), which has estimated the data based on the Vector Error Correction Model (VECM), Korea's manufacturing industries will display different patterns upon some of the major countries' industrial policies in the post-COVID-19 era, as seen in Table 6. For the automobile sector, although clean mobility types are promising, an internal combustion engine would be classified as a risky product line with weak foundation of future demands. Smart ships, semiconductors, remote management system, antibacterial steel, medical materials, smart home appliances, secondary battery and more are all highly promising subjects, yet it is anticipated that the traditional manufacturing sectors would head toward the rustbelts.

Table 6. PROSPECTS FOR PROMISING AND RISKY PRODUCT RANGE AFTER COVID-19

	System industry	Material industry	IT manufacturing
Promising product range	Automobile (clean mobility), ships (smart ship solution), machinery (machinery for manufacturing semiconductors, tele management system, communication equipment)	Antibacterial steel, clothing materials, bunker fuel oil C, textile (masks · textile for testing kits, medical-industrial-safety suits)	Health-smart home appliances, 5G and a next-generation wireless communication equipment, semiconductor, display, secondary battery for EV
Risky product range	Automobile (small commercial vehicles), ship (cargo ships, offshore plant), machinery (construction machinery, machine tool)	Steel (steel pipe, timber), chemicals (construction materials, ICT intermediate goods), oil refining (gasoline, diesel, aviation gasoline), textile (clothing, fabric · knit, bleaching · dyeing · processed goods)	Display (LCD)

Source: KIET (2020).

3.3. Impact of COVID-19 emergency stimulus

In general, an economic crisis negatively affects the employment as well as the domestic market due to a decrease in income, ultimately leading to a severe economic recession. As COVID-19 is prolonged and the corresponding preventative measures intensify, the vulnerable class with reduced income has expanded. Moreover, as social distancing has become a norm, the businesses with greater risks of COVID-19 inevitably restrict their operations, thus the scale of consumption becomes even more attenuated and the economic recession becomes severe. In this sense, the employment suffers a more direct and intensified shock.

For the two months in March and April in 2020, approximately 1,020,000 Korean workers lost jobs. Especially in service industries, such as restaurants or tourism, experienced greater shocks. From May to August, daily COVID-19 cases continued to be below 50, and accordingly, the labor market demonstrated slight patterns of economic recovery. However, as the second wave broke out at the end of August, employment recovery remained stagnant. In particular, the employment of the youth population from ages of 15 to 29 decreased by 165,000 people, and more females lost their jobs compared to males. Centering around the service businesses such as restaurants and tourism, the employment rate was especially decreased. As of March 2021, Korea's unemployment rate soared to 4.0% from 3.3% a year ago.

As heightened preventative measures took place to respond to the spread of the virus, the economic recession followed by the augmented unemployment continued to prevail, and the Korea government reviewed the COVID-19 emergency stimulus package. The government relief funds had been provided for all households with direct employment shocks in the early phase of COVID-19. However, as people have raised the argument of how every citizen is a victim of the virus, consideration of the issue of fairness has become important. As a result, in May the relief package was delivered to all households. The amount of the funding package differed by the number of family members: for 1 person household, it was 400 thousand KRW(US\$339), for 2 people household, 600 thousand KRW(US\$508), for 3 people household, 800 thousand KRW(US\$678), and for more than 4 people household, 1 million KRW(US\$847). When the central government provided this relief stimulus packages, several local governments also provided separate COVID-19 emergency stimulus funding. In the first half of 2020, the total amount of the stimulus package provided by the central government was 14.2 trillion KRW (US\$12.6 billion), and that of the local self-government was 17.6 trillion KRW (US\$14.9 billion). This, in average, is 340 thousand KRW (US\$288) for one person.

