

KOREA INSTITUTE OF PUBLIC FINANCE

# KIPF

## Policy Research Series

**2022 June Vol. 7**

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# Fiscal Policy After COVID-19

Hyun-A Kim\*

## I. Changes in the Social, Economic and Fiscal environment after COVID-19<sup>1</sup>

### 1. Major changes in society and economy after COVID-19

#### A. Characteristics of social and economic changes after COVID-19

##### 1) Changes in the spread of infectious disease in Korea and in the world

The crisis caused by COVID-19 is markedly different from those caused by other infectious diseases and economic crises to date, especially in terms of the scope and scale. In terms of the pathological impact caused by the spread of this infectious disease, the infection rate of COVID-19 is lower than that of SARS and its mortality rate is higher than that of MERS. In addition, COVID-19 spreads at a rate incomparable to the ripple effect and decrease in demand confined in some regions caused by SARS and MERS.<sup>2</sup> Since the first infection was reported in December 2019, COVID-19 has spread at a rapid rate all over the world, and the WHO declared it to be pandemic in March 2020. As of today (October 2021), about 20 months

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**1** This summary has been extracted and summarized by the parts written by Hyun-A Kim from the research report (Kim et al., *Direction of Tax and Fiscal Policy according to Changes in Fiscal Environment after COVID-19*, 2021).

**2** McKibbin and Fernando (2020), p. 1.

after the declaration, the pandemic is still going on (the cases cumulative total, the deaths cumulative total, and total vaccine doses administered are about 240 million, 4.89 million and 6.54 billion, respectively). Even as the public health authorities around the world have worked together to develop a vaccine, the pandemic has never come to an end.<sup>3</sup> Even if the rate of infection has been slowed and the loss of lives has decreased since vaccines were supplied in earnest, it is still possible that COVID-19 would progress into the n<sup>th</sup> pandemic due to the occurrence of new variants. Though the rate of increase in the cases cumulative total and the death cumulative total shows a slight decline, we cannot be sure about the scale of the spread of infectious disease, together with an improvement in economic recovery, in light of the fact that the cases cumulative total is of great importance in the U.S. and Europe. As of October 20, 2021, the cases cumulative total in Korea was 347,523, and it is highly probable that the cases cumulative total in Korea would continue to increase due to variants, such as Delta, etc. ahead of the living with COVID-19 in November.<sup>4</sup>

## 2) Major social and economic changes

COVID-19 has had an effect on the daily lives of people around the world, among which has been the “acceleration of conversion to contactless activities and the digital economy” due to the requirement for social distancing and blockades by countries around the world. According to the records of the ministerial meeting for Korea’s New Deal Policy, online platform-based contactless companies with massive data and contents grew rapidly, as the contactless economy developed.<sup>5</sup> In response to COVID-19, the concept of “social distancing” has been implemented in a full scale, resulting in working from home, online education, contactless treatments, etc., which commenced in 2020, have all become common practices. Remote medical services have increased in developed countries, such as the U.S., China, the U.K., etc. Furthermore, as it is allowed for doctors to counsel patients over the

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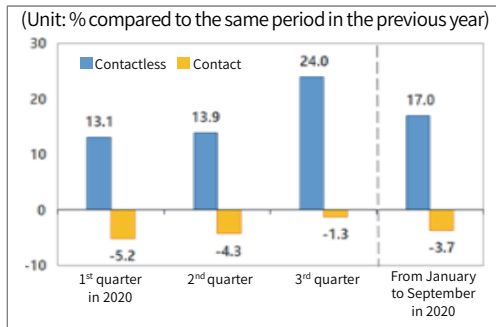
3 WHO, WHO Coronavirus (COVID-19) Dashboard, “<https://covid19.who.int/table>,” <https://covid19.who.int/table> (accessed on October 19, 2021)

4 “Jeong Eun-geong, the Head of Korea Central Disease Control Headquarter (Commissioner of Korea Disease Control and Prevention Agency) stressed that “currently, the Delta variant virus spreads all over the world and it is expected that it would become a prevalent variant of COVID-19 which would account for about 90% of cases cumulative total in Europe and the U.S., etc. by the end of August. The Delta variant virus may be more infectious and difficult to be controlled. However, experts propose the same method to control its spread.” (『Medical News』, 『Rapid spread of Delta variant virus... 153 cases in last week』, 2021. 7. 6., <http://www.bosa.co.kr/news/articleView.html?idxno=2154214>, accessed on October 19, 2021)

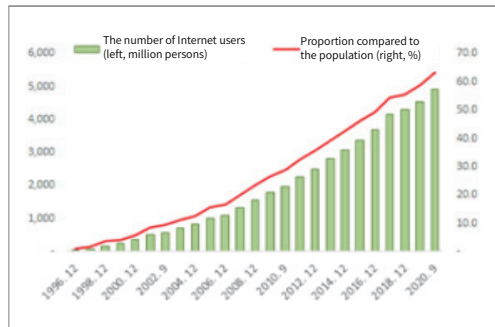
5 Korean Government (November 19, 2020), p. 1.

phone on a temporary basis, the number of such consultations has increased from 454 thousand cases at the end of June 2020 to 947 thousand cases at the end of October 2020.

**Figure 1\_Rate of change in contact and contactless payments by quarter in Korea**



**Figure 2\_Number of internet users in the world (1996-2020)**



Material: Related ministries, “Plans for revitalization of contactless economy in preparation for the post COVID-19 era,” 2020. 11. 19., p. 1; p. 2.

Source: Bank of Korea, World internet Stats.

In terms of impact on the economy, the Asian financial crisis in 1998 and the economic crisis in 2008 occurred due to regional economic causes. In contrast, the COVID-19 pandemic has fallen under an unprecedented and extensive economic crisis umbrella, leading to a rapid decrease in economic activities, such as the simultaneous disruption of supply and demand around the world, etc.<sup>6</sup> These changes in the daily lives of people around the world have made the future of vulnerable social groups more unstable. In addition, it has been difficult to predict the outcomes of the quarantine and monetary and fiscal policies of various countries, as exit strategies remain uncertain.

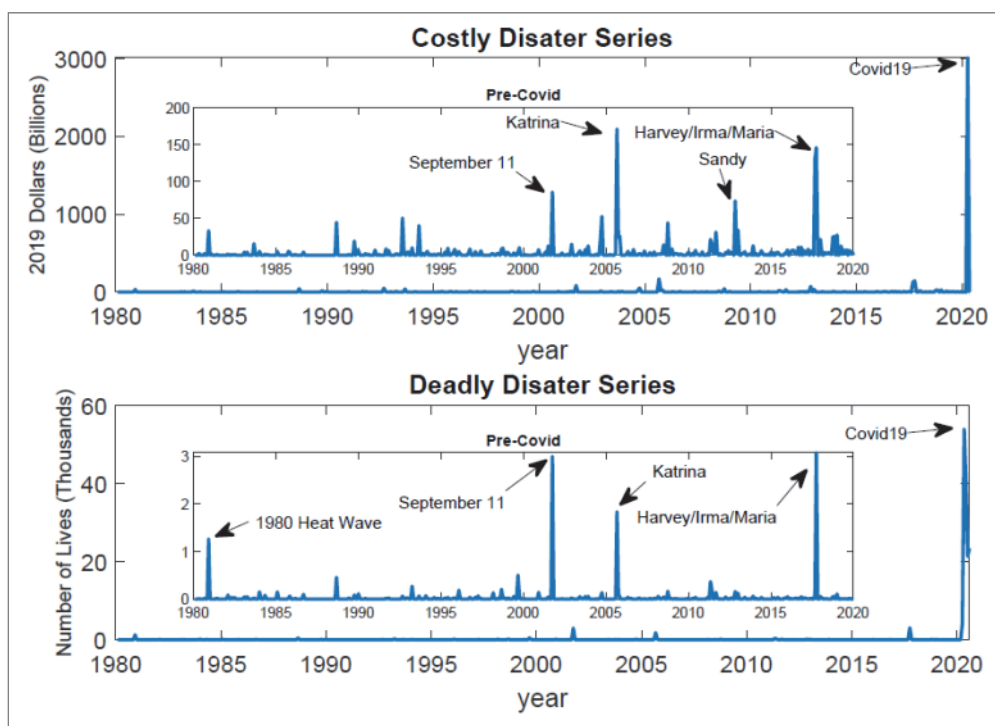
It has been shown that the COVID-19 pandemic, where the loss of lives continues to increase and the economic impact is in progress, exceeds both the Great Depression and the Second World War in terms of the loss of lives and economic impact.<sup>7</sup> Ludvigson et al. (2020) showed that the ripple effect of the COVID-19 pandemic has been unprecedentedly enormous compared to other crises in the U.S., with its huge social and economic impact, compared to the heat wave in 1980 in the U.S., the September 11 attacks, Hurricane Katrina in 2005, etc. This research assumes that, even if the U.S. provided large-scale stimulus packages against the COVID-19 pandemic, its economy would slump for 12 months from March 2020, in the

<sup>6</sup> McKibbin and Vines (2020), p. S298; Baqaee and Farhi (2020), p. 2.

<sup>7</sup> Baker et al.(2020)

following ways: a 20% reduction in industrial production; a 39% decrease in the service section; and a 55% drop in employment.<sup>8</sup> Fernandez (2020) explained that the COVID-19 crisis threatens not only low-income countries but also the world as a whole, and that the demand itself would become stagnant due to the external effects caused by disruptions in the global supply chain under an unprecedentedly low interest rate.

Figure 3\_ Estimation of expenses and casualties caused by disaster crises in the U.S. from 1980 to 2020



Source: Ludvigson et al. (2020), p. 3, Figure 2. Cited.

<sup>8</sup> “But unlike a conventional natural disaster shock, the Coronavirus(COVID-19) shock is a multi-period event that simultaneously disrupts supply, demand, and productivity channels, that is almost perfectly synchronized within and across countries, and that has cataclysmic health, social, and economic implications not just for the foreseeable few weeks after the crisis, but for a long time period”, “A linear model may underestimate the effect of large shocks”(Ludvigson et al. (2020), p. v; p. 16)

## B. Status and analysis of quarantine measures against COVID-19 in major countries

### 1) Contraction of total supply and demand according to the government's quarantine measures

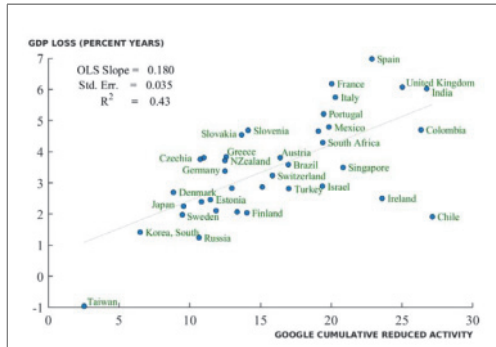
Due to the COVID-19 pandemic, most countries have taken a number of quarantine measures, such as social distancing, blockades, etc. in attempts to prevent the infectious disease from being spread. The corresponding decrease in the demand and supply caused by the compulsory blockade of contact economic activities subsequently resulted in the global macroeconomy to be shrunk sharply. Bonadio et al. (2020) stated that the decrease in the total demand caused by the COVID-19 crisis reminded them of the importance of the global supply chain. Céspedes et al. (2020) found that bipolarization was aggravated, as the unemployment rate worsened and the asset prices soared simultaneously. Using DID methodology, Gupta et al. (2020) showed that even if the economy shrank even before the blockade, the social distancing initiatives and blockades (e.g., any business close (ABC), stay at home (SAH), etc.) affected the unemployment rate, working hours, and income more than ever before.<sup>9</sup>

Based on a literature survey conducted for 1 month from Mar. 20, 2020, this research showed that the employment rate fell by 1.7%, from when the government continued to take quarantine measures for 10 days. The analysis of unemployment insurance claims showed the following. The employment rate decreased by 12% from January to April 2021, even if it is difficult to know whether the employment rate decreased due to the government's blockade or for other voluntary reasons; of this 12%, the social distancing accounted for about 60% and the remaining 40% reflected a falling trend at a national level. On the other hand, it was verified that the extent of economic damage caused by the reduction of total demand and total supply was proportional to the scale of existing economic activities. In Fig. 4 and Fig. 5, respectively, based on Google, Fernandez-Villaverde and Jones (2020) illustrated that the extent of damage was proportional to the scale of existing economic activities and that, in countries with large-scale economic activities, infectious diseases were spread and more people died of infectious diseases in proportion thereto.

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<sup>9</sup> This analysis showed that they affected the labor more than a decrease in the labor had an effect on the reduction of working hours.

**Figure 4** Relationship between Google-based cumulative economic activities and loss of GDP



**Figure 5** Relationship between the number of COVID-19 casualties and reduction of Google-based economic activities



Source: Fernandez-Villaverde and Jones (2020), p. 23, Figure 13; p. 25, Figure 15.

## 2) Analysis of quarantine measures against COVID-19 in major countries and their effect on the shrinkage of economic activities

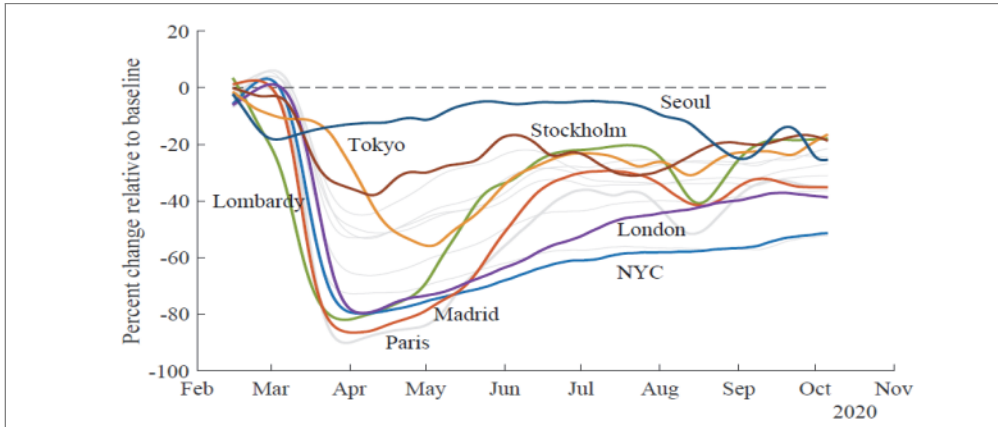
International comparative studies in response to the COVID-19 crisis classify Korea as one of countries that have taken relatively excellent quarantine and economic measures. Loayza and Pennings (2020) classified Korea as one of excellent cases, based on their response to the COVID-19 crisis, and recommended that other countries would be able to apply the basic principles, even if they would not be able to take the same measures as Korea.<sup>10</sup> Fernandez-Villaverde and Jones (2020)<sup>11</sup> classified Korea as one of the countries with a low level of economic impact and deaths caused by the COVID-19. Korea has shown that it had not suffered from serious economic impacts, and that the cumulative total number of cases was controlled to a low level. As in Taiwan, it was considered that Korea's lesson learned from SARS and MERS helped it to respond to the COVID-19 crisis. The reduction in Google-based mobility shows a positive correlation with an increase in the unemployment rate in a relevant country. In addition, in most studies with focus on the U.S., the Google-based mobility values are used as a variable for economic contraction caused by COVID-19.<sup>12</sup>

<sup>10</sup> Loayza and Pennings (2020), p. 5.

<sup>11</sup> The Google-based mobility measurement was used to estimate an extent of the economic loss Fernandez-Villaverde and Jones (2020, p. 33).

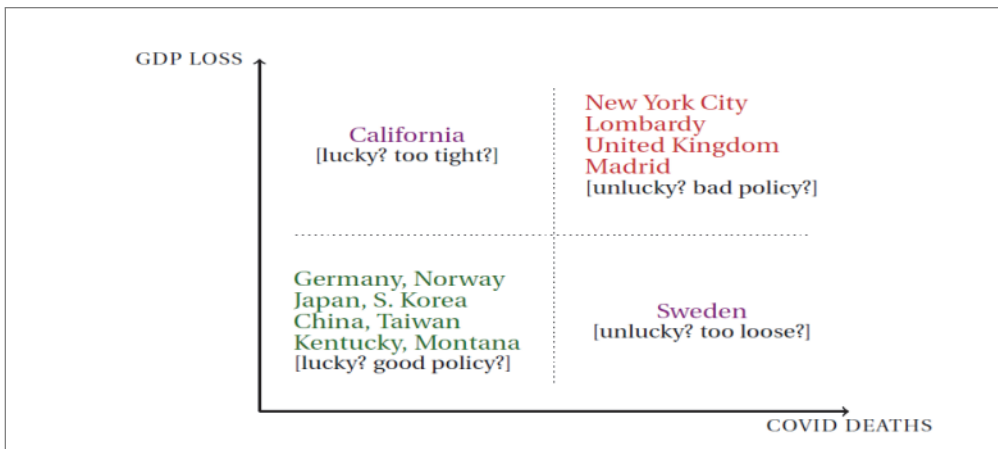
<sup>12</sup> Chen et al. (2020) has used the number of UI claims and Google-based mobility as indexes of economic impact.

Figure 6\_Changes in shock to Google-based economic activities in major cities since February 2020



Source: Fernandez-Villaverde and Jones(2020), p. 21, Figure 10.

Figure 7\_Relationship between the number of deaths and economic loss caused by COVID-19



Source: Fernandez-Villaverde and Jones (2020), p. 2, Figure 1.

Fernandez-Villaverde and Jones (2020) reported that most countries show a proportionality between the number of cases cumulative total and the extent of economic impact, with only a few exceptions that include California and Sweden. This study stated that California suffered from a severe economic decline compared to the number of deaths (too tight), whereas Sweden suffered from a large number of deaths compared to the extent of economic decline

(too loose). While most countries imposed economic blockades based on the number of cases cumulative total, California imposed the blockade on a large scale at an early stage of infection. Accordingly, California could decrease their number of deaths by blocking the path of the spread of the infectious disease at an early stage. On the other hand, Sweden suffered from a large number of cases cumulative total compared to the relatively small extent of economic loss due to somewhat looser quarantine measures.

Chen et al. (2020) examined the relationship between a government's blockade against COVID-19 (coercive policies, non-pharmaceutical indicators (NPIs)) and the voluntary change of people (voluntary behavior). This study showed that people began to voluntarily restrain from moving (in March and April) even before governments imposed legally compulsory measures. Rather, the relationship between people's voluntary movement and economic contraction<sup>13</sup> is meaningful in terms of statistics. However, it was impossible to confirm the meaningful correlation between the government's NPIs and the economic contraction. This lack of clear correlation could be construed to mean that, where a voluntary quarantine environment is not created based on social solidarity and trust, the effect of economic recovery through vaccinations and fiscal efforts could be lost, even if the compulsory quarantine measures are released. This means that the NPIs could not be a perfect shield against COVID-19, as suggested by European countries. In other words, the people shall also make voluntary efforts, such as a conversion to contactless activities, etc. in attempts to prevent infectious diseases from being spread. In addition, it would be impossible to bring infectious diseases to an end only with the government's intervention, as the economy could not be recovered immediately, since people would not move for a substantial period of time, even after NPIs are released. It would take a while for the people to perceive that they are safe, and that their voluntary cooperation shall be required to further prevent infectious diseases.<sup>14</sup>

### C. Effect of national institutions on crisis management capability

Acemoglu et al. (2005) mentioned, in the "Handbook for Economic Growth", the significance and effect that the national institutions has on its economic growth, and explained that it would be no more a noble discovery that the institution and governance could have an

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<sup>13</sup> This study used "UI claims", "electric usage", etc., as indicators for economic contraction.

<sup>14</sup> On the other hand, Mulligan (2020) proposed the necessity to additionally analyze the economic damage and reduction of infectious diseases, pointing out that it is required to evaluate the opportunity of a shutdown.

effect on the economic growth in the long run.<sup>15</sup> The characteristics of the national institutions influence not only the economic growth but also its crisis management capability. Of developed countries, Korea minimized its economic shock without imposing an economic blockade. In May 2021, the Center for Devices and Radiological Health (FDA) reported that one of key success factors is the crisis management system in central-hospital-regional institutions based on the cooperation of citizens.<sup>16</sup>

In particular, this infectious disease crisis helped a political conflict come to the surface. Each state in the U.S. is different in how sensitive it responded to the infectious disease, as the response depending on its own political position. The differences and problems in the crisis management governance in each state pointed out that the vaccination rate was low and that the proportion of cases cumulated total was high in states where the approval rating of Trump was high in the last presidential election in 2020. In reality, Biden won the election in 22 states that had a high vaccination rate.<sup>17</sup> Many press reported that the high mortality rate of the U.S. is not irrelevant to the Red-Blue divide that currently threatens its public health system. According to the Centers for Disease Control and Prevention (CDC), the mortality rate differs three times or more depending on the vaccination rate.<sup>18</sup> Thus, even if the vaccination rate is low in the U.S.—due to various reasons—it is possible to find a constant pattern between the vaccination rate and political inclination in states. Thus, from experiences in the U.S., this study assumes that the political inclination is not irrelevant to the governance of infectious disease crisis management.

In addition, the capability and governance of local governments, which is an important enforcement agency in overcoming a quarantine crisis, are explained as key variables. The OECD (June 2020) viewed the Switzerland response to COVID-19 as being interesting. Switzerland, which is a decentralized country with a sophisticated political and administrative system, displayed the following method of decentralized quarantine administration. In terms of medical serviced, the central government took charge of centralized administration, and in terms of testing and vaccine supply, the central government procured them for the local governments (Canton) to distribute. Italy is a good example of the combination of a centralized and decentralized procurement approach, and is introduced as a case in which the

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**15** Acemoglu et al. (2005), ch.6.

**16** “Specifically, the central government collaborated closely with state governments and the private sector to establish testing locations and to implement standardized testing procedures”(FDA CDRH, May 2021, p. 17)

**17** Domenico Montanaro (June 9, 2021)

**18** Yonhap News Agency (July 6, 2021)

central government shall, in principle, procure the majority of goods, leaving regional governments to take charge of procuring additional supplies, to a certain degree. Germany, Austria, and Switzerland are representative of decentralization between the central government and local governments. They share the following characteristics: they share borders, they are closely linked in terms of culture, they have a similar population size, and they have a mandatory national health insurance and health care system. However, they may have different decentralization systems and exit strategies.

## **2. Change of fiscal environment after COVID-19**

### **A. Asymmetric impact of COVID-19 depending on fields and economic levels**

#### **1) Asymmetric impact within and among countries**

In April 2021, the IMF analyzed the following: the economic impact caused by COVID-19 is asymmetric depending on gender, education level, region, and industry; a policy is thus required, which is more active and sophisticated than a simple redistribution with a focus on the reduction of income inequality through the expansion of salary expenditures. The OECD then confirmed that the extent of damage caused by the pandemic and the national capability to respond thereto would be very different depending on the structural and institutional vulnerability of countries in overcoming the impact caused by the pandemic.<sup>19</sup> On average, the number of days when schools were closed in developed countries was less than that in developing countries and emerging countries. In addition, the number of days when schools were closed tended to increase with parents having a smaller income and lower education.<sup>20</sup>

Park Chang-hyeon et al. (2020) focused on the differentiated impact among sectors within and among countries and its effect on the economy, and then stated that “the growth inequality among countries is being deteriorated among countries as follows: the effect of impact is differentiated depending on the difference in quarantine management, fiscal flexibility, etc. of developed countries and emerging countries; and countries with heavy weight of IT exports recover faster than other countries.” Adams-Prassl et al. (2020) explained that there is a great difference in not only the economic impact in most countries but also an economic impact

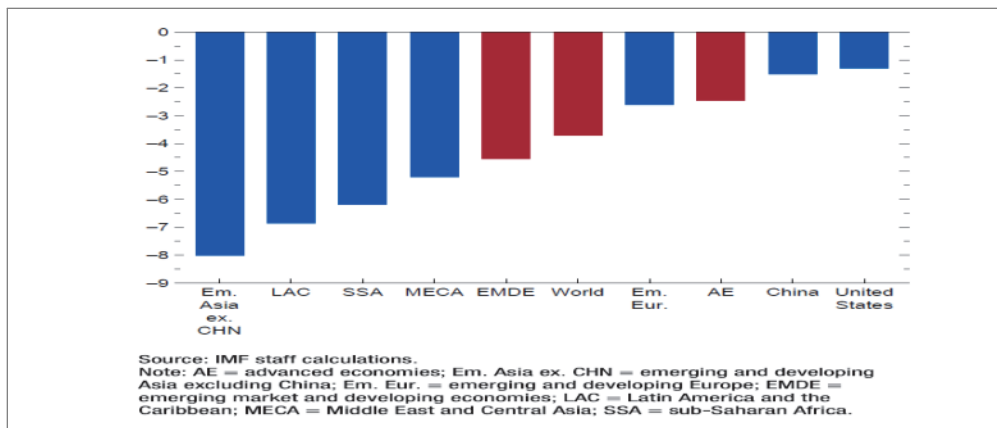
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<sup>19</sup> “The regional and local impact of the crisis has been highly asymmetric within countries”(OECD, 2020. 6., p. 4)

<sup>20</sup> Yoon Seung-joo et al. (2021. 4.), p. 24.

among countries in terms of their extent.<sup>21</sup> By the second quarter of 2020, the extent of damages caused by infectious diseases was different among developed countries, emerging countries, and developing countries in their early stages. A GE model analysis of the World Bank (WB)<sup>22</sup> predicted that the GDP would, before and after COVID-19, fall as follows: by 2% globally; by 2.5% for developing countries; and by 1.8% for developed countries. The WB analyzed that developing countries would be more vulnerable to this infectious disease than developed countries due to the following causes: 1) poor administrative capability in terms of health care; 2) high proportion of non-regular employment; 3) poor financial markets; 4) insubstantial fiscal scale; 5) low level of governance, among other causes. Accordingly, each country has different fiscal means. Thus, the WB advised that it would not be desirable for countries with a poor tax base to enforce fiscal stimulus packages.<sup>23</sup>

Figure 8\_World Economic Outlook (as of January 2021)



Source: IMF “World Economic Outlook Update: Policy Support and Vaccines Expected to Life Activity,” 2021, 1., p. 5, Figure 4.

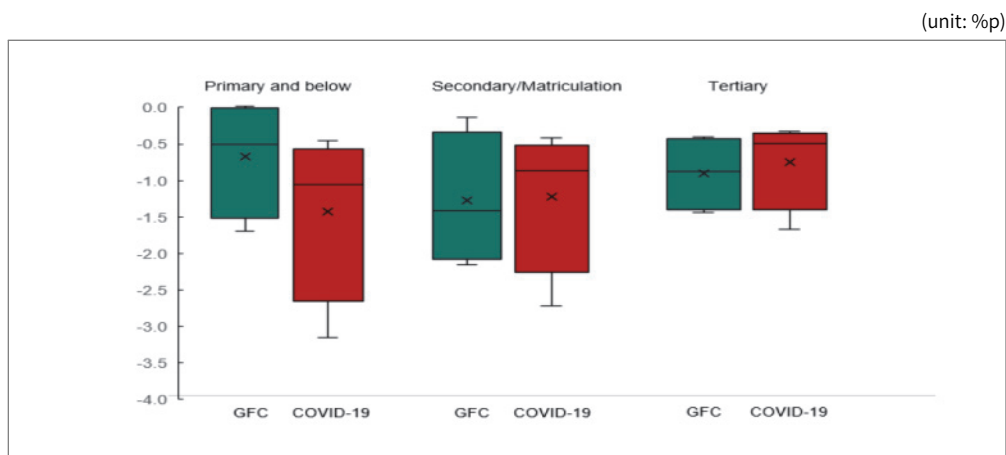
<sup>21</sup> “The impacts of the COVID-19 crisis are large and unequal within and across countries” (Adams-Prassl et al., 2020., p. 1)

<sup>22</sup> his study predicted that, according to the scenario at issue, it would fall up to 4% and 6.5% for developed countries and developing countries, respectively (Maliszewska et al., 2020)

<sup>23</sup> The efficacy of fiscal stimulus also depends on fiscal space and institution quality” (Loayza and Pennings, 2020, p. 6)

The IMF (WEO, 2021. 1) showed differences in employment rates by education level in Asian countries by comparing the employment rate at the time of the financial crisis and the employment rate during the COVID-19 crisis. It was found that, in most Asian countries, people with lower education were more vulnerable to external impacts in both the financial crisis and the COVID-19 crisis. In particular, it was found that the employment rate fell much more for people with lower education during the COVID-19 crisis compared to the financial crisis. Thus, it was confirmed that people with a lower education suffered more from the risk of unemployment caused by economy fluctuations. In addition, Tsvetkova et al. (2020) reported, based on the findings of analysis of MSAs, that large cities with a high proportion of non-regular employment were more exposed to the employment impact.

**Figure 9\_Differences in employment rates by education level in Asian countries at the time of COVID-19 compared to the financial crisis**



Source: Jurzyk et al., "COVID-19 and inequality in Asia: Breaking the vicious cycle," IMF Working Paper, No. 2020/217, 2020, p. 15.

## 2) Asymmetric impact by individuals and industry

Many studies show that the economic impact caused by COVID-19 is asymmetric per individuals and industry. In light of the fact that the ICT industry represented by PANDA (PayPal, Amazon, Nvidia, Disney, Alphabet, and Google) is in an upward trend and that major companies in Korea have enjoyed an increase in operating profits, we must also pay attention to asymmetric growth trends caused by a change in the industrial structure. Abay et al. (2020) showed, based on real-time materials obtained from Google Search, that an industry that is

based on face-to-face sales after quarantine measures of each country were implemented underwent a severe crisis, whereas the demand rose sharply in ICT-based industry and delivery-related fields.<sup>24</sup> The supply in these fields was reduced due to various quarantine measures (social distancing, blockades, etc.) of the government. Such a reduction occurs through routes such as a decrease in consumption due to unemployment and the wage reduction of consumers, contraction of economic activities of individual economic subjects to prevent infection, etc. The voluntary reduction of economic activities and governmental measures used to prevent the infection of COVID-19 sharply contracted the supply and demand in a short period of time. Meanwhile, the demand expanded in contactless-related industries.

In an analysis based on the data from the U.K., Hacıoglu-Hoke et al. (2020) showed the following. People with income in the top 25% cut down their consumption (by 45%) more than their income decreased, whereas people with an income in the bottom 25% cut down their consumption the least though their earnings decreased the most. On the other hand, the overall incomes of the population decreased less than their earnings decreased, due to an increase of transfer payments from the government.<sup>25</sup>

Chiou and Tucker (2020) explain the following: working people having a high income have access to high-speed internet infrastructure. In this case, social distancing can be highly effective and thus economic loss could be minimized; however, most low income working people are placed under a face-to-face labor environment and thus they are unable to highly accept quarantine measures. Adams-Prassl et al. (2020) stated that where an environment for working from home is inadequate<sup>26</sup>, workers with no college degree were highly vulnerable to unemployment. In many countries, the lower the proportion of a contactless working environment, the more the economy suffered. In addition, the vulnerable population who needed to maintain a high degree of face-to-face working environments (females, workers with insufficient experience, immigrants, etc.) suffered greatly. Yassenov (2020) showed that, as an environment of working from home is inadequate for the low-educated, youth, and immigrants, a group with secure jobs and a group without secure jobs are in different employment environments. Dingel and Neiman (2020) stated, based on their findings of

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<sup>24</sup> “COVID-19 is expected to have a broader negative impact on economies while also inducing a reallocation of activities across sectors, where some sectors gain, and others lose” (Abay et al., 2020. 6., p. 3)

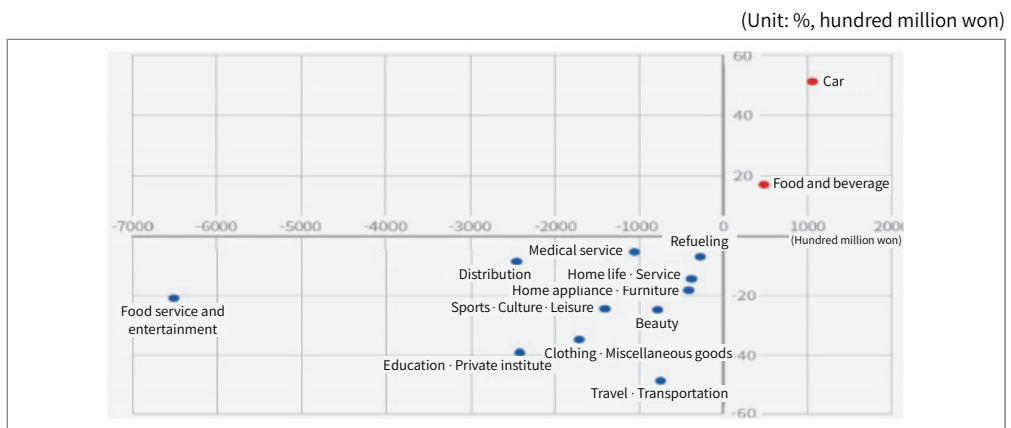
<sup>25</sup> This is based on data from Fintech App users.

<sup>26</sup> Chen et al. (2020)

review of feasibility of working from home, that only about 37% of all workers could effectively work from home. Thus, Béland et al. (2020) explained that many workers with a low income would lose their jobs in the short or medium-term (job status risk).<sup>27</sup> Barrero et al.(2020) viewed that the labor market is now being reorganized due to the pandemic (reallocation of labor: ranging from freelancer writers, to workers in a restaurant that could deliver its foods). However, it would be correct to construe that the low-wage labor market is becoming more vulnerable.

Hwang Soo-bin and Park Sang-soon (2021) pointed out that the gap between job seekers and recruiting companies deteriorated due to the mismatch in the labor market since COVID-19, and thus the labor productivity as a whole could fall due to the long-term unemployment of the vulnerable, the ineffectiveness of labor allocation among industries, etc. They posited that the gap prevalent in a labor market could further deteriorate after the economic crisis, and that such deterioration was occurring in the labor market in Korea. By analyzing credit card data, Lee Jae-yoon (2020) showed the following. Sales have increased in the car, food, and beverage industries, whereas sales have fallen sharply in the food service, entertainment, and travel business industries.

**Figure 10\_Rate and amount of change in sales of the self-employed (Seoul)**



Note: Based on how much credit cards had been used in Seoul from Feb 17, 2020 to Mar. 29, 2020.

Source: Lee Jae-yoon, "State and implication of blockade to suppress the spread of COVID-19," *Issues and Arguments*, Vol. 1702, National Assembly Research Service, 2020. 4. 24., p. 3., [Table 3].

<sup>27</sup> Paradoxically, Brynjolfsson et al. (2020) showed that people who work from home filed more UI claims compared to workers who commute in a traditional way.

## B. Fixation of unbalanced growth due to the bipolarization of income and assets

The fixation of bipolarization is the most apprehensive change in terms of the fiscal environment after the COVID-19 crisis. Even before the COVID-19 crisis, it was predicted that bipolarization would deteriorate due to the continuance of low-growth and changes in the industrial structure. Most research voiced concern that COVID-19 would widen the scope of bipolarization and accelerate the speed thereof. Indeed, the contraction of economic activities caused by COVID-19 had a direct impact on the poor and the vulnerable in terms of employment and residence, whereas COVID-19 had only an indirect impact on high-income jobs based on ICT. Thus, anxiety about the expansion and movement between classes grows worse.

Adams-Prassl et al. (2020) showed, through the results of a survey, a pattern of impact on the labor markets in the U.S., the U.K, and Germany. In particular, females, people with no college degree, youth, the vulnerable, and the working class were more severely affected. It was analyzed that Germany, where the social security system was relatively well established, survived the crisis better than the U.S. and the U.K. in terms of not only the number of cases cumulative total but also bipolarization. In particular, the U.S and the U.K, which are Anglophone countries, experienced a substantial decrease of employment and a large reallocation of employment due to the pandemic. It is thus deemed necessary to understand how movement in the labor market caused by such an external impact and the effect among institutional factors would act after the pandemic.<sup>28</sup>

Angelov and Waldenström (2021) analyzed the effect of the pandemic based on the data from the Swedish tax agency and showed that the monthly wage income fell more for workers in the public sector compared to their counterparts in the private sector. In particular, the wage fell more for female workers. In this respect, in January 2021, the IMF stated that there is a need to relieve wage reception conditions for workers in transition and for the recipients of transfer payments, as an alternative to relieve the pressures of bipolarization.<sup>29</sup>

In relation to unskilled laborers in Asian countries, Jurzyk et al. (2020) showed the following. These workers were more exposed to serious infectious diseases than skilled laborers were, and that their working hours were reduced sharply.<sup>30</sup> On the other hand, the consumption scale was reduced sharply for skilled laborers in comparison to their

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<sup>28</sup> Adams-Prassl et al. (2020), p. 9.

<sup>29</sup> IMF (2021. 1.), p. 10.

<sup>30</sup> Jurzyk et al. (2020), p. 19.

consumption before the pandemic. Thus, they argued that there is a need to provide additional supports in order to relieve the bipolarization using targeted policies that are different from policies for professionals or skilled workers and unskilled workers.

According to the U.S. Federal Reserve Board, the net assets of households and NGOs in the U.S. have increased by 6.8% in the 2nd quarter of 2020, compared to the previous quarter, which was an all-time high. And about 71% of such net assets are retained by the top 20% of high-income earners.<sup>31</sup> Even in Korea, as the interest rate is maintained at a low level, the prices of assets, such as housing, stocks, etc. are rising, and the gap between the rich and poor is widening.<sup>32</sup> Deaton (2020) stated, in a parliamentary statement, that the pandemic would deepen the income bipolarization among the races and in the educational gap in the U.S. In particular, the statement emphasized that the gap in health care and the income between classes would be widened depending on the educational level.

On the other hand, Deaton (2021) subsequently suggested that there would be room to narrow the income gap among countries due to COVID-19. As the income could be reduced more in countries having a large economic scale, the international income inequality could be reduced as a result, and the wealth would be able to be reorganized. To this end, the transfer payments of governments have played a role to narrow the gap in the Gini's coefficient among countries, even before the COVID-19 crisis. This trend increased after the COVID-19 crisis in 2020. In this regard, Deaton (2021) stated that the U.S. is a representative case, and noted that existing developed countries have all been relatively economically affected. Aspachs et al. (2020) deemed that the wealth may be redistributed due to the COVID-19 crisis.<sup>33</sup>

In conclusion, this study deems that the wealth could be redistributed internationally in a short term in an effort to respond to the impact of the COVID-19 crisis, as suggested by Deaton (2021) though it would be more possible for the bipolarization to be deteriorated among and within countries, as the recovery is delayed in countries having poor global supply chain infrastructure.

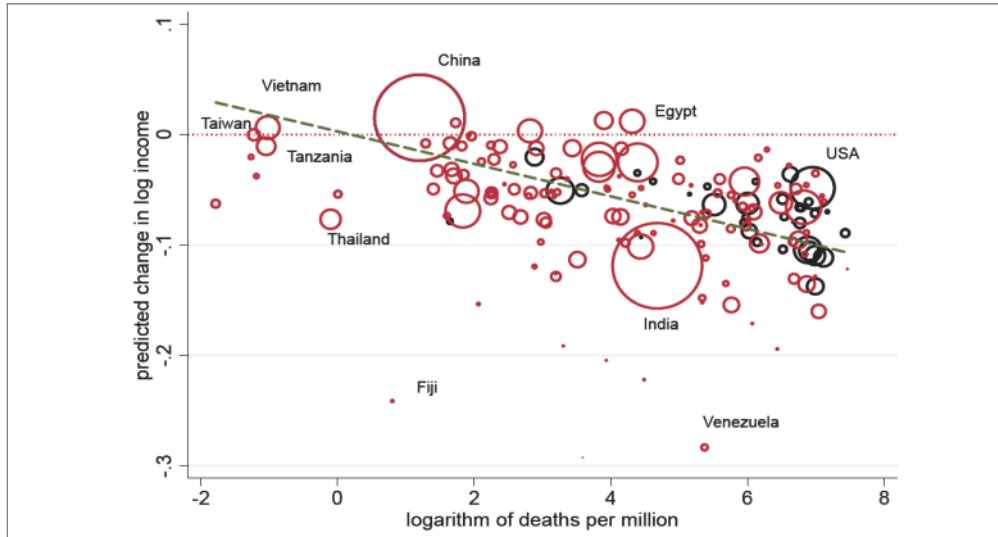
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**31** Korea Institute of Finance (2020), p. 18.

**32** Park Seong-wook (2021), p. 29.

**33** Deaton (2021, p. 16), "The pandemic has made most countries worse off, and there has almost certainly been an increase in global poverty. But that implies nothing about global inequality"; Aspachs et al. (2020), Figure 3. "Evolution of the Gini index for pre-transfer and post-transfer incomes (February–May 2019–2020)," <https://voxeu.org/article/income-inequality-and-welfare-state-during-covid-19> (accessed on March 7, 2021)

**Figure 11** Relationship between change in income level by country and number of deaths from COVID-19



Source: Deaton (2021), p. 11.

## II . Diagnosis of Response to COVID-19 Crisis in 2021 and the Ex-ante Evaluation of Structural Fiscal Risks since 2022

### 1. Recent fiscal conditions and prospects

In terms of economic outlook, the IMF (WEO, 2021. 10b) adjusted its global economic outlook a bit downward (5.9%, which fell by 0.1%p compared to July) for the first time in 2021.<sup>34</sup> Major countries have endeavored to recover their economy with large-scale fiscal commitment since the COVID-19 crisis, and such endeavors reached their peak in the second quarter of 2021. It seems that the economy would continue to recover as the economy has rallied since the third quarter. However, as the Delta variant spread rapidly and it was subsequently predicted that the pandemic would continue to exist, developed countries adjusted their outlook downwards compared to their outlook in July. For example, the Korea

<sup>34</sup> IMF (WEO, 2021. 10.); Yonhap News Agency(October 10, 2021)

forecast was as follows: the economy would grow by 4.3% in 2021, and would grow by 3.3% in 2022, a decrease of 1.0% compared to 2021.

It was predicted that the Korean economy would continue to recover, even in the third quarter, due to the rising of the vaccination rate, increase of exports, etc. This prediction is based on the fact that the outcome of the fourth quarter of 2020 was better than what was forecast in the winter of 2020, and reflects increases in the supply of vaccines, foreign trade, etc. In July, the IMF published the WEO update, predicting that the economy would grow by 4.3% and 3.4% in 2021 and 2022, respectively, which were adjusted upwards by 0.7%p and 0.6%p, respectively, compared to previous predictions. In September 2021, the OECD published its Fall Economy Outlook report and adjusted its prediction further upwards, that the economy would grow by 2.9% (from 2.8%) in 2022 and by 4.0% (from 3.8%) in 2021. For reference, the IMF predicted that the global economy would grow by 5.9% and 4.9% in 2021 and 2022, respectively, whereas the OECD predicted that it would grow 5.7% and 4.5% in 2021 and 2022.<sup>35</sup>

In September 2021, the OECD showed that the developed countries have recovered their economic growth to a level similar to that before the pandemic, since the second quarter of 2021. In addition, in the first quarter of 2021 it was shown that Korea recovered to a level of GDP immediately similar to that before the crisis, due to financial and fiscal supports that included a scale of 310 trillion won in 2020.<sup>36</sup> However, the OECD recommends that each country maintain a degree of fiscal expansion until 2021, in light of the facts that a gap in employment by industry is still serious in most countries and that emerging countries and developing countries with insufficient vaccines still suffer from slow economic growth.<sup>37</sup> In particular, the gap in employment by industry was predicted to be widened even before COVID-19, due to low-growth, digital transition, etc. This study deems that the financial and fiscal policies should continue to pay attention to this narrowing of the gap in employment, the response to employment conversion, etc. in the future.

On the other hand, it is also predicted that the government should further expand its expenditures, notwithstanding an increase of tax revenues due to the maintenance of

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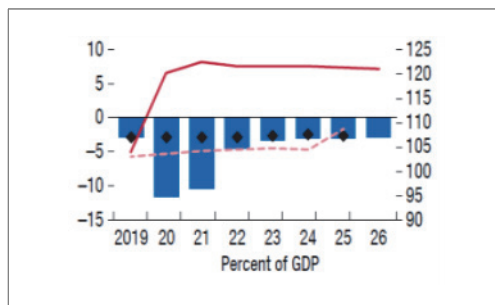
**35** As to the G20, the previous prediction was adjusted upwards for France, Italy, and Spain whose economy had turned down severely. It was adjusted due to the effect that the European economy as a whole would grow by about 1%p from the previous prediction. The economy of the U.S. and the U.K. were analyzed to fall by 0.5~0.9%p compared to the previous prediction (OECD, 2021. 9., p. 4, Table 1 ; IMF, 2021. 10a; IMF, 2021. 10b)

**36** Korean Government (Related ministries), 2021. 6., p. 1.

**37** IMF, *Fiscal Monitor*, 2021. 4.

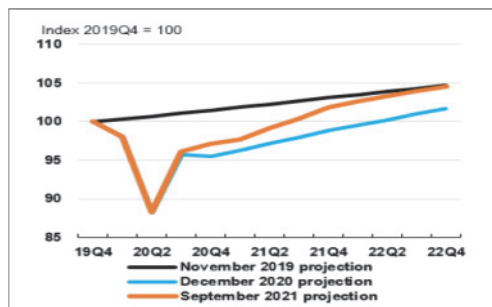
economic recovery. It seems that it would be inevitable for developed countries to accept deficit financing in light of the possibility of additional government interventions. Since 2020, the average ratio of government debt to GDP of developed countries has risen to 120%, and this level is expected to be maintained for a substantial period of time. The rate in which the government debt increases in Korea is not fast in itself, but a trend in which the rate is accelerated is the fastest among countries due to its population structure and fiscal rigidity. In September 2021, the OECD predicted that some countries including Korea would suffer from a fiscal loss higher than that before the pandemic. In addition, the OECD predicted that, even if the average amount of government debt in Europe would decrease to about 92% of the GDP in 2026, the amount of government debt would increase in the medium term in Korea and the U.S.<sup>38</sup>

**Figure 12\_ Comparison of GDPs of developed countries by the IMF**



Source: IMF, *Fiscal Monitor*, 2021. 4, p. 2.

**Figure 13\_ Results and prospects for economic recovery as well as prospects for government debt and balance of the G20**



Source: OECD, *OECD Economic Outlook*, Interim Report 2021. 9., Figure 10., p. 13.

Currently, major countries including Korea shall establish a short and medium-term expenditure frameworks to balance the “risk of debt increase” and the “risk of inequality caused by reduction of fiscal support”. The short-term purpose of fiscal commitment is to provide support for unequal incomes and industries; its medium-term purpose is to reduce fiscal losses by accelerating the economic recovery, i.e. to develop a structurally virtuous cycle. In April 2021, the IMF reported that the substantial fiscal commitment of each country has played a decisive role in the recovery of the economy against severe economic contraction,

<sup>38</sup> IMF, *Fiscal Monitor*, 2021. 4.; Korea Institute of Public Finance (2021), p. 6.

decrease of jobs, substantial social costs, etc.

In August 2021, however, the Bank of Korea showed a signal of economic recovery by raising its Base Rate and stated that it would adjust its monetary policy depending on the economic situation after it would decide to “freeze the interest rate” in October.<sup>39</sup> It seems that the monetary authorities would determine whether to adjust the economy through the monetary policy depending on the economic situation, because the unemployment and inequality could deteriorate due to the slowdown of economic recovery. The fiscal authorities stated, in their 2020 budget and the national fiscal management plan, that they would manage the gross budget as follows: they would continue to expand gross expenditures until 2022, and that the rate of increase in the gross expenditures would be adjusted downwards gradually depending on the progress of economic recovery.

In conclusion, the monetary and fiscal authorities stated their intent to tighten the budget as early as November 2021 and after 2023, respectively. It seems that the fiscal policies may be switched based on the potential economic recovery in the first half of 2022.<sup>40</sup>

It was deemed that an important policy judgement shall be made in 2022 due to the following reasons: the pandemic has not yet come to an end; and it is expected that factors of the economic crisis, such as the abrupt rise of energy prices, aggravation of inflation, rise in exchange rates, employment instability, etc. would continue even after the third quarter of 2021. In particular, it is feared that inflation would deteriorate due to large-scale fiscal commitments, and concern remains pertaining to the effect of inflation on the economic recovery.

Since the economic crisis in 2008, the economy has continued to be stagnant due to low prices; this risk of inflation works as a signal to warn of a change of the economic environment in developed countries. Economic experts predict that the economic recovery will be delayed, because the supply chain is only being slowly restored due to tapering in the U.S., the risk of China, the possible further spread of the Delta variant, etc.<sup>41</sup> As vaccines are supplied and the

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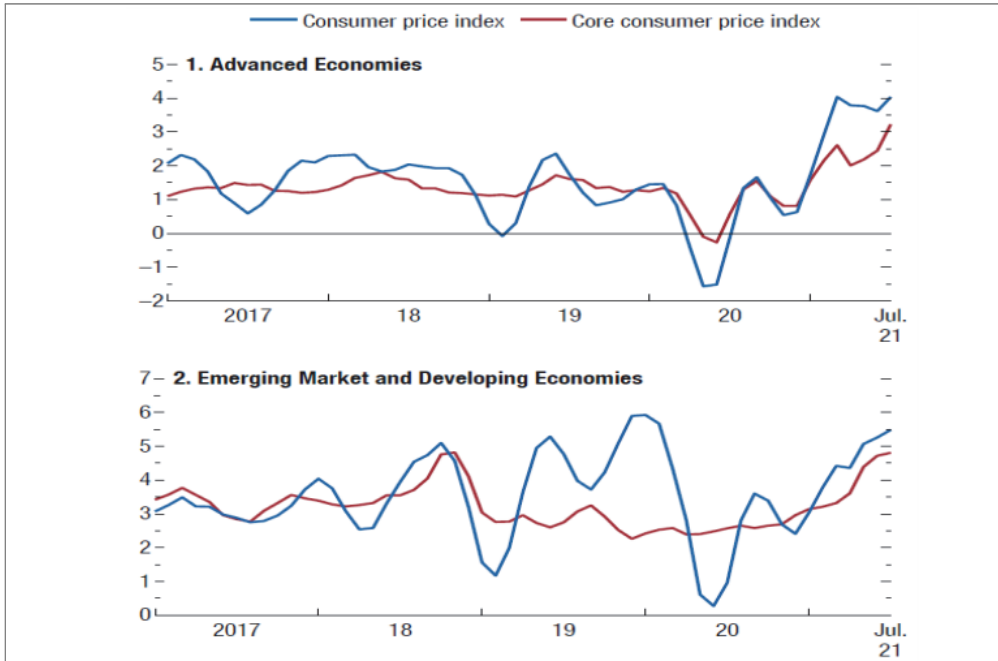
<sup>39</sup> Bank of Korea, 「The Bank of Korea freezes its Base Rate at 0.75% per annum」, 10. 12.; Even if it continues to be uncertain in relation to the COVID-19, it is expected that the domestic economy would continue to grow and that inflation would exceed 2% for a while. Thus, a loose monetary policy will be adjusted accordingly” Bank of Korea, 「Resolution for Monetary Policy of the Monetary Policy Board」, 10. 12.

<sup>40</sup> Korean Government, “2022 Midum Term Expenditure Framework (MTEF)”, p. 12.

<sup>41</sup> “The downward revision for 2021 reflects a downgrade for advanced economies—in part due to supply disruptions—and for low-income developing countries, largely due to worsening pandemic dynamics ... the rapid spread of Delta and the threat of new variants have increased uncertainty about how quickly the pandemic can be overcome, policy choices have become more difficult, with limited room to maneuver” (IMF, 2021. 10b., p. 15; World Economic Outlook, 2021. 10.)

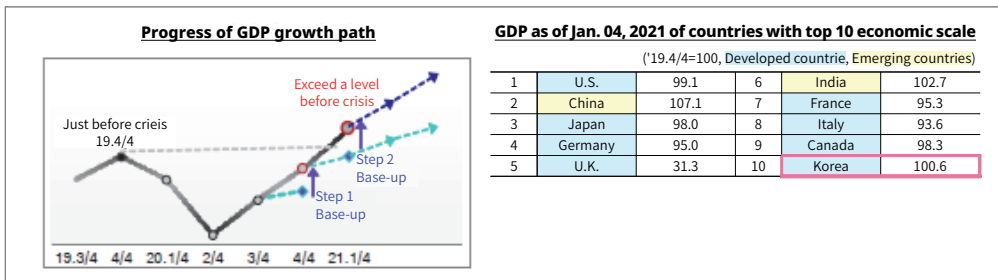
possibility of living with the coronavirus is implemented in earnest, the global economy will eventually recover. Nevertheless, there is a need to urgently implement relevant financial and fiscal policies in order to respond to unprecedented economic growth paths and uncertainties.

Figure 14\_Change in progress of inflation in developed countries and emerging countries



Source: IMF, WEO, 2021. 10b., p. 9 Figure 1. 9.

Figure 15\_Progress of growth of GDP and economic recovery in the first quarter of 2021 in Korea



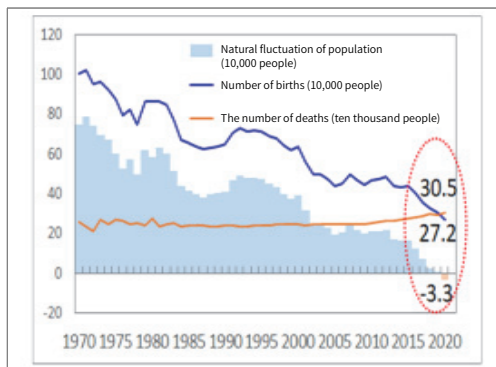
Source: Related ministries, “Main contents of the direction of economic policy in the second half of 2021,” Press Release, 2021. 6., p. 1.

## 2. Fiscal risks caused by change in population structure

Korea faces the following risks in terms of fiscal affairs: fiscal impairment caused by changes of the population structure; low-growth caused thereby; and an increase of fiscal risks in the medium and long-term. In terms of international comparisons, the fiscal affairs of Korea are evaluated to be relatively sound, though there are medium and long-term risk factors, such as an acceleration of aging, a decline of the potential growth rate caused by labor rigidity, etc.

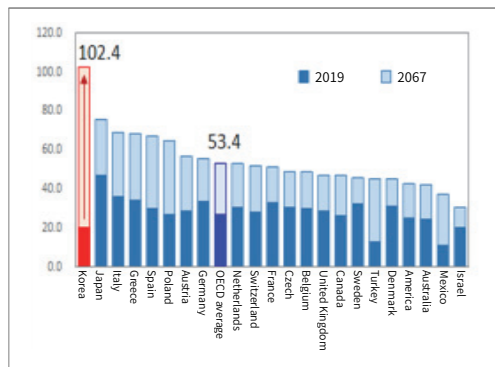
The “Change of population structure and response thereto” published by the Korean government in July 2021 analyzed three population risks, including population decrease, local extinction, and impending superaged society would reach their peaks in 2020.<sup>42</sup> In particular, a so-called “population dead cross” where the population itself decreases occurred in 2020, as the decrease in the number of births far exceeded the increase in the number of deaths. It is anticipated that if this trend continues, the population would decrease by 1.2 million people around 2067, which is 50 years after 2019. Korea is the only country in the OECD that records a birth rate less than 1 (0.84 in 2020). Furthermore, this decreasing trend has continued for 3 consecutive years, to recover the birth rate remains difficult due to the insecurity of jobs, delays in marriage, etc. since the COVID-19 crisis.

Figure 16\_Natural population fluctuation



Source: Related ministries (2021. 7), p. 1, citing figure.  
Raw materials: Statistics Korea, 「Census」.

Figure 17\_Comparison of dependency ratios for the aged in major countries



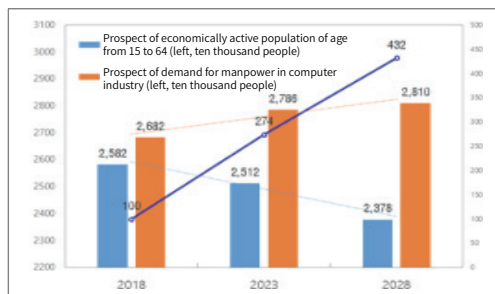
Source: Related ministries (2021. 7), p. 4, citing figure.  
Raw materials: Statistics Korea, 「Census」.

<sup>42</sup> Korean Government (2021. 7.)

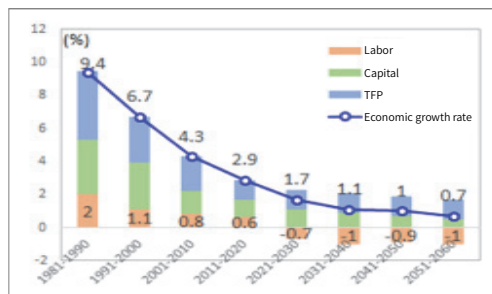
The decline of economic vitality due to rapid aging would cause the productivity of Korean economy to fall and to subsequently cause the burden of government expenditures to increase, even before the COVID-19 crisis. The natural decrease of the population is being accelerated and it is not likely for the birth rate to rebound in the near future. Thus, it is expected that the burden of government expenditures would increase even more. Korea's Old-age dependency ratio (=the population over the age of 65/the population of ages from 15 to 64) would rise by about 81.9% in 2067 compared to that in 2019, which would be the largest increase in the world. Due to this change of the population structure, the social security expenditures would increase rapidly in terms of government expenditures and the potential growth rate would deteriorate in terms of the economy as a whole. As the size of the economically active population continues to decrease, the total factor productivity falls. Thus, the government needs to implement for countermeasures in a multilateral manner. However, for this task, the government needs to devise far-reaching and sophisticated fiscal policies, such as the analysis of scale, fields, speeds, and effect of fiscal expenditures, etc. rather than stating somewhat vague arguments, such as the need to secure sustainability, etc.

In terms of the forecast for the social security field, the fiscal balance would record a deficit and the funds of the national pension are likely to be depleted in the near future (deficits in 2044 (3rd time) and 2042 (4th time) and depleted in 2060 (3rd time) and 2057 (4th time)). As the population of the aged grows, the expenditures for health insurance would increase as well. In addition, it is expected that the fiscal burden would subsequently increase, as the number of recipients grows in terms of the pensions for public officials, pensions for private schools, and veterans' pensions.

**Figure 18\_Prospect of excessive demand for manpower**



**Figure 19\_Prospect of potential growth rate**



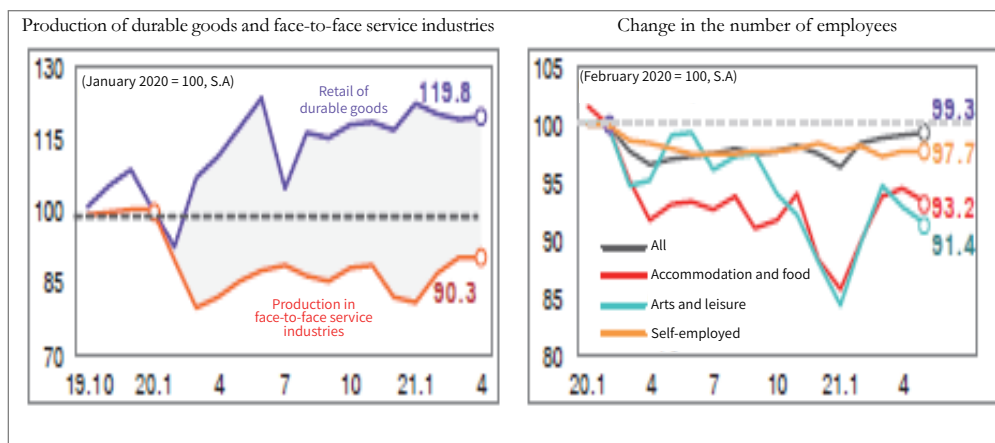
Source: Related ministries, 2021. 7., p. 5, citing figure.

Raw materials: National Assembly Budget Office, "Ministry of Employment '18-'28 Medium and long-term prospect for supply and demand of manpower," 2020.

### 3. Fixation of asymmetric growth by field

It seems that Korea overcame an economic crisis after the COVID-19 pandemic in a period of about 1 year, in terms of its economic growth rate as a whole. It may be deemed that the economic impact was relatively insubstantial compared to other developed countries, because the number of cases cumulative total and the number of deaths were relatively controllable, and that the government made fiscal commitments in an active manner.

**Figure 20\_Rate of recovery of durable goods and face-to-face service industries in Korea and changes in the number of employees by sector**



Source: Related ministries, 「Main contents of the direction of economic policy in the second half of 2021」, Press Release, 2021. 6., p. 3.

In terms of impacts by field, it seems that not all industries and classes were equally benefited from the government's fiscal commitment. The recovery rate by industry differs greatly in not only Korea but also in other OECD member countries. In particular, the recovery rate is slow in the employment field, compared to other fields.<sup>43</sup> Even in developed countries, low-paid workers—most of who are engaged in face-to-face service industries—tended to be more exposed to economic impacts than highly-paid workers who could work in a contactless manner. For example, the gender salary gap in Korea was the biggest among the OECD member countries even before the COVID-19 crisis. Furthermore, the following would deteriorate due to the revitalization of contactless work: heavy burden

<sup>43</sup> OECD, 2021, p. 17 Infographic 1. Key facts and Figures.

of housework and child rearing on females, and proportion of economic activities based on face-to-face services, among others. In terms of the sales and the number of employees in manufacturing and service industries in Korea, an industry with a high proportion of small and medium-sized self-employed has yet to recover from the impact.

As to why the economy has not recovered quickly in a specific field, two possibilities exist in relation to the direction of fiscal policies. First, the fiscal resources might not be provided sufficiently, such that the impact caused by economic measures for quarantine could be overcome. Second, even if fiscal resources were provided, they were not provided for fields in need thereof, and thus the fiscal commitment did not bring about sufficient effectiveness. The purpose of emergency fiscal commitment is to support face-to-face service industries. The fiscal commitment is not sufficient for this field; rather, unequal growth becomes permanent due to the increase of demand for a contactless industry.

As shown in the recovery after enormous fiscal commitment was implemented for each country since 2020, even if the fiscal expansion is important, it is more critical to secure the effectiveness of the fiscal commitment. There is a need to establish a mechanism to allocate fiscal supports in a correct manner as needed, based on an active fiscal policy, in order to narrow the unequal gap among industries and to relieve bipolarization.

### **III. How to Improve the Fiscal Capability for Response to the COVID-19 Crisis and Economic Recovery**

In terms of policies implemented after the COVID-19 crisis, there remains a concern as to whether bipolarization has intensified in all fields. In terms of individuals, Korea experiences the bipolarization of wage income, widening of educational gap, and asset inequality. In terms of region, the following has become permanent: there has been an expansion of regions where the population has become extinct, and there has been a widening of gap between metropolitan and non-metropolitan areas. In terms of industry, it is highly evident that the economic inequality would become permanent due to the continuance of inequalities between the manufacturing and service industries. Ultimately, such economic inequalities could lead to the continuance of low-growth and a decrease of the potential growth rate.

This study deemed the following to be the desired direction of fiscal policies: 1) to improve the income redistribution, 2) to support the recovery of balance through resource reallocation

in unequal industries and, 3) to reorganize the fiscal system to minimize structural fiscal encroachment and thus secure fiscal sustainability. This study would propose the following in order to improve the fiscal capability in the medium and long-term.

## **1. Minimize fiscal encroachment through the restructuring of mandatory spending**

According to the total amount of finances specified in the 「2021–2025 Medium Term Expenditure Framework」, mandatory spending in the welfare field and the local transfer payments increased by 6.6% and 7.4% respectively, compared to the previous year. The local transfer payments increased by 7.4%, which is higher than the growth rate of the total amount of revenues and expenditures, such as discretionary spending (4.5%), total income (4.7%), total spending (5.5%), etc. According to the 「2022 Budget Bill」 and the 「2021–2025 Medium Term Expenditure Framework」, out of the 35 trillion won increase in mandatory spending in 2021 and 2022, 22 trillion won relates to an increase of “local subsidies and local education subsidies” and accounts for 64% of the entire mandatory spending. In terms of the scale of Fiscal expenditure, mandatory spending for the welfare field in the 2022 Budget Bill is 140 trillion won, and the local transfer payments amount to about 131 trillion won. In relation to the welfare expenditures, the demand for national finances has expanded with the “expansion of recipients” and “increase of unit costs.” As to the local transfer payments, the statutory local subsidy rate has increased in conjunction with an increase in demand for fiscal decentralization.

It seems that welfare expenditures shall be increased, in light of the fact that the income level has improved and the fact that national aging has continued. When compared with the welfare expenditures in developed countries, there is a need to show an increase to a certain degree in order to expand a foundation for welfare expansion by implementing a tax increase. On the other hand, there is also a need to discuss whether the local transfer payments shall continue to be promoted as they is promoted now, in light of the international comparison of the fiscal decentralization of revenues and expenditures, the outcome of local decentralization, and balanced development, etc.

Currently, 19.24% and 20.79% of internal taxes are transferred to local governments and local education offices, respectively, as local transfer payments, irrespective of the fiscal demand and the economic situation of local governments. Meanwhile, the transfer of national taxes to local taxes has increased due to the request for fiscal decentralization through such

transfers.

In 2018, the then-new government increased the local consumption tax rate (up to 31% of VAT, from the Presidential Committee on Autonomy and Decentralization) in accordance with the local decentralization roadmap. Then, at the end of July 2021, the Ministry of Public Administration and Security announced an agreement of the government and the ruling party to increase the tax rate by 4.3%p up to 25.3%.<sup>44</sup> Each and every administration has promoted local decentralization as an important agenda.<sup>45</sup> However, academic circles and experts stated that fiscal decentralization through continuous central fiscal encroachment had no effect on the expansion of tax autonomy, nor the securement of local finance autonomy.

The purpose of the local transfer payment was to relieve the centralization of the population in the metropolitan area, caused by rapid industrialization, and to provide equal opportunity for education. However, as compelling as such spending was as “legal expenditure”, it became a fiscal category too rigid to respond to changes of the population structure, nor could meet the demand for finances for diversified local education. The rigid spending structure of each fiscal category was thought to hinder the resource reallocation in an elastic way when taking a broad view. Indeed, as depressed regions continue to suffer from aging and low-growth, the demand for general national finances by local governments has also increased. In addition, even as the size of the school-age population has decreased over the last 20 years, the local subsidy has not yet been separated from the local education subsidy. Overall, this policy has almost never been changed on a national finance scale for elementary and secondary education and for higher education, notwithstanding this issue being raised repeatedly.

#### **A. Reorganize mandatory local transfer payments according to changes in fiscal environment**

Thus, factors that encroach on national finances should be reorganized by restructuring the mandatory transfer payments in order to secure fiscal sustainability. Currently, the local

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<sup>44</sup> Ministry of Public Administration and Security (July 28, 2021)

<sup>45</sup> Each and every administration attempted, as an important agenda, to increase the fiscal transfers between the central and local governments and to improve the system as follows: the Roh Moo-hyun administration (introduced a special account for balanced development); the Lee Myung-bak administration (introduced a local consumption tax, transferred a certain part of VAT to regions, increased tax rate from 5% in 2010 up to 21% in 2020); the Park Geun-hye administration (introduced block grants); and the Moon Jae-in administration (increased the local consumption tax rate up to 31% of VAT).

transfer structure, which amounts to about 40% of internal taxes, encroaches on the need to secure additional tax revenues. The central government may, as a way to secure an additional source of revenue, want to manage a source of revenue as a fund or as an earmarked tax rather than as tax revenue in order to secure a tax revenue effect. If the source of revenue other than tax revenue becomes too big, it might then be excluded from the public discussion in order to secure transparency and fairness in tax revenues, which would not be desirable from the taxpayer's point of view. Even if a source of revenue having the same scale is transferred to a local government, it would be desirable to transfer it in consultation with both the central and local governments. Thus, this study proposes the need to reorganize the mandatory local transfer payment structure every year, or at least every 3~5 years, in light of the annual economic growth and local financial demand.

The gap between the metropolitan and non-metropolitan areas continues to widen, and the population in undeveloped regions has decreased. In such circumstances, if the absolute scale of financial resources of local subsidies, which are general financial resources for non-metropolitan areas, is adjusted, it could be controversial in terms of politics and the economy. There is thus a need to maintain the absolute scale of local transfer financial resources until the people would feel the results of balanced development. However, this topic shall be examined again, by further understanding the demand for finances in undeveloped areas and the degree of financial benefits in metropolitan areas, including whether the transfer method shall be maintained as mandatory, as it is now.