Some claimed that it was a too big burden for the national budget. In September, the government decided to selectively provide the stimulus package for those who have been affected by the second wave of COVID-19. Considering the increasing budget, the government had adopted a selective payment for those who earnestly need the stimulus funding. The amount of support in September was 7.8 trillion (US\$6.6 billion), and each of those in the generic category of business, such as small business owners, freelancers, and drivers, whose sales had decreased below 400 million KRW (US\$339 thousand), was provided with 1 million KRW (US\$847) each. Furthermore, for those in the 'category of restricted grouping', such as restaurants, 1.5 million KRW (US\$1,271) was provided for each, and for the 'category of no-grouping', such as internet cafes · tutoring academies · libraries, 2 million KRW (US\$1,695) was offered each.

In December 2020, as the third wave with rapidly rising cases hit the country, the Korean government strengthened the social distancing guidelines. Subsequently, the third offer of support took place in the same manner as the second one, and the amount was 9.3 trillion KRW (US\$8.3 billion).

Korea's response to the worsening economy was mainly fiscal expenditure expansion, and its overall fiscal deficit deteriorated to 4.1% in 2020, much higher than the Korean government's target of 3%, below which Korea before the COVID-19. While the IMF (2021) highly praised Korean government's response to COVID-19, it sees that it is necessary to continue expanding fiscal policies and easing monetary policies to prevent economic deterioration. It is recommending to the Korean government to maintain easy monetary policy until the economic recovery is certain. On the other hand, the Korea Economic Research Institute (KERI, 2021) argues that

the Korean government should reconsider excessive fiscal expenditures and promote stabilization of long-term interest rates in a situation where it is necessary to respond to the rise in long-term interest rates in the United States.

Although the COVID-19 stimulus package had provided a bond of sympathy within the country, there was a controversy in the issue of fairness and efficiency of the funding. The second stimulus package was mainly provided for about 8 million people who are in low-income class and weak labor market, but as such limited national budget was offered to one-tenth of the nation's population, the net amount of the stimulus was considered insignificant. Therefore, much administrative power was consumed in deliberating the category of businesses and the size of the damage imposed by the pandemic for the third stimulus package.

The core of the controversy would lie in the effects of the stimulus package. For this, the Korea Labor Institute (KLI, 2020) reported a meaningful research finding. Due to COVID-19, the consumer's expenditure of the second quarter of 2020 decreased by 16.3% compared to the first quarter. In the third quarter, the consumer's expenditure increased by 7.3% compared to the second quarter, and the fourth quarter experienced an increase by 10.4% than the third one. The consumer's expenditure which had been weakened by COVID-19 decreased by 16.3%, but the government's stimulus package recovered it in June to the level it was in 2019. According to the KLI research, it is estimated that such recovery of consumer's expenditure has been contributed by the relaxation of social distancing by 41.2% and the COVID-19 relief stimulus package by 58.8%. The effects of consumption increase from the stimulus package, the 10.4%, is approximately 12.7 trillion KRW (US\$10.8 billion) when enumerated. Thus, out of the first stimulus package which was 17.6 trillion KRW (US\$14.9 billion), the effects of augmented consumption were equal to 72.1% ($=12.7/17.6$), and the rest (27.9%) is interpreted to as irrelevant consumption with the emergency funding.

In the third quarter, the household income was temporarily improved by the stimulus package to the level before the pandemic. The spread of COVID-19 reduced the household income by 4.4% and the expenditure by 8.1%. KLI (2020) analyzed that the stimulus package failed to offset the reduction of income expenditure which the second stimulus funding had caused. Nevertheless, from a broader point of view, when the spread of COVID-19 was slightly alleviated and the government's stimulus package was provided, both income and expenditure were largely recovered to the level prior to COVID-19.

4. COVID-19 HERD IMMUNITY AND ECONOMIC RECOVERY

When reviewing countermeasures for COVID-19, it is imperative to analyze the effects relative to the costs. As there were countless fatalities from the virus and the economy has been severely deteriorated, estimation of costs would not be easy. The

time variable also becomes a critical subject of a meticulous review. Although COVID-19 will be exterminated someday, the loss that has occurred until today and the opportunity costs will be immense. Thus, vaccination and building herd immunity in an early phase are significant. The timing of forming herd immunity will also have critical effects on economic growth.