## **B. Improve the efficiency and effectiveness by reallocating financial resources within educational finances**

The request for reorganizing local education subsidies has continued to be raised, due to the sharp decrease of the school-age population. It is expected that the number of elementary and middle school students will decrease from about 4.5 million in 2020 to 3.22 million in 2030. In light of the fact that the birth rate in 2020 was 0.84, it could be anticipated that the number of students would continue to rapidly decrease in the future. The Ministry of Education stated that the local education subsidy that falls under the educational finances for elementary and secondary education would improve the quality of education so that individuals could develop their competency by growing each child and re-educating each adult.<sup>46</sup> However, about 77.2%

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<sup>46</sup> Ministry of Education, "Review of Restructuring and Operation of Local Educational Finance," September 21, 2020 (internal materials).

of the educational resources in 2022 fall under the local education subsidy (64.3 trillion won out of the education budget of 83.2 trillion won in 2022). Its asymmetric scale against various education demands, such as higher education, lifelong education, vocational education, etc. must be improved. Educational demands, such as remote learning, etc. are now being further diversified due to COVID-19. In addition, the demand for lifelong education and the demand for re-education are increasing due to the increase of its aged population and the 4th Industrial Revolution, respectively. Thus, there is a need to re-establish the existing paradigm, by focusing on the financial resources for elementary and secondary education in conjunction with the life cycle education roadmap. Even in developed countries, policy agendas include the support of higher education in order to relieve labor market entry barriers by narrowing the gap in remote learning after the COVID-19, reinforcing re-education, etc.

In fact, the government has not greatly intervened in the budget of education offices, and local governments have tended not to overly consult popularly-elected superintendents of education, since they are elected by popular vote. As such, this can enable a barrier of the local education subsidy that focuses on the support for elementary and secondary education to be removed, which can be used to provide finances for higher education, lifelong education, etc. It is difficult to deem that it would be a fundamental solution to do nothing about the current rate of the local education subsidy and simply adopt the early childhood education support special account. The overall framework of educational finances, which provides a certain proportion of internal taxes only for primary and secondary education, can shift so that the needs for future-oriented education, such as higher education, lifelong education, vocational education can be reflected. As a conclusion, there remains a need to render political determination to lead a national consensus by selecting a viable alternative for education funding, in order to connect the change of population structure with the demand for future education requirements.

### C. Prepare for fiscal risks by reforming national finances for social security

The total tax (tax and social security burden) rate has been rising fast in Korea due to changes in the population structure and welfare expenditures.<sup>47</sup> The total tax rate is the proportion of tax and social security contributions (including health insurance, employment

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<sup>47</sup> As in fiscal year 2019, total tax rate of Korea and OECD were 27.7% and 33.8%, respectively (Kim Wan-hee et al., 2021, p. 8)

insurance, etc.) in the GDP. This burden also means that the per capita contribution of social security field to national finances has been accelerated. On the other hand, balance in social security continues to deteriorate, as the expenditure increases more to reinforce the guarantee of health insurance, the employment safety net, etc. This is why national fiscal support has also increased for eight social insurances, such as health insurance, employment insurance, etc.

Where the existing social security system is to be maintained without change, even in a situation that the aging trend, change of industrial structure, low-growth, and economic crisis would persist, it is expected that a proportion of expenditures for population aging, such as a guarantee of income for the elderly, etc. would increase after the public pension system is well established. Existing studies have proposed the inclusiveness of recipients, including the removal of blind spots, the efficiency of the delivery system, the effectiveness of expenditures, etc. in order to guarantee the sustainability of the social security system.<sup>48</sup> This plan falls under the improvement of the social security system itself, and is significant in terms of developing the infrastructure for social security before the system comes to maturity. However, this plan fails to propose an answer for ‘how’ to guarantee the sustainability of the social security system.

Under a situation in which the population structure is changed, the national income level improves and the economy becomes unstable, it is inevitable for national finances to be used to contribute more to the social security system in order to relieve the national burden. For sustainable national finances, there is a need to discuss the financial burden for social security from a broader perspective, such as the “social security tax”, etc. The government, as a primary party, shall consider solving these problems by increasing taxes. In addition, the people and the National Assembly shall agree as to specific alternatives and implementations thereof, as to who shall bear the additional tax burden, how such burden shall be initiated, and how much of such burden shall be born.

## **2. Secure sustainability and reliability by regulating national finances**

The fiscal challenge that is encountered by developed countries is how to manage the sustainability of national finances after committing national finances on a large scale to respond to COVID-19. The reliability of national finances assessed by a market can be

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<sup>48</sup> National Assembly Budget Office, 2020. 6., p. 3.

expressed as a sovereign credit rating in the short term, and is manifested as a recovery of economic fundamentals in the medium and long-term. Where a market trusts the national finance exit strategy of a country, the country is able to raise financial resources on favorable terms in an international market and thus secure more fiscal margins. Korea may be less sensitive than other developed countries that have incurred enormous additional debts since COVID-19. However, there is a need to pay attention to an effort to guarantee fiscal reliability in consideration of interest burden and additional financing in the current fiscal environment where it is uncertain how to improve revenues and the fiscal expenditures continue to increase. This study deems that it would have a direct effect on a fiscal margin of the country to secure the reliability of mid-term exit strategy for the national debt that has increased sharply in the last 5 years.

#### **A. Secure the market confidence on the medium-term fiscal plan**

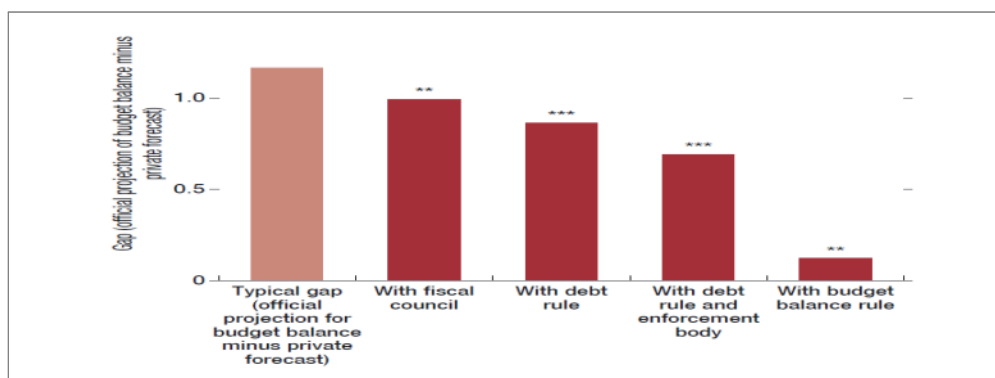
A medium-term fiscal plan becomes important while the economy attempts to recover after the COVID-19 crisis, because it is closely related to the exit strategy for normalizing national finances. A medium-term fiscal plan for 5 years includes the prospect for economic growth, margin for revenues, trends of increases of fiscal expenditures, debt level, etc. The plan falls under the official national prospect, which proposed an exit strategy for normalizing the national finances after the economy recovers. The plan includes the following: the prospect for the population structure to guarantee a sustainable fiscal margin; when to secure revenues under the economic prospect; sequential fiscal expenditures, etc.

In October 2021, the IMF stated that the medium-term fiscal plan, including fiscal regulations, could have an effect on the reliability of an official national prospect. In general, the economic prospect and fiscal balance prospect of private institutions are more pessimistic than those from the government. This means that they are different, in terms of their confidence on the medium-term plan of the country. Thus, the more a fiscal balance in the medium-term fiscal plan announced by the government is reliable, the more the prospects of private institutions would converge on the government figures. Fig. 21 illustrates the fact that, if the rules for fiscal balance operate, both prospects would not differ greatly. The IMF cited the following as to what determines how much the market trusts the government's official prospects: existence of a fiscal committee, rules for debt, rules for fiscal balance, etc.

A fiscal expenditure plan, including economic prospects, revenue estimates, future population prospects, etc., shall be accurate in order to guarantee the predictability of government prospects. Notably, however, the revenue estimate has been subject to

controversy every year. A long-term fiscal prospect announced by the government and a prospect made by the National Assembly Budget Office shall be supported with a persuasive analysis. The confidence pertaining to a government prospect has an effect on the national credit rating, and thus on the expenses available for additional financing. In 2021, the national debt of major developed countries rose to about 100% of their GDP. This means that it was possible to issue government bonds on terms as being favorable, as there is public confidence in the government prospect. Most developed countries whose debt burden was increased rapidly since the COVID-19 crisis tend to specify, in their Medium Term Expenditure Frameworks, the following: revenue and expenditure plans; debt repayment plan, etc.

**Figure 21\_ Effect of Fiscal Rules and Medium Term Expenditure Frameworks on the confidence of official prospects of fiscal balance**



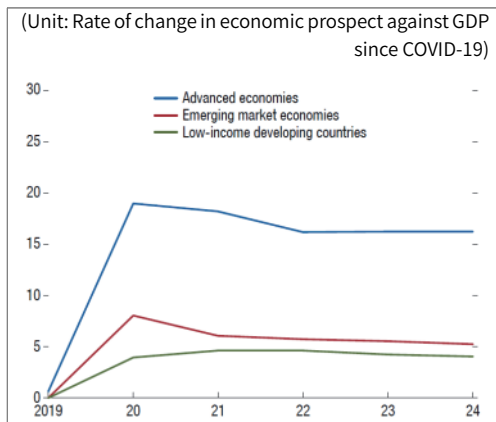
Source: IMF, *Fiscal Monitor*, 2021. 10a., p. 32., Figure 2.11.

## B. Empirical discussion on fiscal rule

Many studies have empirically analyzed effectiveness of fiscal rules, which has been a traditional subject. In the *Fiscal Monitor* (2021, 10a), the IMF conducted a panel analysis on 55 countries from 1970 to 2018, citing David et al. (2018). The IMF reported that the fiscal authorities regulate the debt level in accordance with the debt rule or deficit rule. The IMF empirically found that the fiscal authorities have endeavored to lower the ratio of debt against GDP by reinforcing a requirement for fiscal balance since the debt impact. Bergman et al. (2016) showed a trend to maintain a fiscal deficit, where the fiscal rule is enacted. Debrun et al. (2018) showed that the fiscal rule is highly correlated with a relatively good fiscal balance.

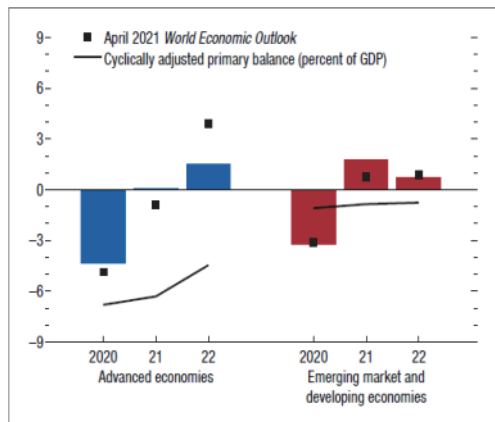
In contrast, Caselli et al. (2020) stated that countries with no fiscal rule exhibited a large fiscal deficit. In addition, many studies found that fiscal rules had almost no effectiveness. Thus, there is a need to examine arguments on both sides in an analytic way, from a perspective that focuses on how to explain the outcome of fiscal rules in an empirical way.

**Figure 22\_Change of general government debt since COVID-19**



Source: IMF, *Fiscal Monitor*, 2021. 10a., p. 3., Figure 1. 3.

**Figure 23\_Financial condition from 2020 to 2022**



Source: IMF World Economic Outlook, 2021.10b., p. 3., Figure 1. 5.

The debt rule has been discussed as being the most extensive, from among the fiscal rules since the economic crisis. It is expected that a debt burden that had been aggravated since the pandemic would continue to be maintained in not only Korea but also in other developed countries. If an economy cannot grow, it would be difficult to secure a sound fiscal space due to the burden of debt repayments. As examined in the empirical analysis, the national debt could explain how solid the fiscal management governance is in the relevant country. The better a sovereign credit rating is, the more a debt margin is. Thus, it is not assessed as if the fiscal affairs are not stable, even if the national debt is substantial. However, if the national debt is substantial, it could be difficult to respond with emergency finances, due to a limit to issue additional debts.

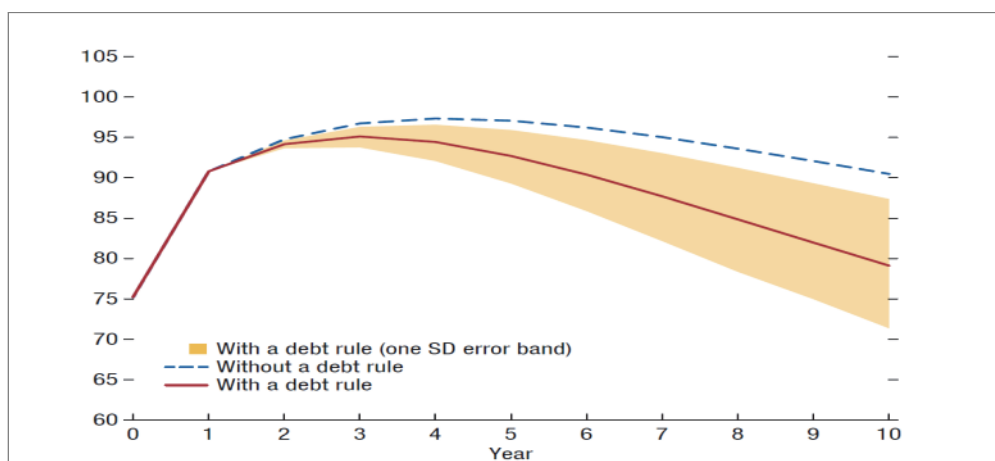
There have been situations referenced above in Asian countries due to the COVID-19 crisis.<sup>49</sup> In October 2021, the IMF stated that the existence of fiscal rules, such as debt rules,

<sup>49</sup> Jurzyk et al., 2020, p. 16, Figure 24.

etc. could have an effect on the speed at which debts temporarily increased are normalized again. Fig. 23 present what the IMF estimates and illustrates the change of fiscal conditions in developed countries and emerging countries to which measures to normalize financial affairs are applied.

As in October 2021, developed countries, including international organizations, have focused on follow-up measures that include retrenchment after providing enormous financial resources during the pandemic. It is expected that the liquidity would fluctuate and that the market prices would be unstable in almost every country. To this end, financial authorities in each country are attempting to develop a medium-term fiscal frame that includes a plan to repay the national debt under unstable macroeconomic conditions. For example, France's stability program (April 2021),<sup>50</sup> Germany's debt brake introduced in 2011, etc. show the application of fiscal management proposals in such a medium-term fiscal framework.

Figure 24 \_Development of fiscal stability after increase of debt



Source: IMF, *Fiscal Monitor*, 2021. 10a., p. 29., Figure 2. 9.

### C. Status of introduction of fiscal rules in Korea

The fiscal rules that the government proposed in 2020 include fiscal regulations used to

<sup>50</sup> France's stability program, <https://www.tresor.economie.gouv.fr/Articles/2021/04/14/presentation-du-programme-de-stabilite-2021-2027> (accessed on October 2, 2021)

maintain the expenditures and balance in a certain scope in order to adjust the rate at which debt increases. Korea is still counteracting the effects of COVID-19 as it tries to recover its economy. In addition, Korea continues to be under the pressure of expenditure increases caused by medium and long-term aging and the increased demand for welfare support. Thus, there is a need to regulate the financial affairs in a “top-down” and “bottom-up” manner. A so-called fiscal regulation from the top may be deemed as a fiscal rule, and a fiscal regulation from the bottom may be deemed to include a comprehensive fiscal system, such as revenues, expenditures, etc. The fiscal regulations from the bottom may deem that expenditures are limited within categories for fiscal expenditures, which give rise to the national debt as follows: 1) reinforce professional competence within the National Assembly to be able to adjust the rate in which mandatory spending increases; 2) restructure the soft budget fiscal structure between the central and local governments; and 3) reorganize a system that restructures similar and/or redundant projects. In conclusion, it would be reasonable to generally reorganize the fiscal system of Korea while discussing the fiscal regulation including the fiscal rule. In the meantime, the fiscal rules fall under the “means” in such a “process”.

In Korea, the fiscal rule was debated and may be introduced as follows. In October 2020, the government established “Korea’s Fiscal Rule” in an enforcement decree, to the effect that the government debt ratio, consolidated fiscal balance, and debt level shall be managed to remain within 60%, -3%, and 60%, respectively. The ruling and the opposition parties agreed on the necessity and grounds for the introduction of this fiscal rule, but were skeptical of making the rule into a law and the manner of how Korea’s Fiscal Rule was to be operated. When the legislation of Korea’s Fiscal Rule was announced in advance in October 2020, the ruling party worried that it would have a negative effect on the fiscal flexibility while overcoming the economic crisis. In addition, the opposition party also had concerns pertaining to the grounds of loose provisions, the formula, etc. therein.<sup>51</sup> If the fiscal rule is introduced as law, it would restrict the decision-making authority of decision-makers. Thus, many forecast that it would not be introduced as law due to its low economic feasibility.<sup>52</sup> The government expressed its apprehension that, in the case in which the fiscal rule is not introduced, it would induce a negative effect on the national credit rating.

Currently, Korea enjoys a relatively high rating in terms of its fiscal stability, based on the view of international credit rating institutions. However, it was reported that its aging (Fitch

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<sup>51</sup> Maeil Business Newspaper, October 26, 2020.

<sup>52</sup> Gwon Oh-seong, 2020, p. 15.

Ratings, Inc., July 22<sup>nd</sup>), rate of increase in debt of public enterprises (S&P, April 28<sup>th</sup>), etc. could threaten its sustainability and increase the rate of government debt.<sup>53</sup> Where an external evaluation is made to implement systematic financial management by legislating the fiscal rule, the fiscal rule could play the role of a shield that could offset the medium and long-term apprehension of credit rating institutions. In terms of the reorganization of institutions in Korea to meet these global standards, it is expected that the fiscal rule would be implemented in phases.

This study deems that the process to debate the fiscal rule on the premise of its introduction is important in itself, notwithstanding the fact that it is politically unlikely that the fiscal rule would be introduced and it is unlikely to be effective although it is introduced. This is because, in the process to debate over a formula in the fiscal rule, it would be verified in phases as to whether the sustainability of the Korean economy could guarantee the following: the credibility of Korea's economic prospects; the rate of increase of the population and welfare recipients; the elasticity of economic prospects based on changes of the population structure, etc.

### **3. Guarantee of the effectiveness of non-traditional fiscal and financial policies**

One of the characteristics manifest since the COVID-19 economic crisis is to actively implement a so-called “non-traditional fiscal and financial policy.” Representative non-traditional fiscal policies include “cash support,” “direct employment,” etc. The following fall under the traditional fiscal policies: income redistribution in revenues; resource reallocation through budget allocations; and adjustment of business support through fiscal commitments, etc. Cash support was provided for small businesses that suffered economically due to quarantine measures, employment safety nets, etc. The 1st stimulus check was provided to the entire nation, and the 5th stimulus check was provided to 88% of the entire nation. This was the first time for the government to provide cash to the entire nation directly, except for the provision of wage cash after selecting recipients by laws. Not only Korea but also other major developed countries provided individuals and households with cash to support their housing expenses, fuel expenses, etc.

Even under this financial policy, the “quantitative easing” has been introduced since the

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<sup>53</sup> Seoul Shinmun (July 10, 2021)

economic crisis in 2008, where monetary authorities controlled the amount of money in circulation by adjusting the purchase of bonds, rather than the fluctuation of market prices, by regulating the interest rate. This was not a traditional monetary policy, though the U.S. introduced this method as a direct intervention to overcome a crisis. Since then, this has become a general method used to adjust the amount of money in circulation with ECM, etc. Importantly, this method was applied comprehensively during the COVID-19 crisis. In addition, a “credit policy” was implemented, under which liquidity was provided for a specific market to recover the loss and stagnation of function in a partial or specific financial market.<sup>54</sup> It is expected that these non-traditional financial and monetary policies would be implemented actively in response to various future fiscal demands and rapidly changing markets.

With the COVID-19 crisis, the government in every country prepared a manual for responding to a crisis by analyzing its effect on emergency policies. Note that it is not overly important to classify economic policies into traditional and non-traditional policies. The implementation of non-traditional fiscal and financial measures are inevitable in order to provide support for those that suffered from the coercive quarantine measures. Only traditional supports are subject to a policy analysis. However, the non-traditional policy that was introduced in urgency or by external conditions may be placed on a blind spot in the policy analysis due to a lack of awareness, materials, etc. The debate on fiscal multipliers since the COVID-19 crisis is still in its early stage, and an analytic study shall be made on the effectiveness of non-traditional policy supports. This study suggests that the debates shall be made on the priority, etc. of emergency fiscal commitments by developing a database to analyze the effect of non-traditional fiscal and financial policies in the manual used for emergency responses.

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<sup>54</sup> “The non-traditional monetary policy specifies its policy objective as the stabilization of corporate bond markets, etc. and leads a financial market to a direction intended by the central bank by directly intervening into a financial market. The general non-traditional monetary policy includes the following: negative interest rate policy as an extension of interest rate policy; forward guidance (hereinafter, the FG); quantitative easing (hereinafter, the “QE”) to provide liquidity for a financial market; credit easing, etc.” (Jang Min, 2020, p. 13)

## IV. Effect Analysis of Response to COVID-19 Through an International Comparison

### 1. Analysis of effect on the impact of COVID-19 infection of OECD member countries

This study examined the impact of COVID-19 infections in two categories, such as the “cases cumulative total” and “death”. The effects of bipolarization and financial policies, which are subjects of this analysis, were not found in the cases cumulative total. On the other hand, where a dependent variable is set to the “deaths from COVID-19 per every 100,000 people,” it was possible to guarantee the statistical significance of bipolarization and fiscal policy variables.

In light of the analysis with the “deaths” of COVID-19 infections as a dependent variable, the deaths increased in proportion in countries with a high per capita GDP in 2019, i.e., countries with lively economic activities. In light of the coefficient value in a form of logarithmic variable, when the GDP per capita increased by 1%, the deaths tended to increase by about 1%.

From the Gini coefficient, the income quintile share ratio, and relative poverty ratio, which are major subjects of this analysis, it was revealed that the degree of bipolarization has a statistically significant effect on the spread of COVID-19 infections and deaths. In other words, it may be viewed that, in 2018, the rate of deaths from COVID-19 was relatively high in countries with large income bipolarization, irrespective of their income. This analysis showed that, when the Gini coefficient, income quintile share ratio, and relative poverty ratio which are variables for income redistribution increase by about 1%, the deaths increase by 2.7%, 1.5%, and 1.1%, respectively.

In addition, it was shown that, as in 2019, the rate of deaths from COVID-19 rises relatively in countries with large government debt. Likewise, this analysis showed that the deaths declined even in countries whose fiscal balance was improved. This supports the possibility that the ratio of deaths from COVID-19 would be relatively low in countries that have a good fiscal balance.

As to other explanatory variables, the “life expectancy” was confirmed as a key variable for explaining the cases and deaths of COVID-19. The life expectancy of a country implies that there is not simply a level of medical service but a comprehensive management level to guarantee the health right of the people—from their early childhood to old age. Thus, even

this analysis verified that there was a decisive contribution to significantly decrease the rate of cases and deaths in countries that have a high life expectancy. This analysis showed that, if the life expectancy increases by 1%, the cases and deaths of COVID-19 are decreased by more than 14% and 20%, respectively. This finding indicates that if each country establishes systematic infrastructure that could manage the life expectancy of the population well, it would be relatively excellent in controlling the pandemic. This could be viewed as suggestive in terms of socio-economic significance of the “life expectancy” in the COVID-19 crisis.

The “European country dummy” is an interesting variable in this analysis. Out of 37 OECD member countries, 26 countries are European countries. In these European countries, the cases and deaths were significantly substantial. However, we shall be careful to construe that it may be deemed that the European countries’ capability to respond to infectious diseases is lower than non-European countries (such as Korea, the U.S., Chile, Australia, etc.). For example, in the case of Greece, a European country, the ratio of cases and deaths is not relatively high. Some stated that this is because Greece was far away from the European continent. Others viewed that Greece could reduce damages caused by COVID-19 due to its physical distance from the European continent, notwithstanding the fact that its quarantine and tracking system as well as public health service system are relatively vulnerable.<sup>55</sup> However, it is difficult to tell whether Greece has a good result in terms of COVID-19 due to its physical restriction with respect to the European continent or due to the failure of its industrial foundation that is based on face-to-face service industries, such as the tourist industry, etc. As a result, there is a need to perform an additional analysis of the European country dummy. The reasons why the COVID-19 spread rapidly in European countries shall be classified into those based on their physical characteristics and those based on their poor capability to control the cases and deaths of COVID-19.

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<sup>55</sup> Fernandez-Villaverde and Jones, 2020, p. 14.

**Table 1\_ Effects on the cases and deaths of COVID-19 in OECD member countries**

	(1)	(2)	(3)
GDP per capita	1.310* (1.97)	1.440** (2.15)	1.303* (1.94)
Government debt	0.656** (2.11)	0.728** (2.36)	0.651** (2.07)
Life expectancy	-21.00** (-2.61)	-24.65** (-3.07)	-21.22** (-2.61)
Gini	2.774* (1.91)	- (-)	- (-)
Proportion of ICT industry	-0.223 (-0.37)	-0.418 (-0.72)	-0.284 (-0.47)
Rate of completion of higher education	-0.574 (-1.70)	-0.458 (-1.38)	-0.522 (-1.54)
Europe / non-Europe	1.367** (2.27)	1.407** (2.32)	1.423** (2.23)
Relative poverty ratio	- (-)	1.193* (1.96)	- (-)
Income quintile share ratio	- (-)	- (-)	1.535* (1.77)
_cons	83.98** (2.67)	92.11** (2.94)	79.16** (2.46)
N	30	30	30

Note: 1. P value in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

2. All variables excluding dummy variables are logarithmic variables.

Source: Calculated and prepared by an author of this study.

## 2. Relationship between key variables and the progression of COVID-19 in 51 states of the U.S.

This analysis examined the relationship between the deaths and the level of response to COVID-19 in each state of the U.S. Each state has a different population, industrial foundation, income level, population density, and political inclination. Notably, each state responded to COVID-19 differently. Accordingly, the state government's countermeasures and scale of fiscal expenditures are quite different in their nature. This analysis viewed that the policy countermeasures of the 51 states in the U.S. are not different from the difference in national countermeasures and conducted a similar analysis.

In terms of the 51 states in the U.S., the following key variables had an effect on the deaths from COVID-19. First, the ratio of deaths from COVID-19 was low in states where the state

governments and local governments make substantial expenditures. It is suggestive that the ratio of deaths was low even in states with a relatively high “fiscal scale of state government and local government compared to the GDP” of 2019 to which the expenditures from the federal government were not applied. Where a proportion of expenditures by a state government increased by 1% in the state GDP, the deaths from COVID-19 tended to decrease about 1%. It seems that where a state government made substantial expenditures, it could actively control infectious diseases by being able to develop the necessary quarantine infrastructure.

It is interesting that, while a “proportion of expenditures for health care” by a state government was not statistically significant, the “proportion of expenditures by the state and local governments” had the effect of reducing the deaths from COVID-19 in a statistically significant way. It could be considered that the COVID-19 crisis played a huge role in not only the pathological control but also the following: to adjust the economic impact, such as border closures, etc.; to control immigration; to provide support by local governments; and in education and promotion to improve the acceptance of social distancing policies, etc. The findings of this analysis show that the “fiscal scale of state and local governments” plays a certain role as the “proxy variable of the infectious disease control system.”

Where the Gini coefficient, poverty rate, and income quintile share ratio, as income redistribution-related variables, are all high, the state is deemed relatively severely bipolarized, and the ratio of deaths by infection was found to be higher than states which were not as severely bipolarized. The findings of this analysis showed that, if the Gini coefficient rises by 1%, the deaths increase by 7%. In addition, the income quintile share ratio and the poverty rate were found to be about 2% and 1.8%, respectively. This analysis used, as variables, the following: the “individuals below poverty level by state” in 2019 stated in the American Community Survey by the U.S. Census Bureau; and the “mean household income of quintiles”. Thus, the findings shown above could be expected in that they were based on data from the U.S. These findings suggest that a system that controls a crisis caused by infectious diseases is not working in states that are severely bipolarized, as a whole.

Lastly, the findings in which the approval rating of Trump in the U.S. presidential election in 2020 was used as a variable are interesting. In states with a high approval rating for Trump, the deaths from COVID-19 tended to be high, and the coefficient value showed a relatively wide range of fluctuation, from 0.56~1. The coefficient value of the number of votes for Trump fluctuates widely depending on variables such as income redistribution and the proportion of the highly-educated, because it is highly correlated with these variables. This

means that the degree of income redistribution is low and that the proportion of the highly-educated is relatively low in states with a high approval rating for Trump. In states with a high approval rating of Trump, the rate of deaths was high—directly due to the low vaccination rate. This is due to not only political inclination but also characteristics such as the degree of income redistribution, education level, rate of participation in economic activities, low population density, etc. As a result, it could be posited, based on the findings of this empirical analysis, that the system to control infectious diseases in a state could vary depending on its political inclination, which is one of the important systematic characteristics of the state.

**Table 2\_ Relationship between key variables and deaths from COVID-19 in 51 states of the U.S.**

	(1)	(2)	(3)	(4)	(5)
Economic growth rate (2019)	-0.0337 (-0.37)	-0.043 (-0.45)	-0.109 (-1.06)	-0.0498 (-0.56)	-0.00946 (-0.10)
Population density	0.0507 (0.85)	0.0769 (1.26)	0.151** (2.79)	0.0652 (1.13)	0.107* (1.97)
Proportion of the aged	0.404 (0.72)	0.268 (0.46)	-0.164 (-0.28)		0.184 (0.32)
Proportion of expenditure by state government	-0.882** (-2.12)	-0.636 (-1.50)	-0.621 (-1.44)	-0.856** (-2.07)	
Income quintile share ratio	2.396*** (4.68)			2.374*** (4.62)	2.295*** (4.30)
Population with bachelor's degree or higher	0.0624 (0.12)	0.0189 (0.03)	1.659* (2.01)	-0.272 (-0.40)	0.367 (0.71)
Vote for Trump	0.805** (2.66)	0.562* (1.85)	1.063** (3.00)	0.876** (3.05)	0.864** (2.73)
Birth rate	0.752 (0.77)	0.757 (0.74)	0.0454 (0.04)	0.339 (0.41)	1.012 (1.01)
Gini		7.033*** (4.05)			
Poverty rate			1.824*** (3.82)		
Life expectancy				2.307 (0.55)	
Debt of state and local governments					-0.249 (-1.21)
_cons	-1.739 (-0.41)	10.78** (2.96)	-5.526 (-1.03)	-9.628 (-0.55)	-4.468 (-1.08)
N	51	51	51	51	51

Note: 1. P value in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

2. All variables excluding dummy variables are logarithmic variables.

Source: Calculated and prepared by an author of this study.

## V. Conclusion

In 2022, in the middle of an economic recovery and global crisis a new administration will be inaugurated. A large scale of liquidity still exists in the market since the unprecedented economic crisis and the economy continues to be unstable due to the existence of COVID-19 variants. Developed countries have recovered to a level similar to that of prior to the pandemic, in terms of economic indexes. However, emerging countries and developing countries remain not certain about their economic recovery. In addition, it is still uncertain as to whether the recovery would be maintained firmly, to an extent that depends on the spread of additional variants. The IMF Fiscal Monitor (2021. 10a) explained the purposes of medium-term fiscal plan to be as follows: 1) to secure sustainability; 2) to stabilize an economy after procyclical fiscal measures; and 3) to establish simple and applicable fiscal rules.

This study aimed to propose that the medium-term fiscal plan shall include, for the recovery of Korea after 2022, the following: a plan to reinforce a social safety net; to invest finances by field in a sequential manner; and to improve the potential growth rate to secure growth momentum, etc.<sup>56</sup>

This study confirmed that the COVID-19 pandemic crisis that occurred in early 2020 is different from economic crises in the past, in terms of its nature and scale, and that the resultant fiscal affairs could play a role that was far wider than before. In addition, this study focused on how COVID-19 spread in each country, and how each country responded thereto. Thus, this study examined the general trend based on data obtained from developed countries and 51 states of the U.S. In light of this data, the rate of deaths from COVID-19 tended to be generally low in the following cases: where a country has a relatively long life expectancy; where the government debt is relatively insubstantial; or where the income is evenly distributed among classes.

As to a direction of fiscal policies that can be used to restructure and overcome a crisis, this study deemed the following as being required: to improve the bipolarization among individuals and regions; to adjust unequal resource reallocation by sequential fiscal investments; and to improve the growth momentum and potential growth rate. A policy that improves income bipolarization, with a focus on individuals and households, is a major agenda item for income redistribution and is supported by references from major countries. On the other hand, this study highlighted the fact that regional bipolarization caused by population

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<sup>56</sup> IMF, *Fiscal Monitor* (2021. 10a.), pp. 4-6; p. 27.

concentration in metropolitan areas, which is not common in developed countries, is dealt with only as an agenda item for the medium and long-term balanced development. Currently, the fiscal relationship between the central and local governments (including education) in Korea has a “soft budget” structure and that the final fiscal accountability is transferred as a debt of the central government. This study stresses that it would be difficult to secure fiscal sustainability in Korea, without first solving issues related to regional extinction, the concentration in metropolitan areas, and the widening of regional gaps.

In relation to fiscal expenditures, this study proposed a plan to minimize fiscal encroachment through the restructuring of mandatory spending. Specifically, this study proposed the need to reorganize the local transfer payments from the mandatory spending to a method that takes into account changes in fiscal conditions. In addition, this study proposed the need to reflect on the fiscal demand and secure fiscal effectiveness in response to aging and changes in the industrial structure by redistributing local education subsidies that concentrate only on elementary and secondary education to higher education, lifelong education, and vocational education in light of changes in the population structure.

The rate of the burden on the social security system can to be increased to improve the sustainability of the system. To this end, this study proposed that the government should promote a debate on tax increases and that the National Assembly and the people who would assume the tax burden should continue to discuss any additional burden. Social security reform, which is not dealt in the policy priority as the medium and long-term agenda, is a policy subject with priority as high as taxation in terms of a burden on the people. The government and political circles shall discuss when and how to promote the agendas for discussion on the medium and long-term fiscal burden, such as the adjustment of age of recipients, changes in the premium rate, the restructuring of decision-making governance, etc. to reinforce the social safety net and secure the sustainability of the social security system.