4.1. Prospects for economic growth

The Bank of Korea (2021) updated Korea's economic growth rate for 2020 to -1.1% at the end of December. Despite the third wave of COVID-19, the nation's economic growth rate was augmented from -1.3%, which was the measure in August, to 0.2%. On December 1, 2020, OECD lowered Korea's 2020 economic growth rate from -1.0% (from September) to -1.1%. This is interpreted as reflecting the economic shock experienced by the third wave of COVID-19.

In last June when Korea successfully overcame the first wave, OECD's growth estimate stayed at -1.2%, but as the situation kept calm from July to August, the economic growth rate estimate was increased to -0.8%. However, in September when the second wave of August broke out, the rate was re-estimated to -1.0%. While the OECD considers the comprehensive impact of the COVID-19 pandemic significant when making economic prospects, Korea seems to take the increasing trend for exports more importantly. Although Korea's export continues to grow with the country's major exports such as semiconductors and electronic devices, the prospects for its global exports is unclear, which makes it difficult to prospect an optimistic result.

According to the OECD's December reports, the global economic growth rate in 2020 was predicted to be -4.2%. In the prediction made last June, it was -6.0%, but as the world's major economies resumed their economic activities, the global economic growth rate was adjusted to be -4.5% in September. As the vaccines become available at the end of the year, the December prediction was updated to -4.2%, which is an estimate increased by 0.3%. The same report evaluated Korea as the country with the smallest damage on its gross domestic product (GDP) among the OECD members. Korea's 2020 economic growth rate is still ranked as the first among the OECD members and as the second in the G20 after China. Such optimistic evaluation reflects that Korea has a relatively less severe shock caused by COVID-19.

Nevertheless, the future economic growth seems opaque. Social distancing guidelines have limits in combating COVID-19. Since the end of 2020, many services sectors such as bars and gymnasiums that are not open for business have been acting as a group against the government's measures. The government is also gradually easing quarantine measures while accepting their requests. As of now, building herd immunity from the vaccines would be the fastest way. The medical experts understand that the herd immunity is complete when 60-70% of the

population has an antibody. In this circumstance, restriction on economic activities can be refrained, and preventative measures mainly focused on those who are infected become possible, while maintaining the national health system.