Second, this study worked to explain that the implantation of an exit strategy is currently important, in order to normalize fiscal affairs after the economic crisis, and that the significance of a medium-term plan becomes different from its importance in the past. This is because a definite medium-term plan that includes fiscal regulations such as the fiscal rule has a notable effect on securing credit ratings and reliability. The performance of the debt burden rapidly increased, since an economic crisis is closely related with the credit rating of country, which is determined based on how strong the fiscal rules and economic outlook in an exit strategy containing the fiscal plan of the country, etc. are. This study deemed that there is a need to reinforce the fiscal regulations containing the fiscal rule, because the government

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debt, fiscal balance, significance of tax increase, etc. would be analyzed in a process to debate the legal effectiveness and coerciveness of the fiscal regulations.

Lastly, this study confirmed that there is a need to verify the effectiveness of so-called non-traditional fiscal policies and financial policies implemented during a period of emergency fiscal support. The non-traditional policies that shall be accepted in a market by external conditions, such as the urgency of fiscal expenditures, political demand for fiscal expenditures, etc. may be placed in a blind spot in the policy analysis due to lack of awareness, data, competency, etc. This study states the significance to understand the overall scope and verify the effectiveness of all policies implemented, because they may be used as a policy—even in a future with further aggravated uncertainty.

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# A study on establishing an expenditure restructuring system for active fiscal policy management

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## I . Introduction

In this study, we examine the factors to consider when building an expenditure restructuring system to ensure active fiscal policy management and recommend relevant policies based on the examination, including expenditure restructuring methods.

This report is composed of the following chapters. Chapter II discusses the necessity of expenditure restructuring and provides a definition of active fiscal policy management. Chapter III reviews the considerations for developing a system required to implement systemic expenditure restructuring in the long term. Chapter IV examines methods for setting the directions for upper-level resource distribution decisions among policy goal sectors under the active fiscal policy management scheme. Chapter V presents evidence related to sector/program-level expenditure restructuring, along with evaluation methods and directions from the expenditure restructuring perspective, followed by our conclusions.

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## **II . Definition and Necessity of Expenditure Restructuring for Active Fiscal Policy Management**

### **1. Definition of active fiscal policy management**

This chapter defines the core concept of this study—expenditure restructuring for active fiscal policy management—and explains why it is needed.

Passive fiscal policy management can be defined as a process of adjusting fiscal policy mixes in accordance with pre-determined and predicted changes in population, public perception, environment, economy, and technology.

However, because fiscal policy can be also used as an instrument to change the future path of the economy, we can define active fiscal policy management as follows: a process intended to change the future path of the economy by modifying existing financial policy mixes.

In standard fiscal policy management, it is common for the government to predict the future path of the economy and adjust government spending across relevant sectors without explicitly considering the purported effects of the fiscal policy. Conversely, in active fiscal policy management, the government utilizes the ability to deliberately adjust the policy initiatives in order to change the future direction of national economic development.

### **2. Definition and necessity of expenditure restructuring for active fiscal policy management**

Based on this definition of active fiscal policy management, we can further define expenditure restructuring for active fiscal policy management. Expenditure restructuring for active policy management is a process of determining the sectors where expenditures should be expanded or reduced to achieve the goals of active fiscal policy management. At any given time, a country can have only limited financial resources. Even when a country is in an excellent fiscal position that allows for expansive fiscal management, the government must reduce spending on programs that, at least in the short term, are given low priority.

In general, active fiscal policy management is meaningful at all time points and locations where policy goals matter. However, in 2021, Korea was especially in need of an active fiscal policy management. The country's low birth rate and aging population have led to less than promising medium- and long-term predictions about the country's future, including the potential for economic recessions and surging welfare costs.

Korea is considered to be in a temporarily advantageous position in terms of fiscal space now. This advantage is in contrast with the bleak future that may arrive without a policy intervention. In this case, maintaining a passive stance regarding expenditure restructuring might not be the best strategy. If financially feasible, it would be much wiser for the country to make efforts to steer its future on a more desirable course.

Granted, as will be discussed in detail, not all spending is designed to achieve specific goals. Neither do all programs effectively contribute to goals related to the national economy. However, if a country's financial resources are spent without a clear sense of purpose or such spending does not effectively achieve the intended goals, the use of these resources may only hurt the country's long-term fiscal health.

It is important that there are additional tasks to be implemented and addressed for active fiscal policy management and expenditure restructuring for active fiscal policy management. These tasks will be discussed in the following section.

### **3. Key tasks for an expenditure restructuring system for active fiscal policy management**

#### **A. Assigning roles and coordinating with actors on the basis of their priorities**

For active fiscal policy management and expenditure restructuring, numerous actors must play their parts. First, active restructuring requires a basic level of infrastructure to collect sufficient information and then analyze the policy effects. As of now, policy researchers (primarily researchers at government-funded institutes) have a relative advantage in performing these tasks. Researchers are well-equipped for undertaking an evidence-based fiscal performance evaluation, which will be discussed later, as well as for performing a basic analysis regarding the future of the economy under passive fiscal policy management. The basic infrastructure for information collection and analysis includes an analysis of empirical data from similar countries to determine which sectors need an expenditure increase or decrease to achieve specific policy goals.

The analysis informs the plans and strategies drafted at a higher level, which can be handled better by the fiscal authorities that guide fiscal policies and control the budget distribution from a national economy perspective.

However, even though the fiscal authorities lead the drafting of strategies based on basic analyses, a public consensus is required to set policy priorities and actively restructure

expenditures. Therefore, the general direction of expenditure restructuring needs to be confirmed and approved by an organization mandated to represent the people, including the National Assembly or Cheongwadae (the “Blue House”).

## **B. Strategic planning: Clarification and prioritization of individual policy goals**

Active fiscal policy management requires a strategy structure, based on a logical model, detailing how individual programs and their policy goals contribute to upper-level goals. Medium- and long-term goals for the national economy need to be clarified and prioritized across all levels, including sectors, programs, individual programs, and subprograms.

A distinguishing point of active fiscal policy management is that expenditure restructuring requires a holistic approach that encompasses the overall expenditures. Expenditure restructuring is often equated with spending cuts. Governments often reduce spending in selected sectors, guided by the misconception that they can identify which sectors to cut without ascertaining the overall structure. It should be noted that all expenditures have their own rationales, purposes, and historical contexts. It is virtually impossible, or at least extremely difficult, to identify which sectors to exclude or in which sectors to cut spending by individually considering each sector.

Hence, expenditure restructuring must be supported by a holistic approach based on a clarification of overall priorities. Governments must determine which sectors need more spending to steer the national economy in the right way and which sectors hold less significance, and then distribute spending according to the established priorities. To reiterate, effective expenditure restructuring cannot be achieved by considering each program individually without first ascertaining the overall structure.

Governments can build on these priorities to clarify policy goals and align lower- and upper-level goals by expanding spending on high-priority programs while improving their efficiency and reducing spending on low-priority programs, starting with subprograms that show poor performance.

## **C. Medium- and long-term management**

The holistic approach discussed above requires clear medium- and long-term management objectives. In fact, the very purpose of active fiscal policy management and expenditure restructuring—addressing medium- and long-term challenges—makes medium- and long-term management a key element.

In this regard, the restructuring programs currently implemented by the Korean government leave much to be desired, as they are closer to mere one-time and short-term responses to unexpectedly high spending.

To approach the task from a long-term strategic standpoint, expenditure restructuring should be managed on a regular basis, as with the National Fiscal Management Plan. This will allow the government to change its tactics as necessary: expanding expenditures when needed, shifting to demonstration and confirmation when there is no specific issue, and focusing on cutbacks when spending needs to be reduced. As such, expenditure restructuring does not need to be an ad-hoc measure to address a temporary surge in spending, as it currently is in Korea.

#### **D. Result-centered management: Evidence-based policy management and feedback**

In this study, we emphasize that active fiscal policy management is aimed at achieving results and therefore does not need to be confined by pre-determined expenditure plans or directions. For example, welfare, gender, and family are some sectors that are closely associated with the low birth rate and aging issues. However, there is no definite evidence to support the claim that solutions for these two issues must come from those sectors. For example, positive results in housing welfare, education, industry, and employment may contribute more to addressing those issues than simply investing in the directly related sectors. As another example, if support for small and medium enterprises (SMEs) is considered high priority, and SME policies are aimed at fostering SMEs in Korea, we do not need to preemptively rule out the possibility that reducing government support for SMEs may ironically increase the productivity and self-reliance of SMEs.

This process of identifying policy effects, obtaining feedback, and actively revising plans to achieve goals related to the national economy constitutes a key element of the active fiscal policy management framework proposed in this study.

### III. Expenditure Restructuring System

#### 1. Example

In this section, we follow up the discussions in the previous section with an example of an expenditure restructuring system. Figure 1 summarizes the proposed system.

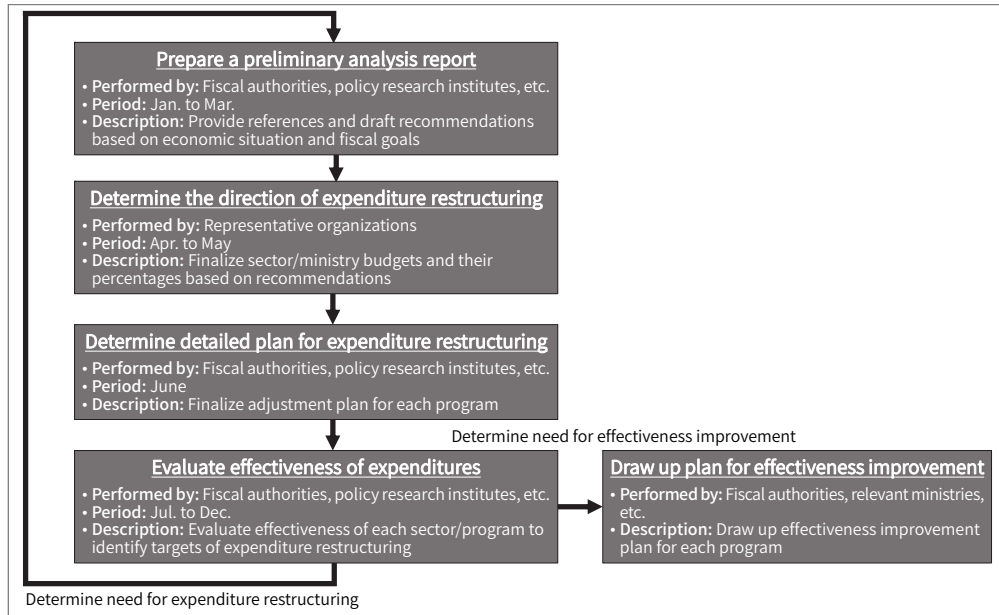
The system performs expenditure restructuring every year, in accordance with the budget cycle. The purpose of this arrangement is to ensure that there is official and continuous expenditure restructuring, as required by an active fiscal policy management system.

The main tasks of expenditure restructuring are performed by the fiscal authorities, organizations representing the people (Cheongwadae [“Blue House”] or National Assembly), and policy research institutes that include government-funded research centers. Evaluation and data analysis are then performed by policy research institutes across all sectors, and drafts are created by the fiscal authorities and confirmed/executed by the representative organizations.

At this point, we would like to stress once again that expenditure restructuring for active fiscal policy management requires the overall assessment of all expenditures, because expenditure restructuring is relative, and determining which expenditures to cut necessitates identifying which expenditures not to cut. In addition, some underperforming programs may need to be given the opportunity to improve their performance rather than quickly reducing spending on them. For these programs, plans must be drawn up to improve the effectiveness of this spending.

While it is true that Korea’s current evaluation systems are not optimized for expenditure restructuring, this expenditure restructuring system can benefit from the results of evaluation programs for fiscal programs, such as autonomous evaluation, in-depth evaluation, core program evaluation, and soon-to-be-adopted advanced evaluation. In this way, collaboration among the relevant organizations can be improved by requesting the evaluating organizations to provide evaluation results related to expenditure restructuring and providing feedback regarding the results.

Figure 1\_ Example of Expenditure Restructuring System



Source: Present study.

## IV. Review of Methods for Upper-Level Resource Distribution Among Sectors

This chapter reviews how financial resources are distributed among sectors under the existing system and explores methods for reviewing the distribution based on results. We also review the methods used in previous studies.

First, to identify policy directions and determine a more effective and efficient expenditure plan, we analyze how the share of each sector in government expenditures affects the performance indicators for the national economy.

### 1. Data and methods

#### A. Data

One of the core explanatory variables in our empirical analysis is the share of government expenditure in each sector. This is defined as the percentage of government expenditure in

a specific sector against the GDP. For this analysis, we identified 10 sectors according to the Classification of the Functions of Government (COFOG) developed by the United Nations: general public services; defense; public order and safety; economic affairs; environmental protection; housing and community amenities; health; recreation, culture, and religion; education; and social protection.

*Government Expenditure by Function* published by OECD Statistics provides data pertaining to government expenditures across these 10 sectors across members of the Organisation for Economic Cooperation and Development (OECD). In this study, we analyze unbalanced panel data from 22 countries for which government expenditure data and capital stock data are available. Although these national datasets on government expenditure represent different periods, 27 countries provide such data for 1995~2019. Therefore, we used the 1995~2019 data for our analysis. Table 1 shows the periods represented by the sector-specific government expenditure data from 38 countries. Table 2 lists the average share of government expenditures for the relevant periods by sector in 34 countries. Table 3 shows government expenditures-GDP percentage by sector. Notably, the data show a rapid increase in government expenditures for social protection and health.

**Table 1**\_Periods Represented by Government Expenditure Data from OECD Members

(unit: Year)

No.	Country	Period	No.	Country	Period
1	Australia	1998~2019	20	Japan	2005~2019
2	Austria	1995~2019	21	Korea	1970~2018
3	Belgium	1995~2019	22	Latvia	1995~2019
4	Canada	No data	23	Lithuania	1995~2019
5	Chile	2013~2019	24	Luxembourg	1995~2020
6	Columbia	2009~2019	25	Mexico	No data
7	Costa Rica	2012~2017	26	Netherlands	1995~2019
8	Czech Republic	1995~2019	27	New Zealand	No data
9	Denmark	1995~2019	28	Norway	1995~2019
10	Estonia	1995~2019	29	Poland	1995~2019
11	Finland	1990~2019	30	Portugal	1995~2019
12	France	1995~2019	31	Slovakia	1995~2019
13	Germany	1995~2019	32	Slovenia	1995~2019
14	Greece	1995~2019	33	Spain	1995~2019
15	Hungary	1995~2019	34	Sweden	1995~2019
16	Iceland	1998~2019	35	Switzerland	1995~2019
17	Ireland	1995~2019	36	Turkey	No data
18	Israel	1995~2019	37	UK	1995~2019
19	Italy	1995~2019	38	US	1970~2020

Source: OECD, *OECD Statistics*, 1995~2019.

**Table 2\_Average Percentage of Government Expenditures Against GDP by Sector**

(unit: %)

No.	Country	Public service	Defense	Public order Safety	Economy	Environment	Housing Community development	Health	Entertainment Culture Religion	Education	Social protection	All government expenditure
1	Australia	4.3	2.0	1.8	4.8	0.8	0.6	6.7	0.9	5.8	10.1	37.9
2	Austria	7.6	0.7	1.4	6.0	0.5	0.5	7.5	1.3	5.1	20.8	51.5
3	Belgium	9.6	1.1	1.7	6.0	1.0	0.4	7.1	1.2	5.9	18.2	52.1
4	Chile	2.8	1.1	2.0	2.5	0.2	0.9	4.0	0.3	5.0	6.2	25.0
5	Columbia	4.7	1.5	2.1	3.3	0.5	0.5	4.7	0.6	4.5	8.4	30.9
6	Costa Rica	3.4	0.0	2.5	2.9	0.4	0.8	6.2	0.2	7.4	8.1	31.9
7	Czech Republic	4.4	1.2	1.9	7.5	1.0	1.0	7.2	1.4	4.6	12.5	42.7
8	Denmark	7.9	1.4	1.0	3.5	0.5	0.4	7.7	1.7	6.6	23.3	53.8
9	Estonia	3.6	1.6	2.3	4.6	0.6	0.4	4.8	2.1	6.3	11.5	37.9
10	Finland	7.8	1.5	1.3	5.0	0.3	0.4	6.7	1.2	6.2	22.3	52.7
11	France	7.2	1.9	1.5	5.1	0.9	1.1	7.6	1.3	5.5	22.5	54.7
12	Germany	6.5	1.1	1.6	4.1	0.6	0.7	6.7	1.1	4.2	20.0	46.6
13	Greece	11.3	2.6	1.6	5.6	0.8	0.3	5.7	0.6	4.0	16.5	49.1
14	Hungary	10.0	1.1	2.0	6.7	0.7	0.8	5.1	1.9	5.3	15.6	49.2
15	Iceland	10.4	0.0	1.4	6.5	0.6	0.4	7.6	3.3	7.2	9.4	46.9
16	Ireland	4.6	0.4	1.5	4.5	0.7	1.0	5.9	0.6	4.3	12.7	36.3
17	Israel	7.8	7.0	1.6	2.9	0.6	0.2	5.1	1.5	7.0	11.1	44.9
18	Italy	10.1	1.2	1.9	4.1	0.8	0.6	6.5	0.7	4.3	18.6	48.8
19	Japan	4.2	0.9	1.2	3.8	1.2	0.7	7.1	0.4	3.5	15.3	38.3
20	Korea	4.0	2.4	1.1	5.6	0.8	1.1	3.0	0.7	4.4	4.7	27.8
21	Latvia	4.3	1.2	2.2	5.9	0.5	1.1	3.8	1.4	5.8	11.7	37.8
22	Lithuania	5.1	1.3	1.8	4.6	0.5	0.4	5.5	1.0	5.5	11.7	37.3
23	Luxemburg	5.2	0.4	1.0	5.5	0.8	0.7	5.0	1.2	4.6	16.7	41.0
24	Netherlands	6.1	1.3	1.7	4.5	1.5	0.7	6.4	1.3	5.1	16.0	44.7
25	Norway	5.1	1.8	1.0	5.0	0.8	0.6	7.5	1.5	5.4	17.5	46.3
26	Poland	6.0	1.7	2.2	4.7	0.6	1.0	4.3	1.1	5.6	17.0	44.2
27	Portugal	7.5	1.3	1.8	4.9	0.6	0.7	6.6	1.1	5.8	15.4	45.8
28	Slovakia	5.9	1.1	2.8	6.2	1.0	0.7	6.5	1.1	3.9	14.4	43.5
29	Slovenia	6.1	1.2	1.7	5.4	0.7	0.6	6.6	1.5	6.1	17.8	47.6
30	Spain	6.2	1.0	1.9	5.0	0.9	0.8	5.8	1.3	4.1	14.9	42.0
31	Sweden	8.3	1.7	1.3	4.2	0.4	0.8	6.5	1.4	6.7	21.3	52.6
32	Switzerland	4.6	1.0	1.5	4.0	0.7	0.2	1.8	1.0	5.2	12.9	32.9
33	UK	4.5	2.2	2.0	2.8	0.7	0.9	6.4	0.8	5.2	14.9	40.4
34	US	6.2	3.7	2.1	3.6	0.0	0.7	7.8	0.3	6.2	7.4	37.9
	OECD average	6.3	1.5	1.7	4.7	0.7	0.7	6.0	1.2	5.4	14.6	42.7

Source: OECD, *OECD Statistics*, 1995~2019.

Table 3\_Changes in Korea's Government Expenditure-GDP Percentage by Sector

(unit: %)

Year	Public service	Defense	Public order Safety	Economy	Environment	Housing/ community development	Health	Entertainment Culture Religion	Education	Social protection	All Government expenditure
1995	2.9	2.3	1.0	4.9	0.7	1.1	1.3	0.4	4.0	2.4	21.0
1996	2.7	2.5	1.0	4.9	0.7	1.3	1.5	0.5	4.2	2.3	21.5
1997	2.8	2.5	1.0	5.3	0.7	1.3	1.5	0.5	4.2	2.5	22.3
1998	3.3	2.5	1.1	6.0	0.8	1.5	1.7	0.6	4.1	3.6	25.3
1999	3.3	2.3	1.0	5.4	0.8	1.2	1.8	0.6	3.9	4.3	24.5
2000	3.4	2.3	1.0	5.4	0.8	1.1	1.9	0.6	3.7	3.3	23.6
2001	4.0	2.2	1.0	5.6	0.7	1.0	2.5	0.6	4.1	3.4	25.2
2002	4.0	2.2	1.0	5.7	0.8	0.9	2.4	0.6	4.2	3.2	24.8
2003	4.5	2.3	1.1	10.3	0.8	1.2	2.4	0.8	4.3	3.6	31.1
2004	4.5	2.2	1.0	6.8	0.8	1.3	2.5	0.7	4.6	3.8	28.1
2005	4.3	2.2	1.1	6.7	0.9	1.1	2.6	0.7	4.3	4.1	27.9
2006	4.3	2.3	1.1	6.7	1.0	1.1	2.9	0.8	4.1	4.3	28.6
2007	4.4	2.2	1.1	5.5	0.9	1.2	3.1	0.7	4.3	4.7	28.0
2008	5.0	2.4	1.1	5.6	0.9	1.2	3.2	0.7	4.6	5.1	29.8
2009	4.6	2.6	1.1	6.7	1.0	1.5	3.6	0.8	4.9	5.4	32.3
2010	4.6	2.3	1.1	5.4	0.9	1.2	3.8	0.7	4.4	5.3	29.6
2011	4.7	2.4	1.1	5.6	0.9	1.1	3.8	0.7	4.5	5.6	30.4
2012	4.7	2.4	1.1	5.5	0.8	1.0	3.8	0.8	4.6	6.1	30.8
2013	4.5	2.5	1.1	4.8	0.8	1.0	3.8	0.8	4.6	6.2	30.1
2014	4.5	2.4	1.1	4.6	0.9	0.9	3.9	0.7	4.7	6.5	30.4
2015	4.3	2.4	1.2	4.5	0.9	1.0	4.0	0.8	4.7	6.7	30.4
2016	4.1	2.3	1.2	4.4	0.9	1.0	4.2	0.8	4.6	6.7	30.3
2017	4.0	2.2	1.2	4.5	0.9	1.0	4.3	0.9	4.6	6.7	30.3
2018	4.0	2.4	1.2	4.4	0.8	1.0	4.7	1.0	4.8	6.9	31.1
Average	4.0	2.4	1.1	5.6	0.8	1.1	3.0	0.7	4.4	4.7	27.8
OECD average	6.3	1.5	1.7	4.7	0.7	0.7	6.0	1.2	5.4	14.6	42.7

Source: OECD, *OECD Statistics*, 1995~2019.

## B. Method

We analyzed the OECD panel data using a panel fixed effect model to estimate how the percentage of government expenditures in each sector affects national economy performance indicators, including growth, employment, productivity, distribution, and fertility rate. We used the following equation in the analysis:

$$y_{i,t} = \alpha + \sum_{j=1}^{10} \beta_j G_{j,t} + \sum_{k=1}^{n_x} \gamma_k X_{k,t} + \theta_t + u_{i,t}, \quad u_{i,t} = \eta_i + \epsilon_{i,t} \quad (1)$$

where  $y_{i,t}$  represents the national economy performance indicators, which consist of the growth, employment, productivity, distribution, and fertility indicators. For the growth indicator, we used the log of real GDP and the log of real GDP per capita. For the employment indicator, we used the employment rate (%) and unemployment rate (%) for the population aged 15 and older. We analyzed the productivity indicator using the log of multi-factor productivity (MFP), log of labor productivity 1 (real GDP/number of employees), and log of labor productivity 2 (real GDP/total working hours).

## 2. Findings

### A. Growth indicator

#### 1) Real GDP

Table 4 presents the empirical findings on the effects of changes in sector-specific government expenditures on the real GDP. As shown in the table, an increase in government expenditures in the health sector was shown to increase the real GDP. Specifically, Model 1 shows that a 1%p increase in health expenditures raised the real GDP by 1.5%.

Social protection expenditures were found to lower the real GDP. According to Model 1, a 1%p increase in expenditures on social protection reduced the real GDP by 2.1%. Social protection spending was mostly used to support and substitute incomes, which may have reduced the motivation to work to increase one's income. Thus, the decline in the labor supply may be attributed to an increase in moral hazard.

**Table 4. Empirical Findings on the Effects of Changes in Percentages of Government Expenditures on Real GDP**

Dependent variables: ln(real GDP)		Model 1		Model 2 (logged variable)		Model 1 (Korea excluded)	
Explanatory variables		Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Sector-specific expenditure Percentage	Public service	0.002	0.607	0.003	0.430	0.004	0.346
	Defense	-0.009	0.666	-0.013	0.542	-0.004	0.858
	Public order and safety	-0.007	0.866	0.007	0.868	0.000	0.998
	Economy	-0.002	0.189	-0.001	0.448	-0.001	0.312
	Environment	0.000	0.984	-0.003	0.906	-0.001	0.978
	Housing and community amenities	-0.011	0.508	-0.003	0.691	-0.004	0.820
	Health	0.015***	0.008	0.016**	0.016	0.015***	0.007
	Entertainment, culture, and religion	0.026	0.411	0.012	0.680	0.014	0.606
	Education	0.011	0.450	0.007	0.548	0.001	0.938
Social protection	-0.021***	0.000	-0.020***	0.000	-0.021***	0.000	
ln(capital stock) 1st logged variable		0.395***	0.000	0.385***	0.002	0.287**	0.025
ln(no. of employees) 1st logged variable		0.426***	0.001	0.399***	0.003	0.453***	0.001
Trade openness		0.000	0.514	0.000	0.861	0.000	0.701
ln(population)		0.216	0.331	0.286	0.227	0.311	0.168
Percentage of population aged 15–64		0.025***	0.003	0.025***	0.005	0.010	0.259
Percentage of population aged 65 and older		0.029***	0.002	0.030***	0.001	0.012	0.202
Year dummy		o		o		o	
No. of countries		22		22		21	
Sample size		509		508		486	
Adjustment determinant coefficient ( $R^2$ )		0.0792		0.0781		0.0847	

Note: 1. Model 2 uses the logged variables of government expenditure percentage by sector ( $G_t - G_{t0}$ ).

2. \*\*\*, \*\*, and \* represent the 1%, 5%, and 10% significance levels, respectively.

3. Uses the robust standard error.

Source: OECD, *OECD Statistics*, 1995–2019.

## 2) Real GDP per capita

Table 5 represents the empirical findings pertaining to the effects of changes in sector-specific government expenditures on the real GDP per capita. The real GDP per capita is a national income indicator that reflects the actual living standards of economic actors.

**Table 5** Empirical Findings on the Effects of Changes in Percentages of Government Expenditures on Real GDP per Capita

Dependent variables: ln(real GDP per capita)		Model 1		Model 2 (logged variable)		Model 1 (Korea excluded)	
Explanatory variables		Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Sector-specific expenditure Percentage	Public service	0.004	0.408	0.005	0.250	0.006	0.164
	Defense	-0.005	0.813	-0.010	0.680	-0.001	0.977
	Public safety	-0.024	0.610	-0.008	0.862	-0.015	0.787
	Economy	-0.003	0.124	-0.002	0.121	-0.002	0.222
	Environment	0.032	0.231	0.025	0.309	0.030	0.221
	Housing and community amenities	-0.038*	0.085	-0.013	0.271	-0.026	0.276
	Health	0.017***	0.001	0.016***	0.007	0.016***	0.000
	Entertainment, culture, and religion	0.031	0.310	0.013	0.670	0.016	0.575
	Education	0.010	0.572	0.006	0.688	-0.003	0.878
Social protection	-0.019***	0.001	-0.019***	0.002	-0.019***	0.001	
ln(capital stock) 1st logged variable		0.268***	0.002	0.284***	0.006	0.157	0.111
ln(no. of employees) 1st logged variable		0.220**	0.035	0.201**	0.042	0.279**	0.013
Trade openness		0.000	0.462	0.000	0.726	0.000	0.695
Percentage of population aged 15–64		0.029***	0.004	0.028***	0.007	0.009	0.353
Percentage of population aged 65 and older		0.043***	0.000	0.043***	0.000	0.019*	0.053
Year dummy		o		o		o	
No. of countries		22		22		21	
Sample size		509		508		486	
Adjustment determinant coefficient ( $R^2$ )		0.7783		0.7509		0.8980	

Note: 1. Model 2 uses the logged variables of government expenditure percentage by sector ( $G_1 - G_{10}$ ).

2. \*\*\*, \*\*, and \* represent the 1%, 5%, and 10% significance levels, respectively.

3. Uses the robust standard error.

Source: OECD, *OECD Statistics*, 1995–2019.

### 3. Summary and policy implications

Table 6 summarizes the empirical findings pertaining to the effects of sector-specific government expenditures on national economy performance indicators (growth, employment, productivity, distribution, and fertility). The table consists of findings that are robust regardless of the model (i.e., whether or not first logged variables were included) and a sample definition (i.e., whether or not Korea was included). Specifically, the findings indicate that a 1% increase in health expenditures raised the real GDP by 1.5%. These findings imply that an increase in

health expenditures may contribute to the real GDP by improving the people's health and, as a result, increase their productivity. The positive effect of health expenditures on labor productivity (real GDP/no. of employees) supports this implication.

**Table 6\_Summary: Empirical Findings on the Effects of Changes in Percentages of Government Expenditures**

National economy Performance indicator		General public services	Defense	Public order & Safety	Economic Affairs	Environmental protection	Housing & Community development	Health	Entertainment / Culture / Religion	Education	Social protection
Growth indicator	Real GDP							+			-
	Real GDP per capita							+			-
Employment indicator	Employment rate	-		-	-						
	Unemployment rate	+		+	+				-		+
Productivity indicator	MFP										
	Labor productivity 1 (real GDP/no. of employees)				+			+			
	Labor productivity 2 (real GDP/total working hours)				+	-					
Distribution indicator	Pre-tax Gini coefficient of market income										+
	Post-tax Gini coefficient of market income							+	-		
	Distribution among income brackets										
Fertility rate indicator	Total fertility rate										

Note: The table summarizes findings from Chapter IV, which are robust regardless of the model (i.e., whether or not first logged variables were included) and sample definition (i.e., whether or not Korea was included).

Source: OECD, *OECD Statistics*, 1995~2019.

When government expenditures on social protection increased by 1%p, the real GDP declined by 2.1%. Government expenditures on social protection mostly support or substitute income, which may subsequently decrease people's will to work for their income. This potential decline in the labor supply may be attributed to a moral hazard. However, in a country in which the elderly population comprises an excessive share of the total labor supply, due to the poor retirement income system in Korea, a decline in the labor supply among the elderly population may also be construed as a positive change. The findings regarding the real GDP per capita

and the real GDP are largely similar.

As for the employment indicator, a 1%p increase in government expenditures on general public services, public order and safety, and economic affairs reduced the economy-wide employment rate by 0.64%p, 2.53%p, and 0.14%p, respectively. The employment rate declined presumably because the multiplier effect of government expenditures in these sectors was exceeded by their crowding-out effect. These findings indicate that government expenditures on general public services, public order and safety, and economic affairs may have unintended side effects. The findings pertaining to the unemployment rate are largely similar, though in the opposite direction. Increased spending on entertainment, culture, and religion lowered the unemployment rate, and increased spending on social protection raised the unemployment rate. Given the low job security and wage levels of the entertainment, culture, and religion sector, increased government expenditures in the sector may result in an increased labor supply and a lower unemployment rate. Social protection spending is mostly used to support and substitute incomes, which may discourage beneficiaries from working to increase their income, as was the case with the social protection sector.

As for the productivity indicator, we found that a 1%p increase in government expenditures on economic affairs and health increased labor productivity by 0.2% and 2.0%, respectively. However, a 1%p increase in expenditures on the social protection sector lowered labor productivity by 1.1%. These similar findings can be attributed to our definition of labor productivity—the real GDP divided by the number of employees. The difference from findings on the real GDP is that an increase in economic affairs spending raised labor productivity but not the real GDP. This difference may be understood to be similar to the effect of expenditures on economic affairs on the employment rate. Our findings indicate that while an increase in expenditures in the economic affairs sector does not raise the real GDP, it improves labor productivity by lowering the unemployment rate. Therefore, increasing expenditures on economic affairs may not necessarily be the best policy for improving labor productivity.

As for the distribution indicator, a 1%p increase in social protection spending was estimated to increase the pre-tax Gini coefficient of market income by 1.4%p, indicating that an increase in social protection spending increases income inequality. If the social protection spending results in a decrease in the labor supply in the expenditure population, the pre-tax Gini coefficient of the market income may increase as the market income of the low-income group declines. A 1%p increase in government expenditures in the health sector increased the post-tax Gini coefficient of market income by 1.8%. A 1%p increase in the entertainment, culture, and religion sector lowered the post-tax Gini coefficient of market income by 6.4%.

These findings imply the possibility that some of the spending on entertainment, culture, and religion may be used to support low-income earners. If government expenditures in the health sector focus on relatively high-income groups, a spending increase in the sector may actually exacerbate post-tax income inequality.

## **V . Methods for Lower-Level Evaluation by Sector (Policy Financing for SMEs)**

Chapter IV examined the methods for conducting an upper-level evaluation among sectors and proposed an example of an expenditure restructuring system. This chapter reviews the methods and provides examples of a lower-level evaluation. We chose public financing for SMEs as a case of expenditure restructuring available for an evidence-based analysis.

Specifically, we analyze the policy financing program of the Ministry of SMEs and Startups (MSS). This is a key program subject to performance management, and it involves subsidies provided by the Korea Credit Guarantee Fund (KODIT), the Korea Technology Finance Corporation (KIBO), and the Korea SMEs and Startups Agency (KOSMES). Therefore, we will examine the data of these three organizations as well.

It should be noted that while we focus on SME policies in this chapter, the approaches used here can be applied to lower-level evaluations in all sectors where support history and result-based performance indicators can be specified and measured. Despite any different levels of preparation across sectors, the standard practices for government performance management and evaluation include the management of result-based performance indicators. Therefore, limitations mainly stem from restrictions in the support history data and performance indicators rather than the methods and evaluations proposed and analyzed in this chapter. To perform lower-level expenditure restructuring, regardless of the sector, we must first collect actual history data and endeavor to select performance indicators and improve their measurability.

This study is distinguished from numerous previous studies on the performance evaluations of policy financing by focusing on and specializing in expenditure restructuring. We review programs across various organizations, targets, and purposes to see whether they have achieved their intended targets, in terms of national economy performance indicators, and then provide evidence-based methods and examples for a comparison among supporting

organizations.

The support history for 2010 to 2015 was identified using data provided by the three supporting organizations. The 2009~2018 period is analyzed using the Korea Enterprise Data integrated with the organization data. Policy financing may be analyzed on the basis of which enterprises have unspent subsidies at year end or on the basis of new subsidies granted in a given year. In this study, we rely on the former criterion.

There are many types of analyses available for verifying whether the expenditure in a given sector has achieved its intended results. Here, we first review whether government expenditures are properly targeted.

For this task, we propose a targeting analysis designed to verify whether a given policy properly targets market failures. Specifically, we review the policy financing provided to 10-year or older enterprises to understand whether policy financing properly targets those startups that fail to finance their business from the private sector due to information asymmetry.

We can also gauge the effects of relevant policies on actual results using a quantitative evaluation method.

First, we analyze the effectiveness of subprograms to arrive at the implications for expenditure restructuring. One possible principle for expenditure restructuring is to increase the percentage of programs that are more conducive to achieving the policy goals and lowering the percentage of programs that are not. Assuming the same level of management effort, a low level of effectiveness is likely to indicate a higher total amount and a high level of effectiveness is likely to indicate a lower total amount.

We can also compare the performance of institutions providing support. Currently, the main goal of the fiscal authorities in this regard is to prevent redundant support. For this task, we need to consider that the absence of redundant support may not necessarily mean the absence of negative side effects, because organizations providing similar services may indicate competition and the possibility of a relative evaluation.

We can also analyze programs on the basis of characteristics of the supported entities. The effect of public financing for SMEs can be compared across different firm sizes or industries.<sup>1</sup>

In this chapter, we use a panel fixed effect model.<sup>2</sup> Using this model, we evaluate the

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**1** Obviously, for industries, interim goals must also be considered, because we should consider the current status of the industry. See Chang and Kang (2019).

**2** In this study, we report the findings from the panel fixed effect model, though the findings from using other methods produce largely similar results.

robustness of the policy performance evaluation and, if the findings are not robust, try to identify the causes, followed by policy implications.

## 1. Targeting analysis: Support provided to non-eligible firms – percentage of supports provided to 10-year or older firms

As an example of a targeting analysis described earlier, we analyze the supports granted to non-eligible firms.

As Chang et al. (2013) discussed, in SME policy financing, market failure is a necessary condition for government intervention. Otherwise, such government intervention lacks a basis and should be subjected to autonomous policy adjustment.

This section presents an analysis of firms with 10 or more years in the market, because they are less associated with information asymmetry, which is the main rationale for providing policy financing. In other words, if a firm operated and earned revenue for 10 or more years, and it still experiences difficulties in financing its business from the private financial market, the problem with the firm is unlikely to be information asymmetry.

As shown in Table 7, excessive public financing is provided to 10-year or older SMEs. This finding implies that the direction of expenditure restructuring can be identified during the targeting analysis phase, prior to the main performance evaluation. Financing support must be transferred to the private sector and fiscal resources must be redistributed to areas where market failures exist.

**Table 7** 2012~2014 Public Financing After Support History and Enterprise Data Integration: Summary of Support by Years in Business

Year	Years in business	No. of firms	Percentage (no. of firms)	Support from the three supporters (KRW trillion)	Percentage (support size)
2012	10 years or less	81,455	66.9%	30.9	57.1%
	More than 10 years	40,364	33.1%	23.2	42.9%
	Supported firms total	121,819	100.0%	54.1	100.0%
2013	10 years or less	82,315	65.5%	32	56.7%
	More than 10 years	43,380	34.5%	24.4	43.3%
	Total	125,695	100.0%	56.4	100.0%
2014	10 years or less	81,878	64.5%	32.2	56.9%
	More than 10 years	45,086	35.5%	24.4	43.1%
	Total	126,964	100.0%	56.6	100.0%

Source: Present study, based on KIBO (2016), KODIT (2016), KOSMES (2016), and Korea Enterprise Data (2020).

## 2. Comparison of Programs and Policy Implications KODIT<sup>3</sup>

In this section, we review the performance of the KODIT program by focusing on qualitative result-based indicators. Specifically, we examine return on assets (ROA), one of the main indicators of the profitability of individual firms.

The following is an equation for estimating the policy effect for 1 period :

$$\Delta y_{i,t} = \alpha + \beta P_{i,t} + x_{i,t-1}\gamma + I_{i,t-1}\delta + \nu_i + v_t + \epsilon_{i,t} \quad (2)$$

$\Delta y_{i,t}$ : ROA increment of firm from  $t-1$  to  $t$

$P_{i,t}$ : whether firm received the support in  $t$

$x_{i,t-1}$ : characteristics of firm in  $t-1$

$I_{i,t-1}$ : characteristics of the industry where firm operates in  $t-1$

$\nu_i$ : firm fixed effect

$v_t$ : year fixed effect

With support from KODIT, all groups' ROA declined by 3.85%<sup>op</sup>. While firms with low revenues reported more serious side effects, firms with revenues exceeding KRW 5 billion did not show significant negative effects. Regarding years in business, the negative effect of KODIT support was mainly found among firms with less than five years in business. Firms operating for 5~10 years, which are likely to be eligible for policy financing, reported significant negative effects. However, such effects were not found among firms with more than 10 years in business which are not the appropriate target firms of policy financing.

<sup>3</sup> Due to page restrictions, we include only the findings for KODIT in this study. Please see Chang and Kim (2021) for detailed findings on other institutions.

Table 8\_Effect of KODIT Support in Period 1 on ROA by Revenue in the Previous Period

Variables	KODIT Support_All	KODIT Support_Revenue in previous period of KRW 1 billion or lower	KODIT Support_Revenue in previous period of KRW 1 to 3 billion	KODIT Support_Revenue in previous period of KRW 3 to 5 billion	KODIT Support_Revenue in previous period of above KRW 5 billion
KODIT support	-3.846*** (0.205)	-3.122*** (0.630)	-1.397*** (0.252)	-0.713** (0.298)	-0.0692 (0.198)
L. Revenue	-0.000313*** (1.83e-05)	-0.0254*** (0.000536)	-0.00314*** (0.000140)	-0.000794*** (0.000130)	-7.76e-05*** (9.47e-06)
L. Total assets	0.000133*** (2.38e-05)	-0.000400*** (0.000108)	0.00100*** (6.99e-05)	0.000474*** (6.34e-05)	9.61e-05*** (1.35e-05)
L. Operating profit	-0.00709*** (7.20e-05)	-0.0340*** (0.000614)	-0.0443*** (0.000359)	-0.0247*** (0.000276)	-0.00455*** (3.52e-05)
L. SME average assets	0.000121 (0.000183)	-0.000186 (0.000445)	0.000917*** (0.000278)	0.000810** (0.000325)	0.000380** (0.000182)
L. SME average revenue	-0.000293 (0.000259)	0.000195 (0.000721)	-0.000684* (0.000354)	-0.000594 (0.000384)	-0.000452** (0.000228)
L. SME average operating profit	0.00592*** (0.00136)	0.00849*** (0.00318)	0.00774*** (0.00200)	0.000873 (0.00215)	0.000987 (0.00127)
L. SME average R&D expenses	0.00378*** (0.00145)	0.00356 (0.00356)	-0.00159 (0.00203)	0.000169 (0.00241)	0.000621 (0.00134)
L. SME average ROA	-0.387*** (0.0371)	-0.779*** (0.0834)	-0.185*** (0.0491)	-0.0407 (0.0618)	0.0640 (0.0421)
2013.Year	-0.571*** (0.110)	0.554* (0.297)	-0.0438 (0.132)	-0.129 (0.153)	-0.514*** (0.106)
2014.Year	-0.974*** (0.124)	1.233*** (0.344)	0.154 (0.154)	-0.0995 (0.179)	-0.819*** (0.120)
2015.Year	-1.234*** (0.139)	2.351*** (0.386)	0.252 (0.177)	-0.191 (0.206)	-1.022*** (0.136)
Constant	6.623*** (0.874)	17.18*** (2.149)	7.684*** (1.200)	5.122*** (1.514)	1.658* (0.924)
Observations	967,167	398,147	279,633	103,672	185,715
R-squared	0.022	0.032	0.115	0.161	0.145
No. of firms	366,150	204,114	138,676	59,184	69,571

Note: 1. Standard errors in parentheses

2. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

Source: present study, based on KODIT (2016) and Korea Enterprise Data (2020)

**Table 9** \_Effect of KODIT Support in Period 1 on ROA by Revenue in the Previous Period

Variables	KODIT Support_ years in business: 5 years or less	KODIT Support_ years in business: Above 5 to 10 years	KODIT Support_ years in business: Above 10 years
KODIT support	-7.150*** (0.441)	-2.176*** (0.419)	-0.169 (0.230)
L. Revenue	-0.000400*** (5.07e-05)	-0.000272*** (3.79e-05)	-0.000110*** (1.60e-05)
L. Total assets	0.000487*** (6.24e-05)	0.000137*** (5.09e-05)	-3.31e-05 (2.08e-05)
L. Operating profit	-0.0142*** (0.000248)	-0.00845*** (0.000150)	-0.00511*** (5.52e-05)
L. SME average total assets	-0.000587 (0.000432)	-6.57e-05 (0.000372)	0.000324* (0.000193)
L. SME average revenue	0.000128 (0.000610)	-0.000875 (0.000537)	6.33e-05 (0.000265)
L. SME average operating profit	0.00569* (0.00297)	0.00786*** (0.00296)	0.00196 (0.00141)
L. SME average R&D expenses	0.00468 (0.00350)	0.00711** (0.00286)	0.00144 (0.00143)
L. SME average ROA	-0.797*** (0.0810)	-0.254*** (0.0724)	-0.0954** (0.0419)
2013.Year	-1.400*** (0.257)	-0.178 (0.199)	0.0451 (0.113)
2014.Year	-2.503*** (0.306)	-0.305 (0.240)	0.134 (0.127)
2015.Year	-3.084*** (0.356)	0.0465 (0.280)	-0.102 (0.142)
Constant	12.42*** (2.036)	5.756*** (1.742)	0.772 (0.949)
Observations	400,827	225,071	341,269
R-squared	0.024	0.032	0.046
No. of firms	190,374	109,019	128,309

Note: 1. Standard errors in parentheses

2. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

Source: present study, based on KODIT (2016) and Korea Enterprise Data (2020)

### 3. Comparison of policy effects among institutions: KIBO and KOSMES<sup>4</sup>

In this section, we compare the performance of the policy financing program between two institutions. We use the same equation, restricting the samples to firms supported by KIBO and KOSMES, and compare the results between firms supported by KIBO and those supported only by KOSMES, and between firms supported by KOSMES and those supported only by KIBO.

After excluding the intersection and separately analyzing overlaps, the findings for KOSMES and KOSMES turned out to be symmetrical. Firms supported only by KIBO reported 2.89%p higher ROA than firms supported only by KOSMES (5% significance level). Firms supported by both institutions showed 0.64%p lower ROA than the other firms (10% significance level), which means overlapping support did not have a desirable effect.

**Table 10\_ Comparison of KIBO and KOSMES Supports in Period 1 on ROA (intersection excluded, overlaps analyzed separately)**

Variables	KIBO-KOSMES Comparison_ intersection excluded	KIBO-KOSMES Comparison_ intersection excluded	KIBO-KOSMES Comparison_ overlaps
KIBO support	2.892** (1.205)		
L. Revenue	-0.000239*** (5.91e-05)	-0.000239*** (5.91e-05)	-0.000145*** (4.80e-05)
L. Total assets	-6.55e-05 (8.03e-05)	-6.55e-05 (8.03e-05)	-7.57e-05 (6.16e-05)
L. Operating profit	-0.0102*** (0.000224)	-0.0102*** (0.000224)	-0.00973*** (0.000183)
L. SME average total assets	0.000784 (0.000779)	0.000784 (0.000779)	0.000624 (0.000659)
L. SME average revenue	7.01e-05 (0.000863)	7.01e-05 (0.000863)	-0.000309 (0.000721)
L. SME average operating profit	-0.00256 (0.00465)	-0.00256 (0.00465)	0.00300 (0.00394)
L. SME average R&D expenses	-0.00976** (0.00487)	-0.00976** (0.00487)	-0.0101** (0.00424)
L. SME average ROA	-0.505*** (0.0942)	-0.505*** (0.0942)	-0.484*** (0.0805)

<sup>4</sup> Due to page restrictions, we include only the comparison between KIBO and KOSMES. Please see Chang and Kim (2021) for detailed findings on other institutions.

**Table 10\_ Comparison of KIBO and KOSMES Supports in Period 1 on ROA (intersection excluded, overlaps analyzed separately)(continued)**

Variables	KIBO-KOSMES Comparison_ intersection excluded	KIBO-KOSMES Comparison_ intersection excluded	KIBO-KOSMES Comparison_ overlaps
2013.Year	-0.266 (0.285)	-0.266 (0.285)	-0.478** (0.241)
2014.Year	-0.0307 (0.347)	-0.0307 (0.347)	-0.396 (0.292)
2015.Year	-0.274 (0.428)	-0.274 (0.428)	-0.717** (0.360)
KOSMES support		-2.892** (1.205)	
Overlapping support			-0.643* (0.387)
Constant	3.875 (2.802)	6.767** (2.683)	6.900*** (2.228)
Observations	436,824	436,842	436,842
R-squared	0.045	0.109	0.027
No. of firms	217,327	217,337	217,337

Note: 1. Standard errors in parentheses

2. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

Source: present study, based on KIBO (2016), KOSMES (2016), and Korea Enterprise Data (2020)

## 4. Chapter Conclusion

Our in-depth analysis of public financing for SMEs identified excessive support for firms operating for more than 10 years, which do not fit the market failure requirement. Regardless of the policy evaluation results, the findings suggest the need for immediate redistribution of more than KRW 20 trillion assigned to public financing programs.

The government must immediately adjust the policy to identify financing provided to firms with more than 10 years in business and redistribute the amount to younger firms.

One reason for the excessive support granted to older firms not closely associated with market failure caused by information asymmetry seems to be the propensity for supporting institutions to make safer choices to ensure recovery of the principal and interest on loans. This suggests the need for adjusting the recovery rate (subrogation payment rate) criteria for performance indicator management.

Our analysis on productivity showed that the programs had largely negative effects on the supported firms' productivity. If there had been characteristics shared by supported firms that

reported higher competitiveness and profitability, we would have recommended redistributing the fiscal resources to firms with those characteristics. Unfortunately, the findings were similar across all firms.

Consequently, in this study, we suggest a policy neutralization goal as a minimum target for future policies. Policy neutralization means zeroing the benefits of a policy without considering its costs. In this sense, policy neutralization represents a minimum goal in cost-benefit analysis. Basically, it means that the relevant policy should not produce negative effect. We suggest the need for managing policies with policy neutralization criteria consisting of short-term minimum goals.

If, after policy normalization, a policy is confirmed to have a desirable effect, depending on the characteristics of the targeted firms or the policy, the government will be able to genuinely improve policy financing by expanding on the policy with the desirable effect and reducing underperforming policies.

In addition, as policy evaluation results differ among supporting institutions, the policy needs to be adjusted by considering the institutions' different requirements. The findings of our targeting analysis suggest the need to depart from blanket support with uniform goals and instruments and transition to targeted support with clearly detailed policy goals. If support departments are organized for specific industries, policy financing support may be divided at the industry level. It would be better to institutionally ensure that each institution performs its own industry distribution/policy adjustment function.

As proposed by Chang and Kang (2019), the government needs to consider adopting interim performance indicators for industries. Booming industries require investment facilitation (by reducing information asymmetry) and productivity improvement. As for underperforming industries, their productivity must be improved by reducing their business facilities and strengthening the core of their business. This distinction should be considered before evaluating policy performance.

The findings are consistent in that the marginal effect of the public financing policy is low. Then, it should always be kept in mind that public financing for SMEs needs to be reduced if their performance cannot be expected to improve.

Although this chapter focused on policy financing, the methods provided in this chapter can be applied to other sectors where support history and national economy performance indicators can be secured. By comparing industries, specific targets, supporting institutions, and the terms of support, the government will be able to identify sectors with better or poorer performance and distribute fiscal resources accordingly.

## VI. Conclusions

In this study, we defined active fiscal policy management and reviewed its associated factors to derive suggestions for constructing a relevant expenditure restructuring system. We emphasized the importance of an evidence-based approach for this process and evaluated the effects of government sector spending by utilizing OECD panel data as an example of a higher-level approach, while making use of Korean micro-level SME public funding data to provide an example for lower-level expenditure restructuring.

Active fiscal policy management is a process intended to change the future path of the economy by modifying existing financial policy mixes. In standard fiscal policy management, it is common for the government to predict the future path of the economy and to adjust government spending among relevant sectors without explicitly considering the purported effects of fiscal policy. Conversely, in active fiscal policy management, the government deliberately adjusts the policy mixes to change the future direction of national economic development.

From the mid- to long-term perspective, the process of determining the expenditure structure in active fiscal policy management must be different from general fiscal policy managements, because active management aims to control the direction of future progress by preemptively responding to challenging future situations. As such, expenditure restructuring needs to be approached from the holistic perspective of future economic development. Thus, expenditure restructuring should be a process of determining the priority of a given program in relation to intended economic goals, rather than a process of simply cutting the budget for selected programs.

Determining the priority of programs in this way requires increasing spending in areas that improve the future of the national economy while reducing expenditure on programs of relatively low importance. To this end, it is necessary to review the effects of overall fiscal expenditure at the upper and lower levels comprehensively.

A comprehensive and systematic approach is required for active fiscal policy management to succeed. Therefore, expenditure restructuring should not be a project conducted by a single entity. Rather, it requires cooperation among various related entities. For example, the Ministry of Economy and Finance might act as a coordinator, the National Assembly or Blue House as a reviewer and approver, ministries as program owners, and a national research institute as an information evaluator and analyst. The definition of active fiscal policy management implies that policy managers should avoid taking a one-time approach to restructuring expenditures, as mid- to long-term management is necessary in this framework.

One important requirement for the expenditure restructuring system is that the process should be based on firm, quantitative evidence. Because almost every government program has good intentions and historical background to rationalize its spending, it is crucial to confirm whether a given program is achieving its goals effectively and efficiently with hard evidence that justifies the expenditure.

To this end, we analyzed the relationship between higher-level sector spending and the actual achievement of various economic goals using OECD panel data for government sector spending. Interestingly, we found that spending is not always directly related to the intended goal of the expenditure

Next, we presented the results of a performance evaluation for restructuring expenditure in lower-level government spending. As an example, we evaluated public funding for SMEs in-depth. Targeting analysis indicated that support for companies with more than 10 years of market experience was excessive, which implies the violation of market failure conditions for government spending. According to these results, current expenditure of more than 20 trillion Korean won can be redistributed more appropriately to young enterprises.

According to the evaluation of productivity for support firms, the effect of public funding was generally negative in terms of its impact on the productivity of supported companies across various subgroups. However, it is also true that there were relative differences between the institutes or firms targeted, meaning that it is still possible to reallocate financial resources to relatively better performing areas. Nevertheless, it would be even better to cut expenditures for each program or to otherwise improve their efficiency.

It is worth noting that the systematic collection of micro-level policy data and the improvement of performance indicators is required to introduce and utilize an evidence-based evaluation for restructuring expenditures. While the degree of preparation for each field affected may be different, the findings suggest that evidence-based evaluation in all fields under the given conditions should be implemented first, for active fiscal policy management to be successful, while conditions for restructuring expenditures can be improved gradually.

Korea currently faces various medium- and long-term challenges. Then, active fiscal policy management and expenditure restructuring clearly hold great significance in the country's efforts to use its fiscal resources to steer the future in a more desirable direction.

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# Wage Increase, Labor Market of Older Workers, and Public Pension Receipt

HeePyung Cho and Changsu Ko\*

## I. Introduction

The aging of the Korean society conferred increasingly greater significance to senior jobs and public pensions as a means to maintain the livelihood and security of the older population. A range of policies has been implemented in attempts to support the older population's participation in the labor market, such as the "Senior Job and Social Work Program." In addition, security for the older population has continuously increased thanks to the expansions of public pension programs, such as the National Pension and Basic Pension Systems. Despite these policy efforts, the quality of life of the older population remains low in Korea. In 2018, the poverty rate of the older population in the country was 43%, which was the highest among OECD countries.<sup>1</sup>

Among the numerous policies related to the labor market of older workers that have been introduced to date, a minimum wage increase can have significant impact on the overall wage levels and incomes of the older population. This is because a considerable number of low-skilled older workers receive wages close to the minimum wage. In fact, the minimum-wage-to-median-wage ratio of workers aged over 60 is much higher than the other

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<sup>1</sup> OECD Data, <https://data.oecd.org/inequality/poverty-rate.htm> (accessed on August 30, 2021)

age groups, approaching almost 70% based on the “Survey Report on Labor Conditions by Employment Type.”

In this paper, we analyze how a rise in the minimum wage affects the labor market of older workers and their public pension receipt. A rise in wages caused by a minimum wage increase can potentially have both positive and negative effects. For positive effects, the wage increase can lead to a rise in the income of lower-income senior citizens. And as for negative effects, the same wage increase can lead to job losses for the older population. The most distinguishable characteristic of the labor market of older workers is that their decision to participate in the labor market is closely related to their retirement decision. If the minimum wage can change senior citizens’ retirement decisions by affecting their labor market, it can also have an impact on their public pension receipt. Borgschulte & Cho (2020) show that minimum wage hikes in the U.S reduce both the total benefits paid through Social Security and the number of beneficiaries, by increasing the labor supply and income of older workers.

We find that a rise in the minimum wage does not have a significant impact on the overall employment size of the older population but significantly reduces their working hours. Also, a rise in the minimum wage increases the average earnings of the employed but does not increase the average earnings of the entire population including the unemployed and non-wage earners. In addition, the impact of the minimum wage on the labor market is considerably heterogeneous across population groups. The income and employment of female and low-skilled workers decrease, whereas such decrease is not found among male and high-skilled workers. Unlike regular workers, the employment of temporary and daily workers decreases. Employment also decreases in industries where older workers work as cleaners or security workers, while public sector jobs increase.

In addition, a rise in the minimum wage does not have a significant impact on the probability of receiving the Old-Age Pension. This is consistent with the findings mentioned above, where female and low-skilled workers without sufficient protection from the National Pension are adversely affected by a minimum wage increase. However, we find a meaningful drop in the probability of receiving the early Old-Age Pension and the amount disbursed. This is also closely related to the fact that people insured under the National Pension System for long periods are likely to be in the group that is not adversely affected by the minimum wage increase. Although a rise in the minimum wage does not have a significant impact on the percentage of people receiving the Basic Pension, it tends to polarize the income of beneficiaries of the Basic Pension.

## II. Minimum Wage Increase and Labor Market Outcomes for Older Workers

According to the neo-classical economic theory, the minimum wage can have negative impacts on the labor market of the older population. If the wage level drops below the older population's productivity, it can force them to retire and ultimately leave the labor market. Their jobs are then taken up by younger workers or machines. If the labor market is rigid, employers may reduce their working hours instead of decreasing the number of jobs. Employers can also alternatively reduce various welfare benefits without reducing the number of employed workers. From the perspective of employers, these measures can lighten the burden of laying off employees while receiving support from government programs such as "Job Stabilization Fund."

However, a rise in the minimum wage can encourage the older population to participate in the labor market. First, jobs in the other age groups can be taken up by the older population. Employers may prefer an older person with ample experience to a younger person who may lack the relevant experience. Moreover, if there exists monopsony in the labor market, a rise in the minimum wage can increase employment. Specifically, older workers' attachments toward their jobs or residences can make monopsony more prominent compared to the other age groups.

The majority of previous studies on minimum wage have focused on the labor demand side, underestimating the aspect of the supply side. However, it is important to consider the labor supply effects of the minimum wage, given the fact that the labor supply elasticity of older workers may be greater than that of the other age groups (Gelber, Isen, and Song 2016; Gelber et al. 2017). As there is little difference between working and not working (retirement) for older workers, their labor supply can be greatly affected by even minor changes in wages. Therefore, a rise in the minimum wage can increase employment as well as working hours by increasing work incentives.

Despite the continuous debates in the academia about whether the minimum wage hurts employment, a consensus has yet to be achieved. However, previous international studies that analyze the impact of the minimum wage on the older population reach similar conclusions. First, Fang and Gunderson (2009) show that a rise in the minimum wage in Canada increased the employment of the older population aged over 50. Borgschulte and Cho (2020) find that a rise in wages in the U.S increased the working hours and incomes of the older population while reducing the probability of receiving Social Security benefits.

A range of studies in Korea assesses the impacts of the minimum wage on the labor market in Korea. However, most of them mainly focus on the impacts of the minimum wage on the working-age population, presenting any impacts on the older population as additional results. In sum, there is no universally agreed conclusion on the impact of the minimum wage on the labor market. Some argue that the minimum wage has negative employment effects, while others claim that such negative employment effects are limited. The same trends are found in the research studying the impacts of the minimum wage on the labor market of older workers. Nevertheless, studies that find negative effects on the entire labor market tend to show that the older population is more adversely affected by the minimum wage.

## 1. Data and Empirical Strategy

### A. Data

In this chapter, we use the Regional Employment Survey (hereinafter referred to as ‘RES’, 2009~2020) to analyze the effects of the minimum wage on the labor market of older workers. The reason for using RES for our empirical analysis is to take advantage of the rich regional-level variations in the minimum wage effects.

According to Bae (2019), the wage gaps across regions in Korea have remained relatively stable. Thus, it is unlikely that other shocks in the local labor market are misidentified as the results of a minimum wage increase. We also control various characteristics of each region, such as population size or industry composition when estimating the effects of the minimum wage. In addition, we find that the results are robust when comparing cities and counties ( $S_i$  and  $G_{im}$ ) within the same region or state ( $D_{\theta}$ ).

### B. Definition of Minimum Wage Bite

In Korea, there is only a single national-level minimum wage. As such, it is impossible to identify the effects of the minimum wage using the variations in minimum wage levels across regions as in other international studies. However, the minimum wage still varies depending on the region, as the ratio of low-paid workers affected by the minimum wage differs by region. Such differences are caused not only by differences in the population composition but also by differences in the wage distribution.

Therefore, we aim to identify the effects of the minimum wage using differences in the

extent of the effect of the minimum wage between regions—minimum wage bite. This measures how much a population group is affected by the minimum wage. We use a total of 966 population groups constructed from 161 cities and counties, age groups (ages between 60~64, 65~69, and over 70), and genders. We use gender and age to construct population groups because the time-series trend in employment and income may differ across ages and genders. Also, the minimum wage bite itself may differ depending on age and gender.

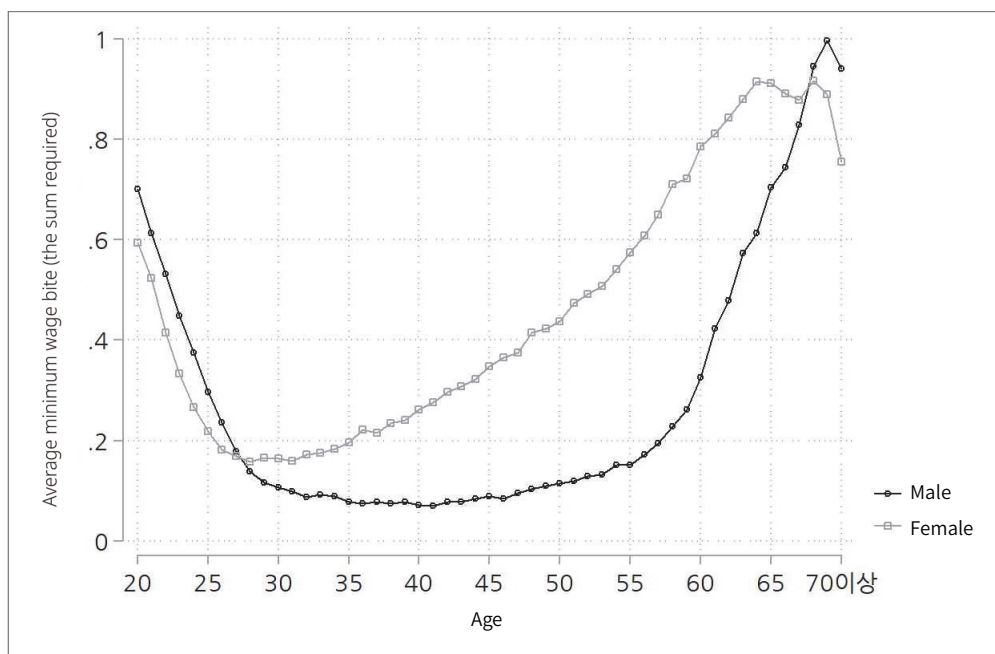
$MWB_{i,t}$ , which represents the minimum wage bite, is defined as follows:

$$MWB_{i,t} = \begin{cases} 0 & \text{if } w_{i,t-12} \geq MW_t \\ (MW_t - w_{i,t-12}) \times h_{i,t-12} & \text{if } MW_t > w_{i,t-12} \geq MW_{t-12} \\ (MW_t - MW_{i,t-12}) \times h_{i,t-12} & \text{if } w_{i,t-12} < MW_{t-12} \end{cases} \quad (1)$$

where  $MW_t$  and  $MW_{t-12}$  refer to minimum wages in period  $t$  and period  $t-12$  (12 months prior), respectively.  $w_{i,t-12}$  and  $h_{i,t-12}$  refer to hourly wages and weekly working hours in period  $t-12$ , respectively.

In cases where the wage in  $t-12$  is higher than the minimum wage in period  $t$ , the value of  $MWB_{i,t}$  is 0 because there is no need to increase the wage. In cases where the hourly wage in period  $t-12$  is greater or equal to the minimum wage in period  $t-12$  but smaller than the minimum wage in period  $t$ ,  $MWB_{i,t}$  is defined as the difference between the minimum wage in  $t$  and  $t-12$  (wage increment), multiplied by the working hours in  $t-12$ . That is,  $MWB_{i,t}$  in period  $t$  is defined as the additional weekly earnings required to increase the hourly wage to the level of the minimum wage in period  $t$ . If the hourly wage in period  $t-12$  is lower than the minimum wage in period  $t-12$ ,  $MWB_{i,t}$  uses the gap between the minimum wages in periods  $t$  and  $t-12$  as the wage increment. Therefore, when calculating  $MWB_{i,t}$ , the maximum limit of the wage increase is the amount of the minimum wage increase. This prevents overestimating  $MWB_{i,t}$  when the estimated hourly wages are lower than the actual wages.

Figure 1\_Minimum wage bite by age



Source: The above graph was made by the authors based on Statistics Korea Micro Data Integrated Service, *Regional Employment Survey*.

$MWB_{i,t}$  of each population group is constructed by calculating the average of individual-level  $MWB_{i,t}$  using the survey weights of the Regional Employment Survey. Figure 1 shows the average minimum wage bite by gender and age (2009~2020). Women are more influenced by the minimum wage than men because of the differences in wages between men and women in their mid-20s. The figure also confirms that the minimum wage bite increases and becomes stronger with age. Based on this fact, we expect that women and the older population are more affected by a rise in the minimum wage.

### C. Empirical Strategy

To estimate the effects of minimum wage on the labor market of older workers, labor market outcome variables are calculated for region-age-gender population groups. Specifically, the employment rate, average working hours, and log of average wage income are obtained using the weights of the Regional Employment Survey (RES). As the RES only has

income data on wage earners, the incomes of the self-employed are excluded when calculating the average income for each population group. The average labor hours and wage income are calculated using two different methods. The first method uses all samples in the population group (treating working hours of the unemployed and non-wage earners' income as 0), and the second uses only the employed group (treating working hours of the unemployed and non-wage earners' income as missing values).

To show the effects of the minimum wage on the labor market, we estimate the following cell-level equation, where cells are defined by  $Si$  and  $Gun$  (*Cities and Counties of Korea*) ( $r$ ), *Gender* ( $s$ ), *Age* ( $a$ ), and *year-month* ( $t$ ).

$$y_{rsa,t} - y_{rsa,t-12} = \beta \text{Log}(MWB_{rsa,t}) + \gamma X'_{r,t-12} + \varnothing_{as,t} + \epsilon_{ras,t} \quad (2)$$

where  $MWB$  refers to the minimum wage bite for each population group, i.e., the average amount required to raise the hourly wage in period  $t-12$  to the level of the minimum wage in period  $t$ . Coefficient  $\beta$  refers to the effect of the minimum wage bite on differences in the labor market outcomes between this year and the last year.

In the equation above, age  $\times$  gender  $\times$  time-fixed effects ( $\varnothing_{as,t}$ ) are controlled. As such, the effects of minimum wage are identified using the cross-sectional variation in the minimum wage bite of population groups with the same age and gender. As the dependent variables are defined as differences, it is possible to control characteristics not observed across regions despite the use of the cross-sectional variation. In addition, the characteristics of each  $Si$  and  $Gun$  (city/county) a year prior are controlled to overcome the estimation problems that might be caused by any heterogeneous nature between regions. Such characteristics of each  $Si$  and  $Gun$  include the log population, ratio of the self-employed, portion of the population aged over 60, and the ratio of agricultural employment to total employment. Lastly, standard errors are clustered by region.

## 2. Effects of Minimum Wage on Employment, Working Hours and Income

### A. Empirical Results

Table 1 presents the estimated  $\beta$  using Equation 2, highlighting the effects of minimum wage on the labor market outcome of the older population over 60. The dependent variables

in Panel A, B, and C are employment rate, average working hours, and log average wage income for each population group, respectively. Columns (1) and (2) use all samples in the analysis, while Columns (3) and (4) only use the samples between 2017 and 2020. In addition, Columns (1) and (3) utilize the entire sample, including both the employed and the unemployed. Columns (2) and (4) of Panel B and Panel C restrict samples to the employed.