4.2. Vaccination and herd immunity

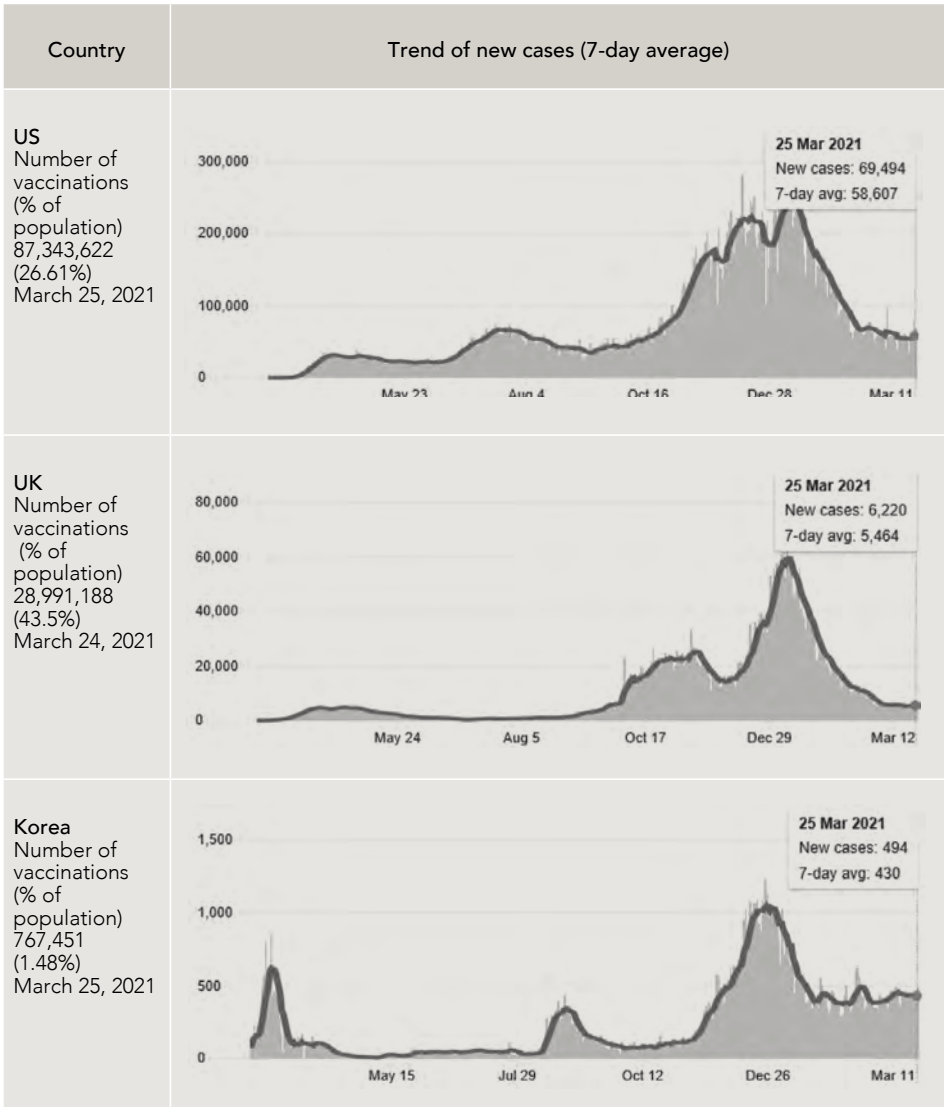
In general, it takes about 10 years for one type of vaccine to be developed, but the vaccines for COVID-19 have been developed and ready for vaccination within one year. On top of the advanced science and astronomical research funds, an additional layer of speedy safety testing called the «clinical demonstration», took place and made it possible. In December 2020, multiple countries, including the United States and the United Kingdom, have started the vaccination programs for COVID-19. There could be countries that can break away from the COVID-19 risks when the herd immunity is formulated in 2021. Yet if a country experiences a delay in building the herd immunity, it will have no difference from the situation gone through in 2020.

Figure 2 summarizes the progress of vaccinations and trend of new COVID-19 cases in the US, UK and Korea. The spread of coronavirus peaked at the end of 2020 in all three countries, but in the US and UK, where vaccination is rapidly progressing, and the number of new cases is rapidly decreasing this year. As of the end of March, the US and UK have vaccinated 26.61% and 43.5% of the total population, and are expected to complete the vaccination to all adults during the first half of the year. However, in Korea, which failed to secure the vaccine last year, the vaccination rate is only 1.48%, and 400 to 500 new confirmed cases a day are emerging throughout February and March despite steady quarantine measures. The US is expected to see an economic growth rate of around 6% this year, while Korea's growth rate is expected to be only around 3%. In this regard, the Wall Street Journal (WSJ, 2021) published an article titled «Slow-Vaccinating Asia Is Squandering Its Economic Advantages.» It states that Korea is a representative country in which the economic recovery is delayed because vaccines are not purchased on time.

Since last summer, the United States and the European countries had begun purchasing the vaccines seeing them as the game changer. Subsequently, since the end of 2020, the COVID-19 vaccination program has been implemented starting from the UK, the US than the European Union. But in the first half of 2020, Korea merely focused on its prior success on curbing the first wave of COVID-19 and advertising such success as 'K-quarantine' without hurrying to purchase the vaccines. On October 9, Korea had claimed to adopt the 'COVAX Facility' securing vaccines for 10 million people, but the exact timing for such purchase has not been confirmed yet. On November 27, Korea signed a contract with Astra Zeneca securing 10 million vaccines. Subsequently, on November 23 with Pfizer (10 million) and Janssen Pharmaceutica (6 million); on December 31 with Moderna (20 million). Theoretically, since Korea has secured 56 million vaccines, which is

slightly more than Korea's populations of 53 million, it can be seen that there are sufficient amounts of vaccines. However, because the ratio of antibody formation is from 70~90%, there may not be enough. Also, the vaccines are first provided for those countries who had purchased earlier, and the exact timing for vaccines to be supplied, safe logistics system or the order-timing of being vaccinated are still undecided. Thus, herd immunity would be possible at the end of 2021 at the earliest.