**Table 1\_Effects of minimum wage on labor market outcomes of older workers**

	2009~2020		2017~2020	
	Total (1)	Employed (2)	Total (3)	Employed (4)
<b>Panel A: Employment Rate</b>				
Effects of Minimum Wage	0.000 (0.002)		-0.004 (0.003)	
N	19,111		5,788	
Average	0.41		0.42	
<b>Panel B: Average Working Hours</b>				
Effects of Minimum Wage	-0.666*** (0.078)	-1.866*** (0.151)	-0.778*** (0.143)	-1.848*** (0.204)
N	19,111	19,111	5,788	5,788
Average	15.63	36.16	15.28	34.01
<b>Panel C: Log Wage Income</b>				
Effects of Minimum Wage	-0.001 (0.013)	0.030*** (0.008)	-0.003 (0.022)	0.024* (0.013)
N	19,083	19,083	5,783	5,783
Average	2.85	4.61	3.19	4.77
Age × Gender × Time Fixed Effects	Y	Y	Y	Y
Control region characteristics	Y	Y	Y	Y

Note: 1. Standard errors are clustered by region

2. Number of population in each cell is used as weights

3. \*\*\* 1%, \*\* 5%, \* 10% significance

Source: The table above was made by the authors

Column (1) of Panel A shows that there are very limited effects of minimum wage on the employment rate of the older population during the analysis period. The absolute size of the coefficient is small, and it is precisely estimated. For the 2017~2020 period, when the rate of increase of the minimum wage was high, a statistically insignificant and small negative coefficient is estimated (Column 3). Although the effects on the employment size are small, this does not mean that the minimum wage increase did not cause any change in the labor

market. We will later show in a heterogeneity analysis that the composition of the employed has changed considerably due to the minimum wage.

Panel (B) shows that the minimum wage has a substantial negative effect on the average working hours of the entire population (including the unemployed). Column (1) shows that the working hours of the entire older population decrease by 0.07 hours when the minimum wage bite increases by 10%. Column (2) shows the effects of minimum wage on working hours in the limited sample solely consisting of the employed. The panel indicates that the working hours of the older workers decrease by 0.19 hours when the minimum wage bite increases by 10%. The same results are observed when the analysis period is limited to years after 2017. Such negative effects on the labor market are caused by a decline in the labor demand for employers and workers' voluntary reduction of working hours (income effect).

Panel (C) shows the effects of the minimum wage on wage income. Although a rise in the minimum wage serves as an income growth factor by increasing the hourly wage of low-skilled workers, it also reduces the total working hours (Panel B). This in turn offsets the income increase to some extent. Column (1) estimates the effects on the entire older population, and a small and statistically insignificant coefficient is estimated. However, a statistically significant positive coefficient was estimated in Column (2), indicating that when the minimum wage bite increases by 10%, the income of the wage earner increases by 0.3%.

Columns (3) and (4), which use the 2017~2020 samples, also show a similar pattern to those of Columns (1) and (2). The reason that the estimated coefficient of Column (1) is smaller than that of Column (2) is that the proportion of wage earners decreases due to a rise in the minimum wage—this will be addressed in Table 3. However, as this result was estimated based only on wage income (excluding the income of the self-employed), this result should not be considered as general effects of the minimum wage on income.

Overall, a rise in the minimum wage does not induce a statistically significant effect on the employment size of the older population, while reducing their working hours significantly. In addition, while a rise in the minimum wage increases the incomes of wage earners, it had only a limited impact on the average increase in the wage income of the entire older population. The negative effects of a rise in the minimum wage occurred in the form of 'working hours,' not in the form of 'employment.' However, the heterogeneity analysis in the next section finds that the employment of vulnerable groups is also adversely affected by the rise in the minimum wage.

## B. Heterogeneity Analysis

### 1) Heterogeneity by Age

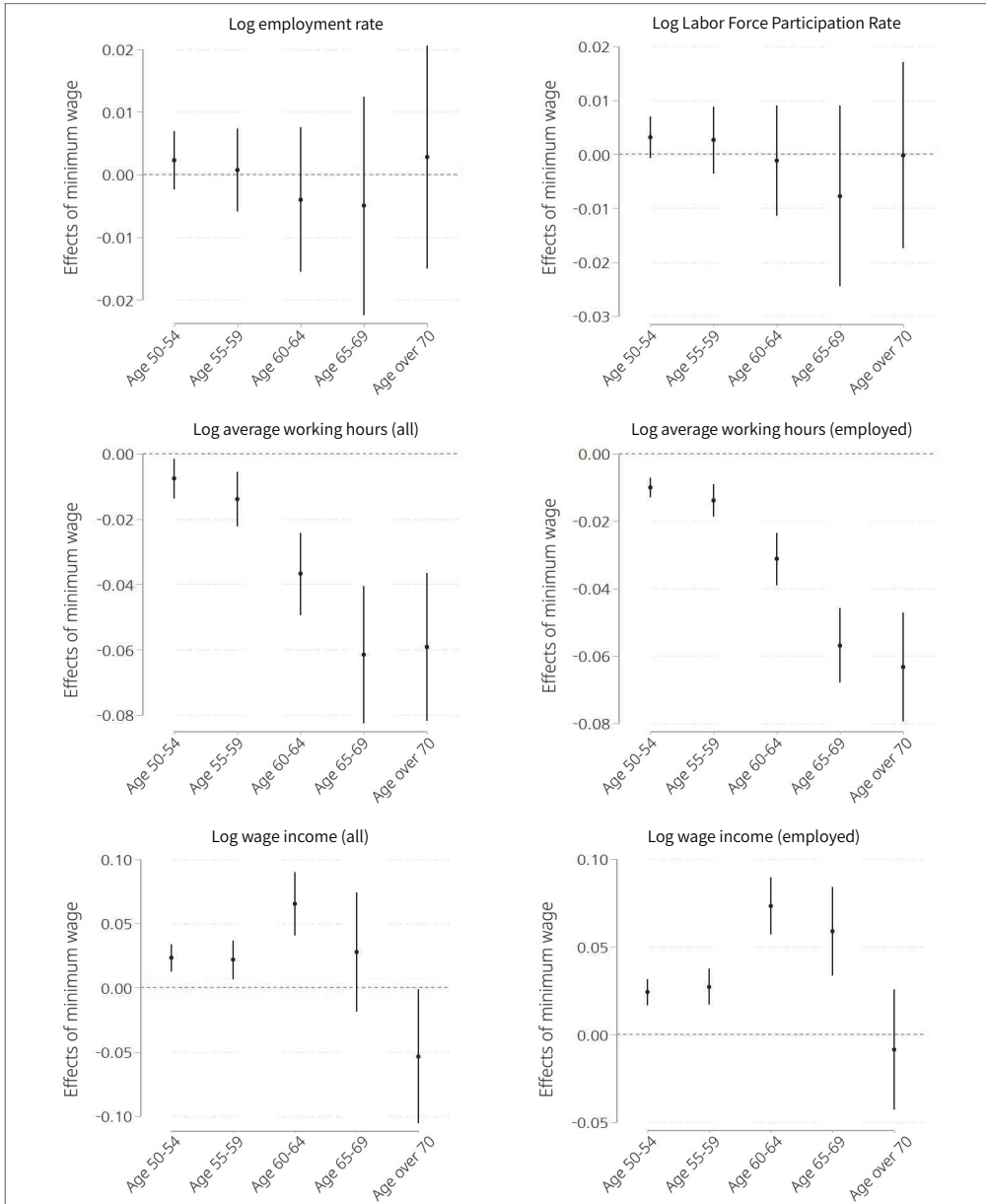
As indicated earlier, the characteristics of the labor market for the older population differ by age, implying that the effects of minimum wage may also differ by age. Figure 2 shows the effects of minimum wage on the older population by age ('50~54 years', '55~59 years', '60~64 years', '65~69 years', and '70 years and older'). Here we use the logarithm of employment rate and average working hours as dependent variables to compare the estimated coefficients of each age group more easily.

Panel A and B show the effects on the employment rate and the labor force participation rate. Insignificant coefficients are estimated at the 95% significance level across all age groups. However, the estimated coefficients tend to be more negative in older population groups. Panel C and Panel D show the effects on working hours, and the negative coefficients are estimated in all age groups. In addition, the absolute value of these coefficients gets bigger as the age groups get older, thus confirming that the older population is adversely affected by a rise in the minimum wage. For example, when the minimum wage bite increases by 10%, the working hours for those in their 50s fall by 0.1%, while the working hours of those aged over 65 fall by about 0.6%.

Finally, Panels E and F analyze the effects of minimum wage on the average wage income of the entire population and wage earners only, respectively. As for those under 70, their average wage incomes increase because of the wage increase caused by a rise in the minimum wage. With a 10% increase in the minimum wage bite, the wage income of those in their 60s increases by 0.5%. On the other hand, for those in their 70s, the minimum wage decreases their wage income, with no statistically significant effect on the incomes of the employed. It can thus be posited that although a rise in the minimum wage has brought about a wage increase, the decrease in the working hours combined with the reduced proportion of wage earners has a negative impact on the average wage incomes of the older population.

In sum, Figure 2 shows that the higher the ages of individuals, the greater the negative impact of a rise in the minimum wage on the labor market outcome. In particular, the average wage income of the older population aged over 70 is hit hardest by the rise in the minimum wage. These older workers tend to have low productivity with low educational attainments. Therefore, the labor market outcome of the older population aged over 70, one of the most vulnerable groups in the labor market, can be aggravated due to a rise in the minimum wage.

Figure 2\_Effects of Minimum Wage by Age Group



## 2) Heterogeneity by Gender and Education Level

Table 2 shows different effects of minimum wage by age (Columns (2) and (3)) and education level (Columns (4) and (5)). We additionally use education levels to define the population groups used in the analysis; the list of categories are cities and counties (161 cities and counties in total), age groups (60~64 years old, 65~69 years old, and over 70 years old), and education level (persons with high school diploma or higher, persons with no high school diploma). In Columns (2) and (3), we further separate each population group into ‘men’ and ‘women’, respectively. And in Columns (4) and (5), we divide the groups into persons ‘with no high school diploma’ and ‘with high school diploma or higher’.

**Table 2\_Effects of Minimum Wage by Gender and Education Level**

	Total (1)	Men (2)	Women (3)	No high school diploma (4)	High school diploma or higher (5)
<b>Panel A: Employment rate</b>					
Minimum wage bite	0.000 (0.001)	0.004** (0.002)	-0.005** (0.002)	-0.002 (0.002)	0.005 (0.003)
N	38,130	18,990	19,140	19,111	19,019
Average	0.41	0.52	0.31	0.38	0.45
<b>Panel B: Average working hours</b>					
Minimum wage bite	-0.644*** (0.076)	-0.559*** (0.102)	-0.755*** (0.096)	-0.692*** (0.073)	-0.550*** (0.168)
N	38,130	18,990	19,140	19,111	19,019
Average	15.63	21.76	10.77	14.09	18.40

Note: 1. Standard errors are clustered by region

2. Number of population in each cell is used as weights

3. \*\*\* 1%, \*\* 5%, \* 10% significance

Source: The table above was made by the authors

First, in Columns (2) and (3), there are significant differences between men and women in terms of the effects of the minimum wage increase in the labor market. With a 10% increase in the minimum wage bite, the men’s employment rate increases by 0.04%p, and the women’s employment rate decreases by 0.05%p (Panel A). In addition, a rise in the minimum wage also reduces the working hours of men and women by 0.06 hours and 0.08 hours, respectively (Panel B).

The absolute size of the decline in working hours seems similar in both genders. However, when it is translated into percentage relative to the population group average, there is a gap in the decrease, 0.3% for men and 0.7% for women. Lastly, the minimum wage has significant impacts on the average wage income. For men, a 10% rise in the minimum wage leads to an overall 0.6% increase in terms of entire income. On the other hand, it leads to a 1% decrease in income for women. It can thus be concluded that decreases in both employment and working hours for women occur at the same time, further adversely affecting their average income.

In Columns (4) and (5), we also show that minimum wage effects differ depending on the education level. The employment coefficient of the older population with no high school diploma is estimated to be negative (although it is not statistically significant), while the coefficient of the older population with a high school diploma or higher is estimated to be positive (Panel A). Also, a 10% rise in the minimum wage bite reduces working hours by 0.07 hours for those with no high school diploma (0.05% relative to the average), while the working hours for the older population with a high school diploma or higher are reduced only by 0.06 hours (0.3% relative to the average).

Overall, minimum wage increases affect the labor market outcomes of women and older workers with low education levels more adversely than those of men and older workers with high education levels. This finding suggests that the minimum wage increases have more negative effects on the vulnerable population groups in the labor market with low productivity. This contradicting effect on employment hints that a ‘labor-labor substitution’ can occur in the older workers’ labor market. That is, women can be substituted by men, and workers with low productivity can also be substituted by workers with high productivity.

### 3) Heterogeneity by Type of Employment

Table 3 analyzes how the minimum wage increase has different impacts on the older population depending on their forms of employment. The dependent variable of Panel A is defined as  $\frac{(\text{Number of employees in certain type of employment})}{(\text{Total population})}$  and the dependent variable of Panel B is defined as  $\frac{(\text{Sum of working hours of employees in certain type of employment})}{(\text{Total population})}$ .

First, Columns (1) and (2) show the effects of a minimum wage increase on full-time and part-time employment (Panel A) and working hours (Panel B), respectively. Whether a person works full-time or not is not directly surveyed in the RES. Therefore, whether a person works 40 hours a week or not is used as the standard for classifying a ‘full-time job’ or a ‘part-time

job.’ To maintain consistency with the previous analysis, the standard of working 40 hours a week is also applied to the self-employed or to family members working without pay.

**Table 3\_Effects of Minimum Wage by Type of Employment**

	Classification by working hours		Classification by worker status					
	Full-time (> 40 hours) (1)	Part-time (< 40 hours) (2)	Regular worker (3)	Temporary worker (4)	Daily worker (6)	Self-employed worker (with staff) (6)	Self-employed worker (no staff) (7)	Worker without pay (8)
<b>Panel A: Employment Rate</b>								
Effects of Minimum Wage	-0.012*** (0.002)	0.012*** (0.001)	0.002 (0.001)	-0.003*** (0.001)	-0.002*** (0.001)	0.000 (0.001)	0.002* (0.001)	0.001*** (0.000)
N	19,111	19,111	19,111	19,111	19,111	19,111	19,111	19,111
Average	0.24	0.17	0.07	0.10	0.04	0.02	0.14	0.04
<b>Panel B: Average Working Hours</b>								
Effects of Minimum Wage	-0.868*** (0.095)	0.202*** (0.040)	-0.071 (0.060)	-0.464*** (0.050)	-0.194*** (0.025)	-0.004 (0.024)	0.034 (0.059)	0.037 (0.022)
N	19,111	19,111	19,111	19,111	19,111	19,111	19,111	19,111
Average	11.71	3.92	3.15	3.21	1.19	0.94	5.62	1.50
Age × Gender × Time Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Control region characteristics	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1. Standard errors are clustered by region  
 2. Number of population in each cell is used as weight  
 3. \*\*\* 1%, \*\* 5%, \* 10% significance

Source: The table above was made by the authors

Interestingly, we find that the minimum wage increase reduces full-time work while increasing part-time work. A 10% increase in the minimum wage bite leads to a 0.1%p decline in the full-time work employment rate of the older population (number of full-time workers divided by total population), increasing part-time employment rate (number of part-time workers divided by total population) by 0.1%p. This result is in line with the previous results, which showed the minimum wage increase leads to a decline in working hours. For the effects of minimum wage increase on the average working hours in Panel B, we find that the average working hours of full-time work decline by 0.09 hours, whereas the average working hours of part-time work increase by 0.02 hours.

A phenomenon in which full-time work has changed into part-time work can be explained by labor demand, labor supply, and public jobs. First, from the perspective of labor demand,

employers can cope with a minimum wage increase by reducing the working hours of the older population and introducing a contract by which full-time work is changed into part-time work. On the other hand, from the perspective of labor supply, older workers may increase their leisure time while reducing their working hours. Lastly, due to the minimum wage increase, older workers may move to public jobs from non-public part-time jobs.

Columns (3)~(7) analyze the effects of the minimum wage increase on employment rate and working hours by worker status. Columns (3)~(5) show the effects of the minimum wage increase on regular worker, temporary worker, and daily worker, respectively. For elderly wage earners, the employment rate of regular worker shows a positive coefficient, though it is not statistically significant. On the other hand, the employment rates of temporary worker and daily worker have statistically significant negative coefficients. With a 10% increase in minimum wage bite, the employment rates of temporary worker and daily worker decline by 0.03p% and 0.02p% (Panel A). Similarly, while small and statistically insignificant coefficients are estimated for the working hours of regular worker, the working hours of regular and daily worker decrease by 0.05 hours and 0.02 hours, respectively (Panel B). Overall, the minimum wage has a negative effect on the labor market outcome of temporary workers, as well as on daily workers.

Columns (6) and (7) show the effects of the minimum wage increase on the labor market outcome of the self-employed with staff and the self-employed without staff, respectively. Regardless of whether the self-employed workers have a staff or not, it seems that the effects of the minimum wage increase on the employment and working hours of the self-employed are not significant. However, as for the self-employed with no staff, who are less likely to be influenced by a minimum wage increase, it is estimated that the employment of the self-employed with no staff increases by 0.02%p. As pointed out earlier, these estimation results should be interpreted with caution because the minimum wage bite of each population group calculated based only on wage income may not exactly reflect the minimum wage bite of the self-employed. Furthermore, it is impossible to understand the effects of a minimum wage increase on the income of the self-employed because their income data do not exist in the RES.

Lastly, Column (8) shows that the minimum wage increase has increased the number of unpaid family workers. Here, 'unpaid family worker' refers to family members or relatives of the employed, who do not receive a fixed sum for work while working more than 1/3 of regular working hours. We find that a 10% increase in the minimum wage bite increases the proportion of unpaid family workers by 0.01%p and working hours by 0.01 hours. Most unpaid family

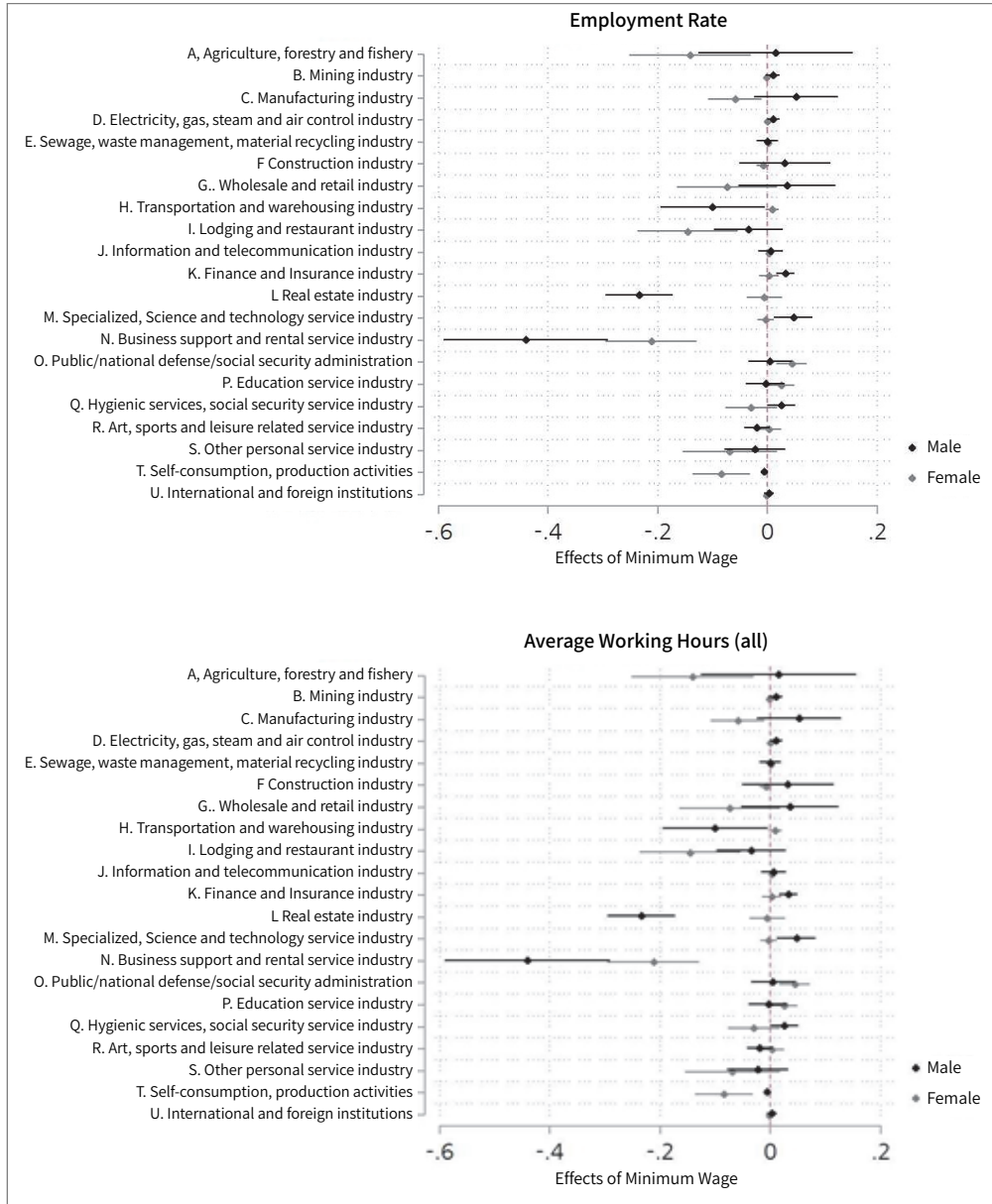
workers are women, largely accounting for most of the increase in unpaid family workers. Although the number is small, this may reflect the phenomenon where the self-employed such as restaurant owners hire their family members or relatives instead of staffs. Considering that unpaid family members are classified as ‘the employed’, the negative effects of the minimum wage on the employment of women may be much greater.

#### 4) Heterogeneity by Industry

Next, we estimate Equation 2 to analyze how the minimum wage increase affects employment and working hours by industry. The dependent variable of Equation 2 is now the probability of being employed in each industry (employment rate by each industry) or average working hours in each industry. For example, in cases where the dependent variable is the employment rate of Industry A,  $y$  is defined as  $\frac{\text{Population employed in Industry } A_{rsa,t}}{\text{Total population}_{rsa,t}}$  of each population group. And in cases where the dependent variable is working hours in Industry A,  $y$  is also defined as  $\frac{\text{SIGMA Number of hours employed in Industry } A_{rsa,t}}{\text{Total population } A_{rsa,t}}$ . The dependent variable is constructed to reflect both changes in employment and the possibility of moving between industries. Figure 3 shows the estimated coefficients and their confidence intervals when the dependent variable is defined by each industry.

First, positive employment effects on men are found in industries such as agriculture, manufacturing, and construction. In contrast, negative effects of employment or working hours on women are found in these same industries. These contradicting effects (positive and negative) suggest that women may have been replaced by men due to the minimum wage increase in certain industries. In fact, many previous studies show that women are more likely to be adversely affected by minimum wage hikes than men. In addition, negative effects on employment and working hours are found in wholesale businesses, retail businesses, the lodging industry, and restaurant businesses. There is a possibility that owners of supermarkets or restaurants operate the business without hiring staff, rather than hiring older women.

Figure 3\_Effects of Minimum Wage by Industry



Also, there are greater negative effects of employment and working hours on men in business facilities management, business supporting rental services, and the real-estate industry. There are also negative effects of the minimum wage increase on women in business support and the rental service industries. Most older workers employed in those industries work in simple labor positions, such as security workers or building cleaners. These low-paid workers in these industries appear to have been adversely affected by the minimum wage increase. For example, a 10% increase in the minimum wage bite reduces the possibility of older male workers being employed in the business support and rental service industries by 0.05% (a 1% decline compared to the average probability of being employed in corresponding industries), which leads to a decline in average working hours by 0.04 hours.

Overall, a minimum wage increase has brought considerably different effects to older workers depending on the industry. There have been greater negative effects of the minimum wage increase in industries and positions where many low-paid and low-skilled are employed, especially in the business support and rental service industries. The fact that the effects of a minimum wage increase were estimated to be different for men and women in some industries suggests that there exist labor substitution effects between men and women.

## 5) Heterogeneity by Type of Senior Jobs

Here, we analyze how the minimum wage increase has heterogeneous effects on different types of senior jobs. Specifically, we focus on whether there exists a connection between the effects of the minimum wage and the ‘Senior Job Program’ implemented by the Korean government. The total number of jobs created by the Senior Job Program has increased dramatically; as of 2019, about 680,000 jobs had been created under this program. The jobs created under the program are grouped into ‘public’, ‘social service’, and ‘private’ jobs. Among them, more than 70% of senior jobs are public jobs for “public-interest activities (Sung and Kim, 2020).”

As a beneficiary of the Basic Pension, those aged over 65 are entitled to apply for jobs involving public-interest activities. If an eligible person participates in a public-interest activity such as volunteer activities for public facilities or supporting the vulnerable elderly for more than 30 hours a week, the person receives KRW 270,000 in payment. The results in Table 1 show that the minimum wage increase does not have any significant impact on the size of older workers’ employment. This lack of impact may be partially attributable to these public jobs. In fact, we have found positive employment effects in public administration, national defense,

and social security administration, as well as in the hygiene and social welfare service industries.

Therefore, we separately analyze how the minimum wage increase affects jobs for public-interest activities and jobs for non-public-interest activities (private jobs). Unfortunately, there is no information about detailed types of senior jobs in the RES data used in this paper. However, it is possible to identify whether older workers participated in the public-interest activities, which account for the biggest share of the government-led senior jobs program. This can be done by using the fact that senior citizens participating in public-interest activities were paid KRW 200,000 every month from 2009 to 2016, KRW 220,000 every month in the first half of 2017, and KRW 270,000 from the second half of 2017 to 2020.

**Table 4\_Effects of Minimum Wage on Public and Non-Public Jobs**

	Public Jobs		Non-Public Jobs	
	Income = payment from public activities (1)	Income ≤ payment from public activities (2)	Income ≠ payment from public activities (3)	Income >payment from public activities (4)
<b>Panel A: Employment rate</b>				
Effects of minimum wage	0.0012** (0.0005)	0.0015*** (0.0006)	-0.0010 (0.0014)	-0.0014 (0.0015)
N	19,111	19,111	19,111	19,111
Average	0.02	0.02	0.38	0.38
<b>Panel B: Employment rate for men</b>				
Effects of minimum wage	0.0008 (0.0006)	0.0011* (0.0006)	0.0031 (0.0019)	0.0028 (0.0019)
N	19,111	9,495	9,495	9,495
Average	0.01	0.01	0.51	0.51
<b>Panel C: Employment rate for women</b>				
Effects of minimum wage	0.0016 (0.0010)	0.0022** (0.0011)	-0.0063*** (0.0022)	-0.0069*** (0.0023)
N	9,616	9,616	9,616	9,616
Average	0.03	0.03	0.28	0.28
Age × Gender × Time	Y	Y	Y	Y
Control region characteristics	Y	Y	Y	Y

Note: 1. Standard errors are clustered by region

2. Number of population in each cell is used as weights

3. Payments from public activities are 200,000 won in 2016, 220,000 won in the first half of 2017, and 270,000 won after the 2nd half of 2017

4. \*\*\* 1%, \*\* 5%, \* 10% significance

Source: The table above was made by the authors

There are two main ways to identify senior citizens employed in public jobs. First, senior citizens aged over 65 who receive wages that are exactly equal to the payment from public-interest activities (e.g., KRW 270,000 starting from the second half of 2017) can be regarded as workers participating in public-interest activities. Interestingly, a considerable number of the older population in the sample receive the same payment (KRW 270,000). Second, senior citizens aged over 65 who receive wages that are either less than or equal to the payment from public-interest activities (e.g., KRW 270,000 starting from the second half of 2017) can be regarded as workers participating in public-interest activities. We also use this second methodology because there may be some senior citizens who receive less than KRW 270,000 even if they participate in public-interest activities.

Table 4 analyzes the effects of a minimum wage increase on the probability of being employed in public jobs (Columns (1) and (2)) and non-public jobs (private) (Columns (3) and (4)) respectively. Columns (1) and (3) use the first method to identify public jobs (receiving the exact amount of KRW 270,000), while Columns (2) and (4) use the second method (receiving the amount less than equal to KRW 270,000). Panels A (entire population), B (men), and C (women) analyze the effects of the minimum wage increase on the probability of being employed in public jobs and non-public jobs.

Interestingly, a statistically significant positive coefficient is estimated for the effects of the minimum wage increase on public jobs in Panel A. However, a statistically insignificant but negative coefficient was estimated for the effects of the minimum wage increase on non-public jobs. A 10% increase in the minimum wage bite has increased the probability of being employed in public jobs by 0.01%p but lowered the probability of being employed in non-public jobs by 0.01%p. In addition, we find in Panels B and C that the effects on the number of jobs in the public sector were twice as high for women compared to men. On the other hand, the effects of losing jobs in the non-public sector are much higher for women compared to men. Such results are in line with the fact that 70% of participants in public-interest activities are women.

Overall, the minimum wage increase has reduced the number of non-public jobs (private) and increased the number of public senior jobs by the same percentage. This shows that the minimum wage increase has forced some senior citizens to switch from private jobs to public jobs. Notably, the effects on public jobs are more prominent for women, who are more vulnerable to shocks in the labor market caused by the minimum wage increase. That is, there is a possibility that the senior job program has masked some negative employment effects of the minimum wage increase (notably, its negative employment effects on temporary workers).

### III. Minimum Wage Increase and Public Pension Receipt

This chapter discusses the relationship between minimum wage increase and public pension receipt. In Chapters II of this paper, we analyzed the effects of the minimum wage on the labor market of the older population using the regional variations in the minimum wage bite. We found that the minimum wage and the labor market outcomes of older workers are closely related to each other. Each older individual can make various decisions on whether to join the labor market and the type of jobs they take. In addition, they will also consider the minimum wage and the conditions of the regional labor markets in their decision-making process. The players on the demand-side of the labor market will also make decisions on important labor market variables, taking the minimum wage level into consideration.

Senior citizens' receipt of pension benefits may also be closely related to changes in the labor market environment. The older population who reach pensionable age and are entitled to receive pension benefits will consider changes in the labor market caused by changes in the minimum wage, the pension system, and the expected pension benefits in their decision-making process. For example, it is expected that the older population will use the old-age pension early on if their wage incomes are not sufficient, even if this incurs a reduction in their overall pension benefits. If an increase in the minimum wage level leads to an increase in wage income, we expect that it will weaken the motivation for using the early payment system.

Some examples of behavioral changes in pension recipients induced by changes in labor market conditions are as follows. If the wage income of the older population increases, it may lead to a decline in the use of the early old-age pension system and an increase in the use of deferred pension benefits. In addition, changes in wage income may affect the benefits to be paid to a beneficiary, as the national pension and old-age pension are designed to reduce pension benefits based on the recipient's wage income. Overall, a minimum wages increase is likely to increase the retirement age and decrease the benefits to be paid. However, because the income levels that lead to benefit reduction are generally higher than the minimum wage level, it is also likely that there will be no change in the probability of receiving the pension benefits. If the labor market is adversely affected, we expect that there will be an increase in the use of early old-age pension benefits and a decrease in the use of deferred pension benefits. However, there may be no change in the benefits, or the benefits may increase if they are subject to an existing pension reduction system linked to wage income.

## 1. Data and Empirical Strategy

### A. Data

In this analysis, we use the statistical annual report of the National Pension Service and “Understanding the Basic Pension Data with Statistics”. The analysis period for the statistical annual report obtained from the National Statistics Portal is from 2012 to 2020. In the empirical analysis, we use the statistical charts (by region, age, and gender) that contain information on the number of beneficiaries and their total benefits of the regular old-age pension and early old-age pension.

Annual statistics include the number of beneficiaries by gender, age (1-year increments) and region, as well as the total benefits (unit: KRW 1,000). The age in the statistical chart begins at 55 years and ends at 79, except for the statistical chart for those who have been insured by the regular old-age pension for more than 20 years (ends at 69 years). There are no further age breaks for those over 70 or 80 years old. We first define the population groups that will be used for the analysis. Then, for each population group, we link the minimum wage bite and corresponding control variables from Chapter II. In Chapter II, population groups were defined by place of residence, age, and gender. Here, population groups are defined by place of residence, year of birth, and gender, after replacing the previous unit of ‘age’ with ‘year of birth.’ For example, we consider the difference between men residing in Incheon in 2016 who were born in 1952, and men residing in Incheon in 2015 who were born in 1952. We control for the year of birth fixed effects interacted with gender and year fixed effects. The minimum wage bite is calculated from the last year’s income distribution of the cohort with the same gender and region.

‘Understanding the Basic Pension Data with Statistics’ offers data from 2015 to 2019, including the number of beneficiaries and their adjusted gross income in each  $S_i$ ,  $G_m$ , and  $G_u$  (city, county and autonomous district in accordance with the administrative divisions of Korea). The minimum wage bite variables that correspond to the statistics are calculated using the population-weighted averages of population groups whose ages are 65 or older.

### B. Empirical Strategy

We estimate the following regression equation as in Chapter II.

$$y_{rsa,t} - y_{rsa,t-12} = \beta \text{Log}(MWB_{rsa,t}) + \gamma X_{r,t-12} + \varnothing_{as,t} + \epsilon_{ras,t} \quad (3)$$

The difference between that of Chapter II is that subscript  $r$  now represents state, not city and county, and subscript  $a$  is year of birth, not age. Note that there are clear limitations of this analysis because it is impossible to fully consider interregional variations in minimum wage bite which can differ within state.

In the analysis on Basic Pension, variations in the minimum wage bite by age and gender cannot be used, which serves a key role in the process of analyzing the National Pension. We can only use variations in the minimum wage bite by  $S_i$ ,  $G_{it}$ ,  $G_{it}$ , and year. Therefore, we need to rely on somewhat limited identification strategies such as controlling time dummies interacted with state fixed effects or controlling for the linear trends of each city. Thus, the empirical results should be interpreted with caution.

As dependent variables for the analysis on the National Pension Service, we use the probability of receiving pension benefits by population group (dividing the total number of beneficiaries by the number of people in the population group), total benefits of each population group, and the number of beneficiaries. As dependent variables for the Basic Pension, we use the ratio of beneficiaries in each adjusted gross income category to the total number of persons entitled to receive the Basic Pension and the ratio of beneficiaries of Basic Pension relative to the number of the older population over 65 by region.<sup>2</sup>

## 2. Effects of Minimum Wage on Senior Citizens' Receipt of Public Pension Benefits

### A. Effects on the National Pension Service

For the analysis on the National Pension Service, we focus on the rate of benefit receipt, total benefits to be paid (log), and the number of beneficiaries. We include year of birth fixed effects interacted with gender and year fixed effects. In addition, we use the control variables used in the labor market analysis such as state-level population, the percentage of those aged over 60 years old, the percentage of the self-employed, and the employment rate in the agriculture industry. Standard errors are clustered by state.

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<sup>2</sup> There are five categories for the adjusted gross income: 0 won, 0~200,000 won, 200,000~500,000 won, 500,000~1,000,000 won, and 1,000,000 won or more.

**Table 5\_Results on the National Pension Service**

	Coefficient	Total (regular, early)	Regular old-age pension	Early old-age pension
Panel A: The probability of receiving pension benefits	Effect of Minimum Wage	-0.0013 (0.0009)	-0.0006 (0.0004)	-0.0016* (0.0008)
	N	3,033	1,950	3,033
Panel B: Total benefits to be paid (log)	Effect of Minimum Wage	-0.0075 (0.0048)	0.0030 (0.0018)	-0.0143* (0.0058)
	N	3,033	1,950	3,033
Panel C: Number of beneficiaries	Effect of Minimum Wage	-0.0007 (0.0037)	0.0029* (0.0015)	-0.0097** (0.0045)
	N	3,033	1,950	3,033

Note: 1. Standard errors clustered by state  
2. \*\*\* 1%, \*\* 5%, \* 10% significance

Source : The table above was made by the authors based on the integrated service of micro data obtained from the Statistics of Korea, "Regional Employment Survey"; National Pension Service, *Statistical Annual Report of the National Pension Service*

Table 5 shows the estimated results. The estimated result for the regular old-age pension shows insignificant negative effects on pension benefit receipt. On the other hand, we find that the total benefits and number of beneficiaries increased, although their statistical significance is not high. Such a reduction in pension benefit receipt may be caused by the relatively rapid growth of the population who do not receive regular old-age pension benefits. The coefficients of benefits to be paid and the number of beneficiaries are not large, representing a 0.03%p increase for a 10% increase in the minimum wage bite. And the degree of changes in the rate of pension receipt is also insignificant, with a 0.006%p decrease.

For the early old-age pension, the rate of pension receipt, benefits to be paid, and the number of beneficiaries decrease because of the minimum wage. The absolute size of the estimated coefficient is larger than that of the regular old-age pension. And for a 10% increase in the minimum wage bite, it is estimated that the rate of pension receipt declines by 0.016%p, benefits to be paid declines by 0.14%p, and the number of beneficiaries also drops by 0.1%p. All estimates are statistically significant at the level of 10%.

There is a range of ways in which an increase/decrease in the minimum wage bite changes pension-related variables. They include changes in the decision-making of the older population in terms of pension receipt and changes in population. Changes in decision-making on pension receipt include changes in utilizing the deferred pension scheme and early old-age pension. The deferred pension scheme is a scheme related to the results for the regular old-age pension. For the early old-age pension, whether an insured receives benefits or not is determined by the senior citizens themselves.

Given the fact that the Korean pension schemes have not fully matured, it is highly likely that a subscriber to the National Pension Service for more than 10 years, who is eligible to apply for the deferred pension, worked as ‘regular workers’ for a long period of time. Given the heterogeneous effects across ages, genders, and education levels, it is not likely that the increased impact of the minimum wage system reduced the wage incomes of subscribers who use deferred pension benefits<sup>3</sup>. Therefore, an interpretation that links the findings with the deferred pension scheme seems inappropriate because it is not consistent with the analysis results on the labor market.

The early old-age pension scheme is a scheme in which a subscriber applies to receive benefits before an individual reaches pensionable age. When making decisions on whether to apply for the early old-age pension, an individual’s wage income or other income before reaching the pensionable age will be an important factor. If the need for living expenses increases due to worsening labor market conditions, the possibility of applying for the early old-age pension scheme will be higher, despite the reduced benefits that are to be paid after the pensionable age. The statistically negative effects estimated in Table 5 indicate that there are fewer applications to the early old-age pension in a situation in which the minimum wage is high. We have found that those aged 55~61 years old are not adversely affected by the minimum wage in terms of wage income. Therefore, when considering this fact, the negative estimates in Table 5 are in line with the intuitive assumption regarding the behavioral changes of the older population applying for the early old-age pension.

The negative coefficients of the those pension receipt rate were not estimated in a statistically stable manner. Therefore, we remain cautious in interpreting these results. However, when considering the general direction of these coefficients, it is in line with the scenario in which non-beneficiaries of the pension respond to the minimum wage more sensitively than beneficiaries. Considering the previous analysis results, the effects of minimum wage on the wage incomes of the older population aged 60~69 years old (age group included in the analysis on the regular old-age pension) were positive. Therefore, it is natural to assume that older people move to the labor market with better conditions. The reason why there exists a difference in the relative size of migration between beneficiaries and non-beneficiaries may be the difference in the labor market participation rate. Non-beneficiaries of

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**3** Under the deferred pension scheme, an insured (subscriber) can apply to receive pension benefits 5 years after they reach pensionable age. When considering the period included in this analysis, those aged in their 60s~70s are affected by this deferred pension scheme.

the pension are more motivated to join the labor market than recipients of the regular old-age pension, and it is also expected that they will respond to changes in labor market more sensitively. However, it is possible that the current model fails to control for other factors, considering the limitations of identification strategies mentioned in the previous pages.

## B. Effects on the Basic Pension

Dependent variables for the analysis on the Basic Pension include the number of beneficiaries by each adjusted gross income category and the rate of pension receipt relative to the (total) population. Adjusted gross income (AGI) is divided into five categories: KRW 0, 0~200,000, 200,000~500,000, 500,000~1,000,000, and 1,000,000 or more.

The estimation results are presented in Table 6. The same control variables are included in the regression equation, based on units of *Si*, *Gum*, and *Gu*. The population aged over 65 years old in each *si*, *gun* and *gu* are used as the weights of the regression analysis. To control for different state-level trends, we include state fixed effects interacted with year fixed effects.

**Table 6\_Results on the Basic Pension Service**

Coefficient	0 (Korean won)	0~200,000 won	200,000~500,000 won	500,000~1,000,000 won	1,000,000 won or more	Rate of pension receipt
Effect of Minimum Wage	0.0011** (0.0004)	-0.0007 (0.0009)	-0.0007 (0.0008)	-0.0014 (0.0008)	0.0016 (0.0012)	0.0005 (0.0008)
N	616					

Note: Standard errors are clustered by state

Data: Based on "Regional Employment Survey"; Ministry of Health and Welfare, "Understanding the Basic Pension in 2019 with Statistics"

According to the estimation results shown in Table 6, the minimum wage increase did not have a significant impact on the rate of Basic Pension receipt. However, we find that the minimum wage hikes increase the share of beneficiaries whose AGI is KRW 0 and the share of beneficiaries whose AGI exceeds KRW 1 million. There is a possibility that this is caused by an increase in the number of older workers whose wage income declined due to the minimum wage increase. In addition, the positive coefficient of the top income category is due to the older population in their 60's whose wage incomes are not adversely affected by the minimum wage.

## IV. Conclusion

The minimum wage has continuous impacts on the older population's income and their decision to participate in the labor market. This is because most older workers, whose average education levels and productivity are low, receive wages close to the minimum wage. If a minimum wage increase leads to a reduction in the demand for older workers and causes negative employment and income effects, it can make older workers retire early and increase their public pension receipt. Conversely, if the minimum wage increase leads to an increase in the labor supply of the older workers and their incomes, it can reduce their public pension receipt by increasing their retirement age.

This paper empirically analyzes the effects of a minimum wage increase on the older population's labor market participation and their public pension receipts. The minimum wage effects are identified using the rich differences in the minimum wage bite across regions. In the analysis on the older population's labor market outcomes, which uses the "Regional Employment Survey (2009~2020)", we find that minimum wage increases do not significantly affect the overall employment size of those aged over 60, even though they considerably reduce the number of working hours. In addition, though the minimum wage hikes increase the wage income of the employed, no significant effects are found in the average wage income of the total population that also include non-wage earners or the unemployed.

The fact that the minimum wage does not significantly affect the employment size of the older population does not mean that it does not affect the labor market. In fact, the effects of the minimum wage increase on the labor market vary considerably depending on the population group. First, we find that the negative effects of the minimum wage on working hours and wage income become stronger as the age of the population group increases. In addition, the minimum wage increase brings about negative employment effects for female, low-skilled, and older workers, but positive effects on high-skilled and male workers. In addition, the minimum wage increase has different effects on older workers by employment type, worker status, and industry. The number of full-time workers increases while the number of part-time workers declines, reflected in the decrease in working hours. Unlike regular workers, temporary and daily workers experience negative employment effects. Industries in which the older population account for a large share (such as cleaners or security workers) exhibit negative employment effects. However, the public industry or social security industry shows positive employment effects, representing the fact that public jobs in the senior job program have partially offset the negative effects of minimum wage.

Overall, unlike the previous research on Canada and the U.S. (Fang and Gunderson 2009, Borgschulte and Cho 2020), we cannot find clear evidence that the labor supply and income of older workers have increased because of the minimum wage hikes. This is because the average education level and labor productivity of the older population in Korea remain relatively low. In the U.S., for example, the ratio of the older population (aged 65 or more) with a high school diploma or higher is 85%; similar to the 89% for those aged between 25~64 years. In Korea, the ratio of the older population with a high school diploma or higher in Korea is only about 32%, which means that the labor productivity of the older population in Korea is relatively low. This is why older workers in Korea are more adversely affected by the minimum wage compared to the other age groups. The analysis in this paper finds that the negative labor market effects are especially prominent for women, low-skilled, and temporary workers.

Next, this paper analyzes the effects of minimum wage on the probability of receiving old-age pension benefits and Basic Pension benefits using the *Statistics Annual Report of the National Pension Service* (2021~2020) and the *Understanding the Basic Pension with Statistics* (2015~2020). We find that there exists a negative relationship between minimum wage bite and the probability of receiving the old-age pension in general, but the coefficient is not statistically significant. To interpret these results, we further analyze the effects on the regular old-age pension and early old-age pension. We find that the effects of minimum wage on the regular old-age pension, which accounts for most of the old-age pension, are very small. For the early old-age pension, on the other hand, we find that the rate of benefit receipt, the number of beneficiaries, and the total benefits are significantly reduced. In addition, a minimum wage increase does not have a significant impact on the rate of Basic Pension benefit receipt, while polarizing the adjusted gross income of the beneficiaries. In other words, the share of beneficiaries whose adjusted gross income is 0 and the share of beneficiaries whose adjusted gross income is more than KRW 1 million increase at the same time.

This paper's finding that there is no significant negative relationship between minimum wage increase and public pension receipts is in contrast to the previous research (Borgschulte and Cho 2020, Hampton and Totty 2021). This is because the old-age pension system in Korea is not mature enough compared to those of other advanced nations. Since its first inception in 1988, the Korean National Pension Service gradually expanded the pension's coverage. However, most senior citizens remained outside the coverage. In addition, their expected benefits paid are insufficient to provide for their needs, even if they are insured. Therefore, it is expected that there will be no increase in benefit receipt, despite the negative employment

and income effects on the vulnerable groups. On the contrary, the number of public jobs in the senior job program has increased because of the minimum wage, which means that public jobs have served as the 'old-age pension' for the vulnerable older workers in Korea.

However, for the early old-age pension, we show that the probability of receiving benefits and total benefits to be paid decline significantly, which is consistent with the previous studies. The fact that the average benefits of the early old-age pension are higher than those of the basic old-age pension suggests that the beneficiaries of the early old-age pension generally have higher productivity and wages. In the labor market analysis, we found that young and high-skilled men are not that adversely affected by the minimum wage. That is to say, the older population who have subscribed to the National Pension Service for a long time can delay their retirement because of increases in their income thanks to the minimum wage. Therefore, if the National Pension Service in Korea matures to the point where its coverage is expanded further, it is likely that a linkage between minimum wage changes and public pension receipts will be higher like in the United States. This also suggests that fluctuations in the minimum wage should also be considered in operating and designing a public pension scheme in the future.

In conclusion, this paper finds that older workers in Korea are generally vulnerable to labor market shocks. In particular, the effects of minimum wage on the labor market are largely heterogeneous across different population groups, where female, low-skilled, and temporary workers are more adversely affected by the minimum wage increase. This difference in the effects of the minimum wage increase can be also found in the polarization of income of beneficiaries of the Basic Pension program. Despite the negative minimum wage effects on the vulnerable workers in the labor market, no significant effects are found in public pension receipts in general because the pension system is not mature enough. Women and low-skilled workers who have difficulties in preparing for their old age with the current pension system are more likely to get public jobs in the senior job program. This partially offset the negative labor market effects due to an increase in the minimum wage.

Therefore, we should improve the overall stability of the labor market for older workers by encouraging their employment. To achieve this goal, it is necessary to provide incentives for companies to continuously hire older workers, as well as to introduce policies to enhance matches between older workers and companies. Because the effects of minimum wage vary across population groups, a range of support programs and educational programs should be offered based on the needs of each population group. In addition, the overall quality of public jobs should be improved. As shown in the findings of this paper, public jobs in the Senior Jobs

Programs serve the role of public pension for the older population who have difficulties in preparing for their older years from the National Pension Service. However, the pays for these public jobs are insufficient to solve the poverty problems of the older population. Therefore, the government should flexibly operate the Senior Jobs Program according to the needs of each population group, focusing on low-skilled older workers who are vulnerable to labor market shocks.

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# Tax Incentives for Retirement Income: Reverse Mortgage Scheme

Byung Mok Jeon\*

## I . Introduction

Population aging has expanded the role of individuals and the state in terms of the need for securing retirement income. The elderly support ratio in Korea (population aged 65 and older/population aged 15 to 64) is expected to increase from 17.5% in 2015 to 38.2% in 2030, and 102.4% in 2060. This issue is further compounded by the low income of the elderly population (households with heads of household aged 65 and older). As of 2016, the elderly poverty rate<sup>1</sup> reached 43.6%, which is more than two times larger than the poverty rate of all households in Korea. As such, securing retirement income for the elderly has become a major challenge for policymakers. In attempts to mitigate this problem, the government has taken several measures to address the challenge, including the introduction and expansion of the National Pension (NP) program, as well as the introduction other programs to help the elderly sign up for both corporate pension and private pension plans. However, these programs have yet to produce their desired effects. The effectiveness of these measures has been restricted by, among others, the immaturity of NP scheme and the large number of people left out of the program. In order to address this coverage problem, we need a more mature NP scheme

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<sup>1</sup> The percentage of people earning 50% of the median income or less.

and a wider subscriber base.

In this study, we explore ways to boost the Housing Pension (HP), a reverse mortgage plan that utilizes existing housing assets to lower the poverty rate of the elderly population. The HP serves as a policy instrument to help individuals liquidate their housing assets and to then use this fund as part of their retirement income. It also offers a cost-effective way to prepare against post-retirement poverty, because it is capable of providing post-retirement income security without direct subsidy from the government. If the HP program is designed such that it includes poor or near poverty groups that require government support as its beneficiaries, the program could also serve as an instrument to alleviate or prevent their financial distress. However, these groups are likely to be outside the scope covered by the current NP scheme, and indeed it may take considerable time before any coverage-expanding efforts produce the intended outcomes. For this reason, in this study, we focus on the HP program which, unlike the NP, produces almost instantaneous outcomes.

Specifically, we review housing liquidation policies in other countries, including the size of subsidization offered by their governments. We also analyze the level of poverty among Korea's elderly citizens and their housing assets. Then, we build on the findings in order to assess the possibility of alleviating poverty through the HP program. We use microdata to identify factors that encourage HP subscription among the elderly, and draw policy implications for expanding its subscriber base. In addition, we assess the justification for government support for the HP program by comparing tax benefits for private pension that serve similar functions. By comparing the government support provided to different programs designed for retirement income security, we can verify whether government support for the HP program is justified. We also work to quantify the effect of the program by estimating its poverty alleviation effect. Then, in the last section, we discuss the policy implications of our findings.

## **II . Retirement Income Security and HP**

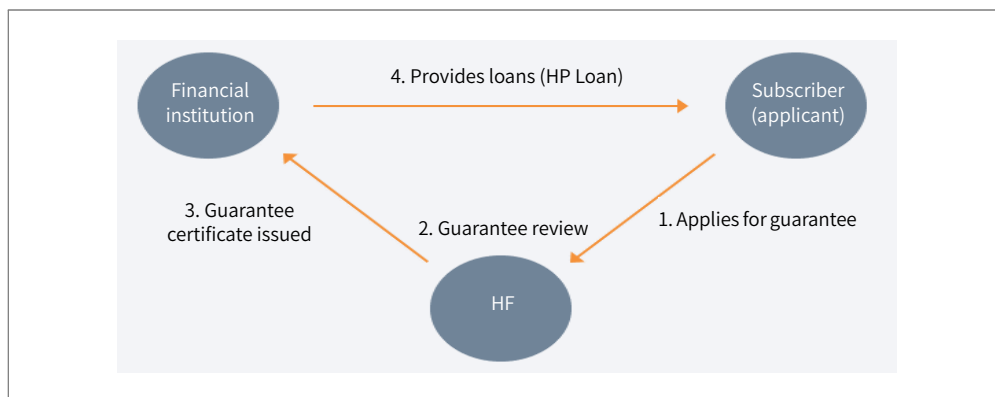
### **1. Structure and Functions**

The Housing Pension is a reverse mortgage plan whereby a homeowner pledges their property as collateral, and continues to live in the property for a set period, or until death, while receiving monthly payouts. The program is guaranteed by the government, with a limited

scope of eligibility. The homeowner or their spouse must be 55 years old or older, and the property's declared value should not exceed KRW 900 million. Multi-home owners are also eligible for the program as long as their combined declared value does not exceed KRW 900 million. A homeowner with two properties worth more than KRW 900 million may also subscribe to the program as long as they sell one of the properties within three years.

In terms of the subscription process, an applicant applies for a guarantee from the Housing Finance Corporation (HF), which reviews the application and, depending on the result, issues a guarantee certificate to a financial institution. The financial institution provides the subscriber with an HP loan that is secured by a guarantee against default risk provided by HF.

Figure 1\_ HP Process



Source: Korea Housing Finance Corp. Homepage (<https://www.hf.go.kr/>)

Monthly HP payouts are determined based on the predicted housing price and the amount of any outstanding loan at the time of the subscriber's death, at a level that achieves the balance of revenue and cost, where the cost is the outstanding loan and the revenue is the housing price at the time of the subscriber's death. The prediction of the housing price varies depending on the expected time of death and the future prospect of housing prices. The outstanding loan amount also varies depending on the interest rate. The volatility of these variables thus poses risks for the fulfillment of HP contracts, because they can destabilize actuarial balance of the contracts. To control these risks, the government provides guarantees for the program. Under this guarantee, if the outstanding loan exceeds the housing price at the time of the subscriber's death, the government is liable for paying the excess. In other words, the government offers

an insurance policy that covers possible loss caused by an outstanding loan amount that exceeds the housing price. Specifically, this insurance function is provided by HF, which is responsible for operating the HP scheme.

## 2. Retirement Income Security and HP

Despite Korea's stellar economic growth, the rapid aging of its population has created difficulties in securing retirement income for many elderly Koreans. This economic growth has elevated people's expectations for a retirement income. However, Korea has not had sufficient time to mature its support schemes for the elderly. A member of society needs to enter the labor market and work for around 40 years before they can enjoy retirement income security through the NP scheme. However, the scheme did not cover self-employed persons in urban areas until 1999.

The elderly support ratio in Korea (population aged 65 and older/population aged 15 to 64) is expected to surge over the next four decades, from 17.5% in 2015 to 38.2% in 2030, and 102.4% in 2060. The rapid aging of the population is expected to greatly increase the burden from social welfare expenditure related to the elderly.

In fact, Korea has reported a serious income shortage among its elderly citizens, which is represented by the country's high poverty rate relative to developed countries in the Organization for Economic Cooperation and Development (OECD). According to the OECD,<sup>2</sup> the poverty rate among Korean households with people aged 65 and older stands at 43.8%, which is 2.5 times larger than the poverty rate of all Korean households.<sup>3</sup> Korea's poverty rate is also the highest among OECD members in absolute terms as well. These statistics show us how important it is to achieve income security for the elderly.

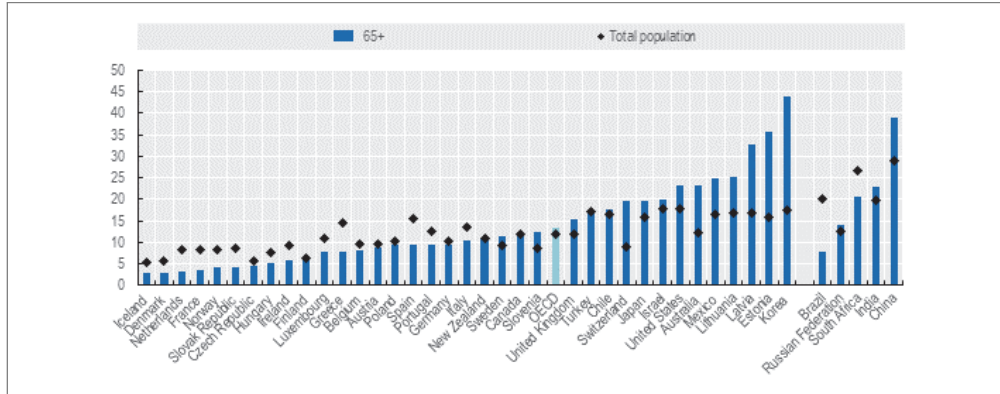
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<sup>2</sup> OECD, "Pensions at a glance 2019: OECD and G20 Indicators," 2019.

<sup>3</sup> Korean Statistical Information Service, Statistics Korea, Survey of Household Finances and Living Conditions – Income Distribution Index, [https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT\\_1HDLF05&conn\\_path=I2](https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1HDLF05&conn_path=I2) (accessed on July 21, 2021); Survey of Household Finances and Living Conditions – Income Distribution Index (by age), [https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT\\_1HDLF06&conn\\_path=I2](https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1HDLF06&conn_path=I2) (accessed on July 21, 2021) shows that the relative poverty rate in 2016 based on disposable income is 17.6% for all population, and 43.6% for people aged 65 and older.

Figure 2\_Elderly Poverty Rates in OECD Countries

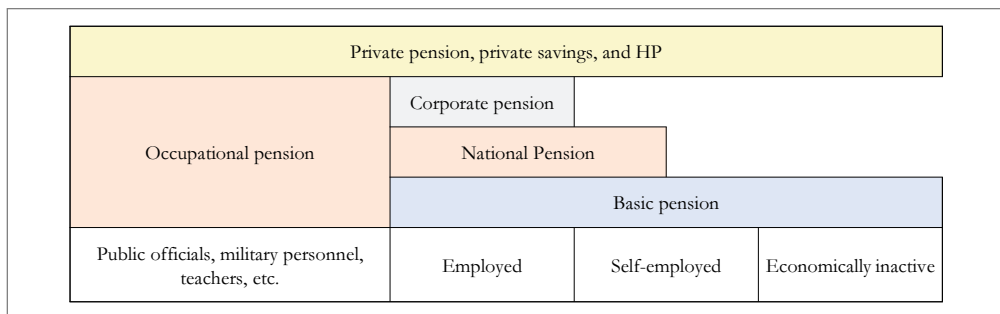
(unit: %)



Note: The poverty rate refers to the percentage of households earning 50% of median income or lower as of 2016 (or the latest available year). Source: OECD, “Pensions at a glance 2019: OECD and G20 Indicators,” 2019, p. 23.

The elderly population in Korea obtains its retirement income mostly from two types of incomes. The first type consists of mandatory or voluntary savings before retirement (during their years of employment), under various public pension, corporate pension, private pension, and private savings plans. The second type includes basic pension and other income supports provided by the government after retirement. HP falls under the first group, because it secures retirement income by liquidating assets built with pre-retirement savings. However, HP is distinguished from the other pension or savings plans because it requires additional government support in order to be successful.

Figure 3\_Retirement Income Sources in Korea By Occupation



Source: author

With its mandatory application making it eligible to Koreans, NP plays the most important role among the many sources of retirement income. The National Pension covers all workers other than occupational pension subscribers. The income replacement ratio for a 40-year subscriber is 40%. As of 2019, the number of NP subscribers stood at 22.2 million.

However, the effectiveness of the scheme is undermined by the high percentage of ‘contribution exempted persons’ who are not required to pay contributions. Contribution exempted persons include subscribers who do not earn income on account of business suspension, displacement, long-term leave, or business closure, and individually insured subscribers with zero reported income.<sup>4</sup> Workers providing intermittent or short-term labor can be also classified as contribution exempted persons, because it is difficult to identify their income. Among individually insured subscribers,<sup>5</sup> contribution exempted persons accounted for 58.8% in 2010. The percentage continued to decline and reached 45.3% in 2019, which can be attributed to the decreased percentage of self-employed persons, as well as the government’s continued efforts to identify self-employed incomes. In 2019, around 3.3 million individually insured subscribers were exempted from contribution payment. The existence of these contribution exempted persons may ultimately negatively affect their rights as NP beneficiaries and maintaining the amount of pension benefits. If a subscriber is exempted from contribution obligations for a long time, they may ultimately have difficulty in securing pension benefits due to their lack of subscription period.<sup>6</sup> Then, even if the subscriber becomes eligible for pension benefits, the actual payout amount is likely to be low—for the same reason.<sup>7</sup>

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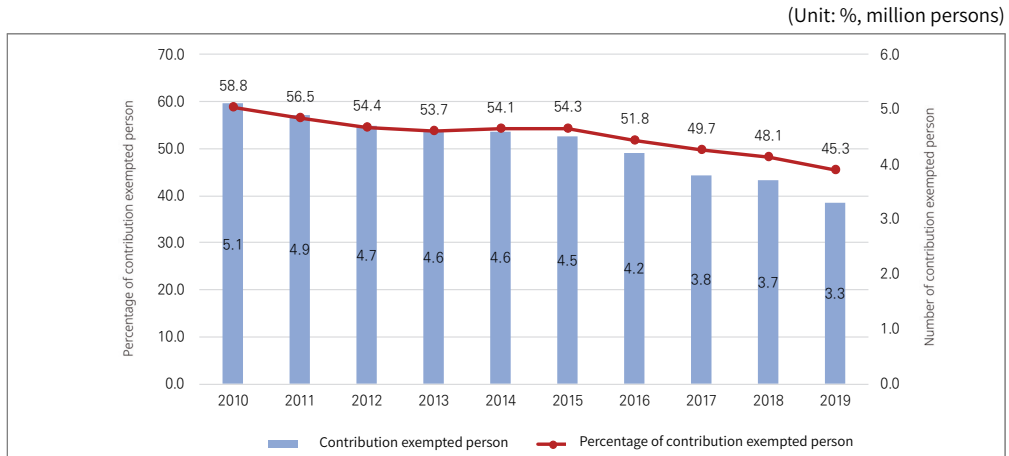
**4** A person who no longer earns income may be included in the NP scheme, in which case they may be a contribution exempted person. Therefore, this group includes both unemployed persons and some economically inactive persons.

**5** NP subscribers consist of workplace-based insured persons, individually insured persons, and voluntarily insured persons.

**6** Under the NP scheme, a subscriber needs to maintain the subscriber status for at least ten years to be eligible for pension benefits.

**7** The NP scheme guarantees 1% income replacement ratio per year of contribution.

**Figure 4\_ The Number and the Share of Contribution Exempted Persons Among Individually Insured Subscribers (National Pension)**



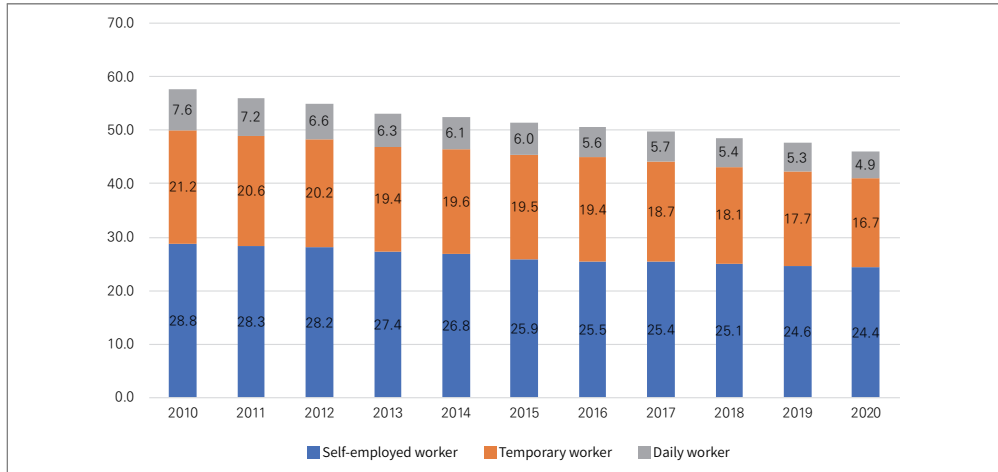
Source: National Pension Service, *Statistical Yearbook of National Pension 2019, 2020*.

To reduce the share of contribution exempted persons, we need to reduce the percentage of short-term workers and self-employed persons in the labor market. However, the percentage of these workers remains high, despite their steadfast decline in recent years. Given the slow pace of change in the labor market, the NP's retirement income security function is bound to be limited. In addition, the universal coverage of the NP scheme was achieved in 1999, which means that Korea NP system did not mature yet to provide NP benefits to all workers.

For this reason, Korea needs to implement another policy option in order to secure retirement income for non-beneficiaries. The retirement income of citizens left out of the NP scheme can be achieved by converting their personal assets into an annuity at the time of their retirement. A non-subscriber to the NP scheme can secure retirement income by utilizing their assets. In other words, the government can help people secure retirement income, while maintaining their motivation for saving. If the option is also designed to support self-employed persons and short-term workers not covered by mandatory schemes, such as the NP and corporate pension plans, it will improve the fairness between those workers and the beneficiaries of other public pension programs.

**Figure 5\_Potential Non-Beneficiaries of Public Pension Programs  
(Percentage among Employed Persons)**

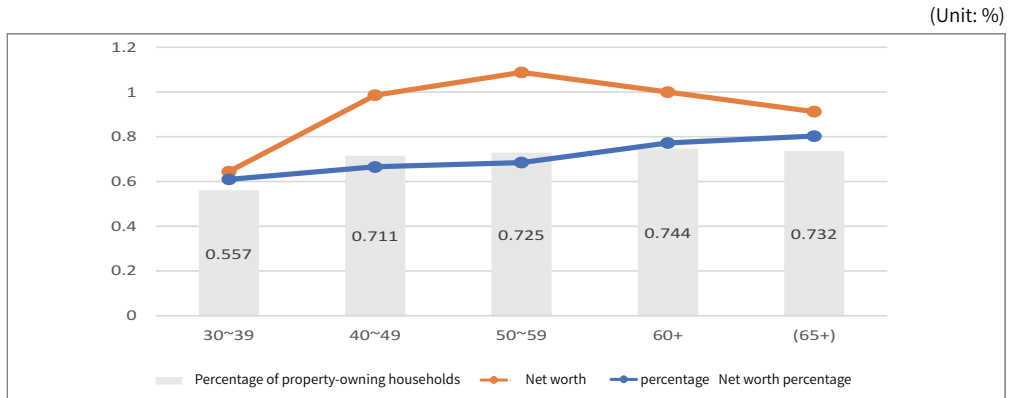
(Unit: %)



Source: Korean Statistical Information Service, Statistics Korea, Economically Active Population Survey – Employed Persons By Employment Status, [https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT\\_1DA7010S&conn\\_path=I2](https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1DA7010S&conn_path=I2) (accessed on March 10, 2021)

The most common type of asset for Korean households is their housing. According to Statistics Korea, 73.2% of households with heads of household aged 60 and older owned real properties in 2019. In addition, real properties take up 80% of all assets owned by households with heads of household aged 60 and older. These statistics support the possibility of providing sufficient retirement income security by liquidating their housing assets.

**Figure 6\_Net Worth and Percentage of Property-Owning Households by Head of Household Age (2019)**

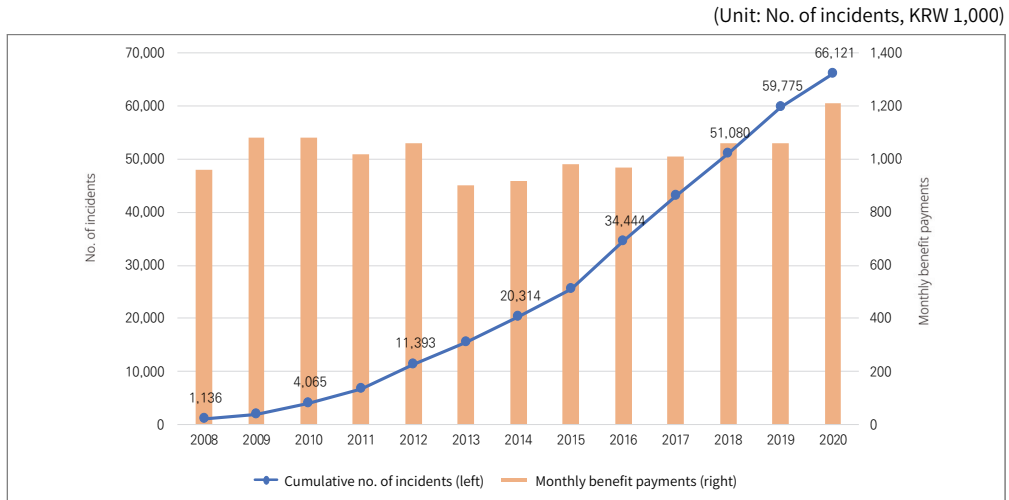


Note: The percentages represent those in age groups. The net worth percentage represents the relative percentage among households with heads of household aged 60 and older.