Figure 2. PROGRESS OF VACCINATIONS AND TREND OF NEW COVID-19 CASES IN US, UK AND KOREA



Source: The Statistics of the WHO COVID19 Dashboard & «Vaccinations» Our World in Data.

The Korean government had not expected that vaccines would be developed within the year of 2020. Even in the 2021 budget proposal submitted last September, the cost of COVID-19 vaccines was not indicated; instead, the cost of advertising the K-quarantine was arranged as 120 billion KRW(US\$101.7 million).⁷ Since the administration began purchasing the vaccines too late, they had no choice but to buy them at higher prices.⁸

Due to the delay in COVID-19 vaccines, it is estimated the loss will be immense. At the end of 2020, KERI (2020) reported its research findings on the economic effects of the delay in vaccination program. In this research, the timing of when the vaccines are introduced and the scale of the spread of COVID-19 followed by its reproductive number were set for each scenario, then used the computational general equilibrium (CGE) model to estimate the damage caused by the virus. The reproductive number means the average number for the number of positive cases infected from one COVID-19 patient, and if this index surpasses 1, the increasing trend continues, while if it goes below 1, it is understood as the decreasing trend. As of December 2020, the reproductive number was in the range of 1.00-1.28.

Table 7. **DAILY CASES BY SCENARIOS, TIMING OF VACCINATION, TIMING OF ERADICATION**

	Daily cases prior to vaccination	Reproductive number	Timing of vaccination	Timing of vaccination for ordinary people	Timing of COVID-19 eradication
Standard scenario (optimistic)	337		1 st quarter of 2021	2 nd quarter of 2021	3 rd quarter of 2022
Scenario 1 (proliferation)	1200	1.29	1 st quarter of 2021	2 nd quarter of 2021	4 th quarter of 2022
Scenario 2 (Dangerous)	1500	1.40	2 nd quarter of 2021	3 rd quarter of 2021	1 st quarter of 2023
Scenario 3 (very dangerous)	2500	2.60	2 nd quarter of 2021	2021	2023

Source: Summary based on KERI (2020).

⁷ For detailed information, refer to Newsis (2021).

⁸ Since the efficiency varies by vaccines, it is difficult to compare the prices in a uniform manner. However, the Astra Zeneca vaccines that Korea purchased last November are \$3~5 per dose, while those of Moderna are \$32~37; those of Pfizer and Janssen are \$19.5 and \$10, respectively, thus they are 3 to 7 times more expensive.

The standard (optimistic) scenario includes the maintenance of the number of cases at the level of the fourth quarter in 2020 (337 cases per day) and initiation of the vaccination program in the first quarter as in developed countries, which eventually would eradicate COVID-19 in the third quarter of 2022. Scenario 1 (proliferation) assumes the daily cases to be 1,200 while the vaccination program proceeds as the standard scenario mentioned above. Yet, COVID-19 will be eradicated in the fourth quarter of 2022 in this scenario. Scenario 2 (dangerous) assumes the number of daily cases to be 1,500 and the timing of the vaccination program and eradication of the virus to be on quarter later than Scenario 1. Lastly, Scenario 3, which indicates the most severe danger, will experience the daily cases of 2,500, and although its vaccination program will begin at the same quarter as Scenario 2, the timing of eradication will be one quarter later than that.

Korea's 2021 economic growth rate can be deteriorated to -8.3% at the worst case (Scenario 3) depending on the delay on vaccines. While some of the developed countries would be able to build herd immunity from their vaccination programs in 2021, Korea's economic recession may become more severe in 2021 if the supply of vaccines continues to be delayed. KERI (2020) has suggested that it may turn out to be the opposite of the prospects made by the Bank of Korea, OECD and IMF, which had viewed the country's economy will experience a plus growth rate in 2021.⁹

Table 8. IMPACTS OF COVID-19 ON GDP BY SCENARIO

	Standard scenario (optimistic)	Scenario 1 (proliferation)	Scenario 2 (dangerous)	Scenario 3 (very dangerous)
2020	-1.8	-1.8	-1.8	-1.8
2021	3.4	0.0	-2.7	-8.3
2022	3.1	4.9	6.3	10.7
2023	2.7	3.6	4.2	5.7
2024	2.5	2.9	3.2	3.9

Source: KERI (2020).

Among the three scenarios, the most applicable one concerning the Korean government's plan to supply vaccines as of now would be Scenario 1. Under this scenario, the nation will experience a 0% growth in 2021 and a plus growth in 2022.

⁹ OECD made a prospect of Korea's 2021 economic growth rate to be 2.8%, and 3.4% for 2022 in its world economic forecast December 2020.

It is highly probable that the world's major countries with herd immunity in 2021 will experience a plus growth, while Korea would have to wait one more year to completely overcome COVID-19. If a sufficient amount of vaccines is supplied in the second half of 2021, there would be a huge rally in the country's economic growth in 2022. According to KERI (2020), a quarter delay of the vaccination program will result in an additional loss of the GDP in 2021 ranging from 48.2 billion dollars to 208.8 billion dollars. As the number of cases rapidly increases, social distancing guidelines will be intensified while vaccination continues to be delayed, then the nation's economic activities would be largely weakened.

5. CONCLUSION AND IMPLICATIONS

At the beginning of 2020, Korea was in the second-worst situation caused by COVID-19 after China; yet, with the systematic 3T application, the country has made a successful case in combating the virus. At this time when the nation's COVID-19 cases had peaked, Korea's rate of tracing reached 98%. For such tracing, it has to collect comprehensive personal information, including travel routes, phone call records, CCTV videos, credit card records and more.

While Korea regulates the protection of personal information at the same level as Europe's General Data Protection Regulation (GDPR), the nation allows the health authorities when it faces infection pandemic. As the access to personal information was restricted, tracing of COVID-19 patients lost its efficiency to the level of 70%. The silent spread by the non-identified patients prevailed in every corner of the country.

The Korean government has been gradually curbing the third wave of COVID-19 which began in December 2020. 400-500 new confirmed cases per day is continuously maintained in Korea. The number of confirmed cases is still relatively small compared to other countries, but the improvement is significantly lower compared to the US and UK, which already vaccinated many citizens, targeting herd immunity in the first half of this year. In the case of UK, the current rate of confirmed cases compared to the peak (December 2020) is around 1/10, whereas in Korea it is still around 40-50%. This means that the situation of restraining economic activities while keeping quarantine measures is prolonged, as the WSJ (2021) pointed out. The costs of the Korean government's failure to take precautions against vaccination could be substantial. There is a limit to appealing to patriotism and ensuring that quarantine measures are followed for long time. People are complaining of serious fatigue after taking measures for longer than a year. Without the vaccination program and herd immunity, the fourth and fifth waves can break any time.

There are no vaccines without side effects, and no vaccines that have complete and consistent immunity levels. Therefore, building herd immunity followed by the consistent preventive measures is the key to overcoming COVID-19. According to

the research by KERI (2020), one quarter delay in vaccination can result in a greater loss on the national economy than the costs for purchasing the vaccines. Thus, even if the vaccines are costly, purchasing them is the best solution today.

Lastly, the authors would like to mention the vaccines' role as public goods. As the countries who have paid the investment costs are the first ones to receive the vaccines, the argument that the vaccines must be public goods certainly has its point. COVID-19 does not discriminate against a small country, a wealthy country, or a poor country. If not eradicated globally, it can always come back. Pharmaceutical companies are not charities, but international organizations, such as the WHO, must stand up to supply vaccines for underdeveloped countries at reasonable prices.

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