Source: Korean Statistical Information Service, Statistics Korea, Survey of Household Finances and Living Conditions – Income Distribution Index, Assets, Liabilities, and Income By Household head Age Group (10 years), [https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT\\_1HDA.A06&conn\\_path=I2](https://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1HDA.A06&conn_path=I2) (accessed on February 3, 2021)

As of the end of 2020, a total of approximately 66,000 persons were subscribed to the HP program. After the launch of the program, 81,000 people subscribed and 15,000 subscribers terminated their subscriptions. The amount of monthly payout continued to increase after the mid-2010's, and reached around KRW 1,212,000 in 2020, indicating that monthly HP payout far exceeds the NP benefit. As of March 2021, the average of old age pension benefits under the NP scheme is KRW 548,000 per month, and the old age pension beneficiaries for those with 20 or more years of subscription receive around KRS 941,000.<sup>8</sup>

<sup>8</sup> National Pension Service, National Pension Statistics: March 2021.

**Figure 7\_HP Subscribers and Monthly Benefit Payouts**

Note: The number of subscribers represents the (cumulative) number of subscribers who maintain contracts. The monthly payouts represent the payments for new subscribers in the relevant years.

Source: Korea Housing Finance Corporation, *Housing Finance Statistics* (December 2020), 2021.

### 3. Literature Review

An extensive body of work exists on retirement income that is based on security that utilizes owner-occupied housing. This is attributable to the fact that the majority of the elderly population in Korea does not earn a regular income, while the percentage of elderlies owning real assets remains high.

Choi et al. (2019) compared various retirement income security options utilizing owner-occupied housing. The analyzed options include the HP, immediate annuity, and annuity-type 'Hope Sharing Housing.' Their findings indicate that there is an inverse correlation between the monthly profit/loss and the remaining value.

Baek et al. (2018) analyzed income replacement ratios at different levels of initial guarantee fees and annual guarantee fees under the HP program across income classes. They then proposed an optimal guaranteed fee rates pair that achieves the highest possible income replacement ratio. However, as the guaranteed fee rate is an insurance premium for future risks, changes in initial and annual guaranteed fee rates are allowed on the restricting condition that the total value of guaranteed fees is the same. However, the study does not appear to pay

enough attention to this restriction.

Chun et al. (2015) used the National Survey of Tax and Benefits data to estimate the income growth effect of introducing housing pension for heads of household aged 60 and older, in order to analyze the alleviating effect of the housing pension on poverty.

Song (2017) analyzed the long-term financial risk factors of the HP program based on the findings of a survey investigating the demand for the program. The factors include the uncertainty of the assumed housing price growth rate, different housing price growth rates in different regions, performance and expenses of guarantee obligations, and lump-sum processing of housing provided as collateral. Song also estimated the financial burden stemming from the long-term decline of real housing price brought on by population aging and the low birth rate, and proposed ways to improve the sustainability of the program.

Unlike the previous studies, the current study explores ways to revitalize the HP program from the perspective of equitable government support. It compares the estimated amount of government support under the program with private pension, which is also a voluntary subscription program. It also reviews the operation of similar schemes in other countries. Lastly, it estimates the income distribution effect of HP subscription and, in particular, the effect of support for people without public pension subscription records, which increases the program's effect on equity. Then, building on these findings, this study recommends ways to revitalize the HP program

### III. Reverse Mortgage Schemes in Other Countries

Countries with public reverse mortgage schemes include Korea, the United States, Hong Kong, and Singapore. Public reverse mortgage schemes may be aimed at supporting retirement income security. The stated purpose of the Home Equity Conversion Mortgage (HECM) in the United States is to help homeowners liquidate their assets and secure lump-sum money. However, in reality, it serves as a scheme for retirement income security because the age eligibility is 62 years.

Korea and Singapore apply eligibility requirements related to public reverse mortgage; in the United States and Hong Kong, the loan limit or housing value limit serve a similar function. Korea's HP program restricts the number of housing units owned, the total value of the properties, and the loan amount. Singapore's Reverse Mortgage Program (RMP) narrows the scope of beneficiaries to low-income earners, by restricting eligibility to owners of a single

home provided by the Housing Development Board (HDB), along with income restrictions.

The payout period of retirement income plans is mostly for life or long-term, which reflects the purpose of those programs; to secure retirement income. In Singapore, loans are deposited to pension accounts, which means that lifetime annuity is the only option for beneficiaries.

As for guarantee fee rates, Korea, the United States, and Hong Kong collect both initial guarantee fees and annual guarantee fees. The amount of guarantee fee varies from country to country, with Korea collecting a relatively low amount. The low guarantee fee rate may be motivated by differences in future housing price growth, life expectancy, and interest rate. It may be also influenced by the government's tacit support. We thus need to review whether the low guaranteed fee rate in Korea sufficiently reflect future risks, because the low rate increases the possibility of derived liabilities related to the HP in the future (Song, 2017).

**Table 1\_Comparison: HP and Public Reverse Mortgage in Key Countries**

Items	HP (2021)	US (HECM, 2019)	Hong Kong (RMP, 2021)	Singapore (LBS, 2021)
Purpose	Retirement income support	Asset liquidation for home owners (lump-sum fund)	Retirement income support	Lifetime annuity
Age of subscription	55 and older, for one of the spouses	62 and older	55 and older	65 and older for all owners
Home ownership	Declared value: KRW 900 million or lower (for multi-home owners, the total prices of all housing units should be KRW 900 million or lower)	No restriction on the number and price of properties	No restriction on the number and price of properties (upper limit: HK\$ 15 million)	Owner of a single home provided by HDB Income: ≤ HK\$ 14,000
Loan limit	KRW 500 million	USD 726,625 (USD 765,600 in 2020)	n.a.	Depending on contract term
Payment method	Lifetime/mixed Fixed period/mixed Loan redemption Preferential/mixed	Lifetime/mixed Fixed period/mixed Limit	Lifetime/mixed Fixed period/mixed	Cash paid after deposit in RA account
Guaranteed fee rate	Initial guarantee fee 1.5% Annual guarantee fee 0.75%	Initial guarantee fee 2.0% Annual guarantee fee 1.25%	Initial guarantee fee 1.96% Annual guarantee fee 1.25%	n.a.
Interest rate	CD+1.1%/COFIX+ 0.85%	Libor (1 month)+ 2.25–2.75%	n.a.	n.a.

Source: Ko (2019); HKMC (2021), Singapore government website (<https://www.hdb.gov.sg/>)

Governments do not typically provide extensive tax benefits related to reverse mortgage schemes, because the schemes themselves are understood to be government interventions used to lower the risk of housing asset liquidation programs. Specifically, in reality the government guarantees against the risk of the loan amount that may exceed the values of the properties. To provide this function, each government imposes an appropriate insurance premium to guarantee against possible housing price drops and interest rate risks. Granted, a government may opt not to provide these functions on its own, but rather outsource them to the private market, as in the United Kingdom and Australia.

In Korea, the United States, Singapore, and Hong Kong, the public sector supplies the pension instruments, because the participation from the private market is either low or the government think they can directly achieve the policy goals. If the government sector supplies reverse mortgage plans, it constitutes a tacit form of financial support, and the operation expenses incurred by the relevant government institution may constitute fiscal expenses.

Korea offers national and local tax benefits for its public reverse mortgage program. The tax benefit for the national tax includes pension income deduction for loan interest expenses up to KRW 2 million. This benefit is for HP subscribers that have pension income. The tax law revision proposed by the government in 2021 includes a value-added tax (VAT) exemption for the disposal of trust housing units pledged as collateral for the HP program.<sup>9</sup> The purpose of the exemption is to reduce the VAT burden in case of disposing of a housing unit after transferring the title over to HF through a collateral trust, which reduces the expenses incurred by the transfer of housing ownership to HF.

Tax benefits for local taxes include the 25% property tax reduction for housing owned by HP subscribers, and 75% reduction of registration tax for collateral registration. The 25% property tax reduction lowers the actual cost burden for home-owning subscribers. In this case, 25% of the property tax is reduced for houses with declared value of up to KRW 500 million. For a property with a declared value exceeding KRW 500 million, 25% is reduced from the property tax imposed on a property worth KRW 500 million. In the case of a housing unit with a declared value of KRW 500 million, the total property tax reduction is around KRW 248,000. This tax reduction applies for the duration of the taxpayer's subscription to the HP program. As for the tax reduction for the housing registration tax, which is a one-time tax paid at the time of registering the provision of a house as collateral security or title transfer, 75% of the registration tax is reduced. A 75% reduction is applied for a registration tax of KRW

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<sup>9</sup> Ministry of Economy and Finance, "2021 Tax Revision Proposal," Press release, July 26, 2021.

4 million or lower, and KRW 3 million is reduced if the tax amount exceeds KRW 4 million. The registration tax reduction is only granted to households owning a single housing unit with a declared value of KRW 500 million or lower.

The other countries do not grant tax benefits to public reverse mortgage schemes, because these schemes are long-term loan programs collateralized by the housing units, which may mean that there is less need for government intervention. The need for government intervention is closely related to the poverty rate of elderly households. Countries with mature public pension schemes do not need to boost the schemes to secure additional retirement income. For example, the United States, Singapore, the United Kingdom, and Australia launched their public pension schemes in 1935 (Social Security), 1955 (Provident Fund), 1908 (Old Age Pension), and 1908 (Old Age and Disability Pensions), respectively, and has maintained their schemes for more than a generation.<sup>10</sup> These public pension schemes are likely to benefit most retirees. In these cases, even if retirees need additional retirement income, these countries may have thought that it is the role of the public sector to provide long-term housing-backed loan instruments through public institutions. In this case, the public sector alleviates risks undermining long-term operation of the plans in the private market.

In the United Kingdom and Australia, two countries with a relatively long history of public pension, reverse mortgage programs are offered by the private sector. The government only supervises the financial instruments and, therefore, seldom grants tax benefits to housing-backed loans.

On another note, the home revision plans in the United Kingdom (which sells shares to house equities), no income tax is applied to the sale of the housing equities. In other words, these countries do not impose taxes on capital gains of housing. The United Kingdom does not impose taxes on capital gains of living residential property,<sup>11</sup> which makes it difficult to regard it as a tax concession.

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<sup>10</sup> Social Security Administration, “Social Security Programs Throughout the World: Europe,” 2018, SSA Pub. No. 13-11801, 2018.; Social Security Administration, “Social Security Programs Throughout the World: Asia and the Pacific,” 2018, SSA Pub. No. 13-11802, 2019.; Social Security Administration, “Social Security Programs Throughout the World: The Americas,” 2019, SSA Pub. No. 13-11804, 2020.

<sup>11</sup> OECD, “Taxation of Household Savings,” *OECD Tax Policy Studies*, No. 25, OECD, 2018.

**Table 2. Government's Role in Reverse Mortgage Schemes**

Country	Government role and support
US	<ul style="list-style-type: none"> <li>• A public reverse mortgage plan provided by the Federal Housing Agency (FHA) with Ginnie Mae payment guarantee.</li> <li>• No capital gains tax for residential property occupied the taxpayer for at least two years in the last five years</li> </ul>
Hong Kong	<ul style="list-style-type: none"> <li>• A public reverse mortgage plan guaranteed by HKMCI</li> <li>• No housing price restriction (however, collateral price is limited)</li> </ul>
Singapore	<ul style="list-style-type: none"> <li>• Sells properties supplied by HDB and deposits the proceeds into pension accounts</li> <li>• A public program for all low-income households (USD 14,000/month); grants lifetime beneficiary eligibility</li> </ul>
Korea	<ul style="list-style-type: none"> <li>• Guarantee is provided by HF, and loans are provided by the private sector.</li> <li>• To be eligible, the household should have 900 million or lower in the declared value</li> <li>• Property tax reduction (25%) on subscriber's property; 75% registration tax reduction for collateral registration, and pension income deduction for interest expenses (up to KRW 2 million per year)</li> </ul>
UK	<ul style="list-style-type: none"> <li>• The private sector supplies the plans, and the government regulates their operation.</li> <li>• No capital gains tax on the sale of housing equities</li> </ul>
Australia	<ul style="list-style-type: none"> <li>• The private sector supplies the plans, and the government regulates their operation.</li> <li>• In certain cases, Services Australia provides the loan</li> <li>• No capital gains tax on the sale of housing equities</li> </ul>

Source: Ko (2019); HKMC (2021), Singapore government website (<https://www.hdb.gov.sg/>), Australia government website, US government website.

## IV. Contribution of the HP as a Source of Retirement Income

### 1. Income and Asset Distribution Among the Elderly

According to the Survey of Household Finances and Living Conditions data, in Korea, the percentage of poor households increases with age. As of 2019, poor households comprised 11.8% of households with heads of household aged 50 to 54 where poverty line is defined as 50% of the median income. The poverty rate increases with the household head's age. The poverty rate among households with heads of household aged 55 to 59 is slightly higher at 12.2%, and goes up to 16.0% among heads of household nearing the retirement age (60 to 64). The poverty rate soars in the 65 and older group, at 45.2%.

**Table 3\_Distribution of Household Income By Household head Age(as of 2019)**

(Unit: households, %)

Household head age	50% of median income or below	50~100% of median income	100~150% of median income	150% of median income or higher	Sub total
Aged 50~54	242	561	497	743	2,043
	11.8%	27.5%	24.3%	36.4%	100.0%
Aged 55~59	258	581	512	769	2,120
	12.2%	27.4%	24.2%	36.3%	100.0%
Aged 60~64	350	658	541	640	2,189
	16.0%	30.1%	24.7%	29.2%	100.0%
65 and older	2,709	1,905	815	562	5,991
	45.2%	31.8%	13.6%	9.4%	100.0%
Sub total	3,559	3,705	2,365	2,714	12,343
	28.8%	30.0%	19.2%	22.0%	100.0%

Note: The household income distribution is based on income adjusted for the number of household members ( $Y/\sqrt{n}$ ) and the median income of all samples.

Source: Statistics Korea, Survey of Household Finances and Living Conditions; raw data.

As for the income mix of households, those with heads of household aged 65 and older still earn labor income. For poor households (50% of median income or lower), the percentage of wage and salary income is around 10.1%. The same type of income takes up 29.3% of households earning 50% to 100% of median income, which includes near poverty groups. These households are likely to become poor once they lose access to the labor market. The percentage of wage and salary income is quite high at 51.9% among heads of household aged 60 to 64 earning 50% to 100% of median income. The data indicate the possibility that the elderly poverty rate may be exacerbated, depending on the labor market status.

**Table 4\_Income Mix By Head of Household Age and Household Income Level (as of 2019)**

(Unit: %)

Household head age	Income Type	50% of median income or below	50~100% of median income	100~150% of median income	150% of median income or higher
Aged 50~54	Wage and salary income	46.5	63.0	71.2	74.8
	Business income	22.2	26.5	22.1	18.2
	Property income	3.4	3.0	3.4	6.0
	Private transfer income	4.4	2.1	0.7	0.3
	Public transfer income	23.5	5.4	2.5	0.7
	Total	100.0	100.0	100.0	100.0
Aged 55~59	Wage and salary income	50.6	61.0	70.1	71.1
	Business income	15.7	26.9	21.4	18.6
	Property income	4.2	3.9	4.3	8.6
	Private transfer income	6.0	1.9	1.0	0.2
	Public transfer income	23.4	6.3	3.2	1.5
	Total	100.0	100.0	100.0	100.0
Aged 60~64	Wage and salary income	37.7	51.9	54.8	58.7
	Business income	13.9	21.3	24.1	22.1
	Property income	8.3	7.1	7.8	9.9
	Private transfer income	11.7	4.3	1.4	0.7
	Public transfer income	28.4	15.5	11.9	8.5
	Total	100.0	100.0	100.0	100.0
65 and older	Wage and salary income	10.1	29.3	40.2	37.2
	Business income	6.6	14.5	16.4	19.0
	Property income	11.3	13.2	12.4	24.1
	Private transfer income	17.8	9.6	4.0	1.7
	Public transfer income	54.3	33.5	27.0	18.0
	Total	100.0	100.0	100.0	100.0

Source: Statistics Korea, Survey of Household Finances and Living Conditions; raw data.

A review of assets held across different head of household age groups and income levels shows that poor households own a substantial amount of assets. The net asset value of poor households with heads of household aged 65 and older stands around KRW 140 million, of which 61.7% is taken up by residential properties (KRW 86.9 million). The net asset value of poor households with heads of household aged 60 to 64 stands around KRW 150 million, and 62.2% of the assets are residential properties (KRW 93.83 million). Importantly, residential properties account for a higher percentage of assets held by poor households. These findings thus suggest the possibility of reducing the poverty gap or helping poor households escape poverty by expanding the HP scheme.

The percentage of residential properties is also high among households earning 50% to

100% of the median income, and includes the near poverty groups. This percentage stands at 50.5% among households with heads of household aged 65 and older, and the percentage of residential properties against the net asset value stands at 56.2%. The percentage of wage and salary income stands at 29.3% when including the near poverty groups, which points to the need for a policy against income reduction of retirees. Ultimately, the HP program that utilizes their housing may serve as an alternative source for retirement income of the elderly.

**Table 5** Asset Mix By the Head of Household Age (as of 2019)

(Unit: KRW 10,000)

Household head age	Asset Type	50% of median income or below	50~100% of median income	100~150% of median income	150% of median income or higher
Aged 50~54	Financial assets	4,088	7,170	9,803	20,983
	Owner-occupied housing	4,771	12,415	16,931	31,403
	Other real properties	1,769	8,523	10,357	24,264
	Other real assets	604	1,406	2,212	3,543
	Liabilities	2,866	6,720	8,971	15,143
	Net worth	8,366	22,794	30,332	65,050
Aged 55~59	Financial assets	4,133	6,191	9,830	21,666
	Owner-occupied housing	6,766	10,910	18,490	30,582
	Other real estates	5,688	7,282	9,958	33,415
	Other real assets	649	1,464	2,418	4,445
	Liabilities	4,246	4,900	6,950	16,733
	Net worth	12,990	20,947	33,746	73,375
Aged 60~64	Financial assets	4,304	5,507	10,448	18,994
	Owner-occupied housing	9,383	16,424	21,569	34,713
	Other real estates	4,806	7,335	13,864	29,713
	Other real assets	725	1,300	2,633	4,420
	Liabilities	4,136	4,433	6,560	12,111
	Net worth	15,082	26,133	41,954	75,729
65 and older	Financial assets	2,499	5,263	8,582	25,993
	Owner-occupied housing	8,690	17,806	25,347	47,859
	Other real estates	4,197	11,229	16,862	55,503
	Other real assets	176	966	1,738	4,556
	Liabilities	1,469	3,615	5,910	17,689
	Net worth	14,093	31,649	46,619	116,222

Source: Statistics Korea, Survey of Household Finances and Living Conditions, raw data.

**Table 6** Asset Mix By Head of Household Age and Household Income Level (as of 2019)

(Unit: %)

Household head age	Asset Type	50% of median income or below	50~100% of median income	100~150% of median income	150% of median income or higher
Aged 50~54	Financial assets	36.4	24.3	24.9	26.2
	Owner-occupied housing	42.5	42.1	43.1	39.2
	Other real estates	15.7	28.9	26.4	30.3
	Other real assets	5.4	4.8	5.6	4.4
	Liabilities	25.5	22.8	22.8	18.9
	Net worth	74.5	77.2	77.2	81.1
Aged 55~59	Financial assets	24.0	24.0	24.2	24.0
	Owner-occupied housing	39.3	42.2	45.4	33.9
	Other real estates	33.0	28.2	24.5	37.1
	Other real assets	3.8	5.7	5.9	4.9
	Liabilities	24.6	19.0	17.1	18.6
	Net worth	75.4	81.0	82.9	81.4
Aged 60~64	Financial assets	22.4	18.0	21.5	21.6
	Owner-occupied housing	48.8	53.7	44.5	39.5
	Other real estates	25.0	24.0	28.6	33.8
	Other real assets	3.8	4.3	5.4	5.0
	Liabilities	21.5	14.5	13.5	13.8
	Net worth	78.5	85.5	86.5	86.2
65 and older	Financial assets	16.1	14.9	16.3	19.4
	Owner-occupied housing	55.8	50.5	48.3	35.7
	Other real estates	27.0	31.8	32.1	41.4
	Other real assets	1.1	2.7	3.3	3.4
	Liabilities	9.4	10.3	11.3	13.2
	Net worth	90.6	89.7	88.7	86.8

Note: Percentage against total assets (net worth + liabilities).

Source: Statistics Korea, Survey of Household Finances and Living Conditions; raw data

## 2. Factors Determining Subscription to the HP Program

This section uses the National Survey of Tax and Benefit (NaSTaB) data (2019) to analyze factors determining the subscription to the HP program.

The basic statistics show that the survey includes 1,525 home-owning households with heads of household aged 60 and older eligible for the HP. Here, 72.5% of the heads of household have spouses, and 75.6% are subscribed to public pension (or earns pension income). The high percentage of public pension subscribers (or recipients) seems to be attributable to the payment of the basic pension benefits. However, the actual percentage of

NP and occupational pension subscribers may not be as high as indicated by the data. The average number of household members is 2.2, which indicates that some households may have co-habiting members that are not spouses.

The average share of pension income among the current income is 32.2%. Notably, the percentage of private transfer income far exceeds that of public transfer income (0.8%), at 11.1%. On the other hand, the percentage of spending for other households in the total expenditure (transfer payment/total expenditure) was very low, at 0.8%. We include the housing price growth rate in the previous year as a proxy variable for the future prospect of housing prices, and the growth rate was fairly high, at 19.5%

**Table 7\_Descriptive Statistics (home-owning households, heads of household aged 60 and older)**

(Unit: persons, KRW 10,000)

Variable	Obs	Mean	Std. Dev.	Min	Max
HP subscription status	1,525	0.022	0.1477	0	1
Dummy for household head age (60–70=1, Others=0)	1,525	0.458	0.4984	0	1
Dummy for household head age (70 and older=1, Others=0)	1,525	0.542	0.4984	0	1
Spouse status (Yes=1, No=0)	1,525	0.725	0.4469	0	1
Public pension subscription status (Yes=1, No=0)	1,525	0.756	0.4296	0	1
No. of household members	1,525	2.188	0.9547	1	8
Total assets (KRW 10,000)	1,525	48,052	67,098	300	876,200
Housing assets (KRW 10,000)	1,525	40,790	60,610	300	760,000
Ratio of housing assets/total assets	1,525	0.831	0.1659	0.11	1
Current income (KRW 10,000)	1,525	3,732	3,647	0	52,440
Pension income (KRW 10,000)	1,525	759	1,024	0	9,468
Private transfer income (KRW 10,000)	1,525	177	395	0	5,000
Pension income / current income	1,516	0.322	0.3116	0	1
Public transfer income / current income	1,516	0.008	0.0687	0	1
Private transfer income / current income	1,516	0.111	0.2180	0	1
Transfer payment (KRW 10,000)	1,525	42	386	0	10,000
Transfer payment / total expenditure	1,367	0.008	0.0482	0	0.83
Housing price growth rate <sup>1)</sup>	1,165	0.195	0.8342	-0.93	10.58

Note: As of 2018.

1) Housing price growth rate = (market price of owner-occupied housing at the end of 2018 – market price of owner-occupied housing at the beginning of 2018) / owner-occupied housing at the beginning of 2018

Source: Korea Institute of Public Finance, Korea Institute of Public Finance, raw data, 2019, arranged by the author.

We used the following probit model to analyze the factors for determining HP subscription.

$$Y = \begin{cases} 1, & Y^* > 0 \\ 0, & \text{otherwise} \end{cases} = \begin{cases} 1, & X^T\beta + \epsilon > 0 \\ 0, & \text{otherwise} \end{cases}$$

The independent variables included factors affecting people's economic life, such as public pension subscription status, income, assets, etc. We also included pension income share and public pension subscription status in order to consider the existence and level of pension income. In addition, we included private transfer income and transfer payments in order to incorporate income support from children and the respondents' willingness to provide income support to children.

The analysis shows that factors that have a significant impact on HP subscription are the age of the household head, the existence of a spouse, public pension subscription status, current income, and the share of private transfer income. Difficulty in securing retirement income was found to increase with age, which in turn increases the likelihood of subscribing to the HP program. The likelihood of a head of household aged 70 and older was significantly higher than that of heads of household aged 60 to 69. The existence of a spouse also indicates that there is a higher need for retirement income, which increases the likelihood of subscribing to the HP program. The percentage of housing assets in the total assets increases the likelihood of HP subscription, albeit at low statistical significance level.

Subscription to public pensions, which was expected to affect HP subscription, significantly lowered the likelihood of HP subscription. Higher public pension incomes lower the need for an additional retirement income, which in turn lowers the likelihood of HP subscription. The level of household assets does not significantly affect HP subscription decision. Notably, the share of housing assets positively affected HP subscription, though the level of significance was low.

A household's current income level and the share of pension income found to have a positive impact on the subscription to HP. These findings imply that a person with a higher percentage of pension income is more likely to use the HP as an additional source of income. The proxy variable of children's financial situation did not have a negative effect on the parents' HP subscription decisions. The share of private transfer income in the current income represents the level of assistance from outside the household, and the results show that the likelihood of HP subscription declined with the level of external assistance. That is, a higher share of transfer income from children and relatives is likely to lower the likelihood

of HP subscription for additional retirement income. The share of public transfer income does not significantly affect the likelihood of HP subscription

In order to consider incentives for inheritance (or asset transfer) to children, we included the share of transfer payment as an explanatory variable. A household head who values inheritance to their children is more likely to support the sons' and daughters' households in the form of transfer payments. At the same time, a person making these transfers is less likely to subscribe for them to the HP program, which reduces assets available for inheritance. A higher share of transfer payment was found to be inversely correlated with the likelihood of HP subscription, though the level of statistical significance was low.

In addition, we analyzed the effect of the future prospects of the housing market on subscription decisions. In a situation in which rapid price growth is expected, it lowers the motivation for HP subscription because the HP benefits are determined based on current housing prices. Even though the HP program pays for the difference between the sale price and the loan amount at the time of settlement, the subscriber is not able to benefit from the price increase that occurred in the meantime. In fact, housing price growth may increase the likelihood of existing subscribers leaving the program. Indeed, our estimation shows that, in light with economic intuition, a higher housing price growth rate<sup>12</sup> lowers the likelihood of HP subscription, albeit at a low level of statistical significance.<sup>13</sup>

The data analyzed in this study include owners of properties exceeding KRW 900 million (market value: around KRW 110 million) who are currently not eligible for HP program).<sup>14</sup> This too may lower the estimation coefficients relative to data exclusively consisting of eligible persons, which should be taken into account when interpreting the estimation coefficients. The estimate is close to the lower limit of the effect on the decisions made by eligible heads of household.

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**12** We used the past price growth rate to represent the housing price growth rate in the future, which is based on the adaptive expectations theory that future expectations are determined by past results.

**13** The analysis model includes total assets, the percentage of housing asset, total income, and the percentage of pension income as explanatory variables. The multiple collinearity among variables may destabilize the estimation coefficients or lower the significance level. To account for this possibility, we estimated a model including only housing asset and pension income, which produced similar results to the other model.

**14** 105 among the 1,500 households.

**Table 8\_Probit Model Estimation Results on HP Subscription Decisions(home-owning households, heads of household aged 60 and older)**

Variable	Dependent variables: HP subscription				
	Model 1	Model 2	Model 3	Model 4	Model 5
Dummy for household head age (60–70=1, Others=0)	-0.8272*** (0.0000)	-0.5535*** (0.0090)	-0.8518*** (0.0000)	-0.8698*** (0.0000)	-0.8705*** (0.0000)
Spouse status (Yes=1, No=0)	0.6329** (0.0200)	0.5837** (0.0360)	0.6322** (0.0250)	0.6907** (0.0120)	0.8199** (0.0140)
Public pension subscription status (Yes=1, No=0)	-0.4335** (0.0470)	-0.7917*** (0.0010)	-0.4731** (0.0300)	-0.4301** (0.0500)	-0.5347** (0.0250)
No. of household members	-0.1924 (0.2070)	-0.1182 (0.4410)	-0.2215 (0.1640)	-0.2515 (0.1340)	-0.3241 (0.1290)
ln (total assets)	0.0225 (0.7610)	0.0075 (0.9250)	0.0684 (0.3690)	0.0257 (0.7350)	0.0300 (0.7280)
Housing asset / total assets	1.3712* (0.0800)	1.4535* (0.0670)	1.2613 (0.1030)	1.3650* (0.0800)	1.1857 (0.1840)
ln (current income)	0.5837** (0.0130)	0.5837** (0.0000)	0.1684 (0.1150)	0.2995*** (0.0050)	0.2431** (0.0480)
Pension income / current income	- (-)	1.3423*** (0.0000)	- (-)	- (-)	- (-)
Public transfer income / current income	- (-)	- (-)	0.9291 (0.2660)	- (-)	- (-)
Private transfer income / current income	- (-)	- (-)	-1.0088** (0.0750)	- (-)	- (-)
Transfer payment / total expenditures	- (-)	- (-)		-5.1339 (0.2370)	- (-)
Housing price growth rate	- (-)	- (-)	- (-)	- (-)	-0.2718 (0.1330)
Constant	-4.9514*** (0.0000)	-7.1503*** (0.0000)	-4.5190*** (0.0000)	-5.2424*** (0.0000)	-4.5369*** (0.0000)
Sample size	1,516	1,516	1,516	1,358	1,157

Note: Figures in ( ) represent P>Z, and \*\*\*, \*\*, and \* mean the significance levels of 1%, 5%, and 10%, respectively.  
Source: Author.

The analysis showed that the important variables in HP subscriptions are public pension subscription status, subscriber age, and housing asset. People with no public pension plan had a higher motivation for subscribing to the HP program, which suggests the possibility of alleviating elderly poverty by supporting these groups. These people are not subscribed to public pension plans due to their unstable employment history. Allowing these groups to use their housing asset seems to be a sensible policy choice. Other than the HP program, most policy instruments against poverty are typically government subsidies. As such, a policy

supporting non-public pension subscribers may be another cost-effective policy option. A household head's motivation for subscribing to the HP program increases with their age, which shows the effectiveness of policy incentives based on household head age may be effective in increasing HP subscription.

The housing assets held by a household positively correlated with their likelihood of HP subscription. This indicates the possibility of increasing the use of the HP program by relaxing current eligibility conditions, such as the single-home ownership requirement and the declared value cap of KRW 900 million. In order to address subscribers' need for retirement income, these criteria can be changed to include non-subscriber to public pensions or low income household. The change will allow the government to support people in need while maintaining the retirement income security function of the HP program.

## V. HP Tax Benefits and Their Poverty Alleviating Effect

### 1. Tax Benefits of the HP and Private Pension

This section estimates the amount of tax benefits of both the HP and private pension. Tax benefits related to private pension include tax credits for savings and income deductions for pension income. For the tax credits, the tax-favored savings limit of private pension account is KRW 4 million per year. However, it can be lowered to KRW 3 million if the comprehensive income amount exceeds KRW 100 million (for a person with wage and salary income only, a total wage/salary of KRW 120 million). The tax credit rate varies depending on the income level; 15% applies to people earning a comprehensive income below KRW 40 million (KRW 55 million for people with wage and salary income only), and 12% applies to those earning above this threshold. Pension income deductions<sup>15</sup> are applied when receiving pension income. The deduction rate varies depending on the pension income level.

The HP provides reverse mortgage plans in the market via a guarantee by a public organization. However, this supply benefit is difficult to estimate. Other than supplying reverse mortgage plans, Korea offers a 25% reduction on property tax, 75% reduction on registration tax, and pension income deduction for interest expenses, where the property tax reduction is the largest of the three. Under the property tax reduction scheme, the property

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<sup>15</sup> Pension income deduction applies to the total of all pension incomes, including public pension.

tax is reduced by 25% (declared value of up to KRW 500 million). Although there may be additional tax benefits, we did not include them in the comparison because they are either small or are rarely applied.

**Table 9\_Tax Benefit of the Schemes**

Private pension savings	HP
<ul style="list-style-type: none"> <li>○ Pension account tax credit               <ul style="list-style-type: none"> <li>- 12% (15%) of deposits in pension account</li> <li>• Who earns KRW 40 million (total wage/salary: KRW 55 million) or lower: 15%</li> <li>- Account deposit limit: KRW 4 million (KRW 3 million)</li> <li>• Who earns more than KRW 100 million (total wage/salary: KRW 120 million): KRW 3 million</li> </ul> </li> <li>○ Pension income deduction               <ul style="list-style-type: none"> <li>- 100%, 40%, 20%, 10% income deduction for KRW 3.5 million, KRW 7 million, KRW 14 million and beyond KRW 14 million.</li> <li>- Limit: KRW 9 million</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>○ Property tax reduction               <ul style="list-style-type: none"> <li>- 25% reduction</li> <li>For a property with a declared value exceeding KRW 500 million, 25% reduction of property tax amount which imposed on a property worth KRW 500 million.</li> <li>- Applies to single home-owning household</li> </ul> </li> </ul>

Source: National Law Information Center, Income Tax Act, Local Tax Act, <https://www.law.go.kr/LSW/main.html> (accessed on September 30, 2021)

To estimate the size of the tax benefit under the two schemes, we added the following assumptions. For economic variables, we assumed a 3% real return on assets and a 1% inflation rate. The contribution or subscription period of the pension plan was assumed to be 20 years, and the private pension eligibility period was assumed to be 10 years in order to have similar pension incomes. For pension savings, we consider several contribution amount scenarios.

**Table 10 Assumptions of Tax Benefit Estimation**

Items	Private pension savings	HP
Baseline year	First pensionable year ( Subscription year)	
Economic variables	Real return on asset: 3%, inflation rate: 1%	
Term of pension plan	20 years (eligibility period: 10 years)	20 years
Compared normal state	Contribution: Tax credit (×) Benefits: Pension income taxation (×)	Income tax reduction (×)
Scenario	Subscription period: 15 years (7 years eligibility), 25 years (12 years eligibility) Annual contributions: KRW 1, 2, 3, 4 million Tax credit rates: 12%, 15%	Declared housing price: KRW 300 million, 500 million, 700 million

Source: Author.

The amount of tax benefits for private pension plans is estimated as follows.

$$T_{sub} = Ftaxc + Ppentax$$

$$Ftaxc = \sum_{i=1}^T (1 + CPI)^{T-i+1} TC(i)$$

$$Ppentax = \sum_{i=1}^{T/2} \frac{1}{(1 + CPI)^{i-1}} (T(y_i) - T(pen_i))$$

where  $T_{sub}$  is amount of tax benefits for pension saving accounts,  $Ftaxc$  is the value of tax credits for the contributions paid during the period of subscription, at the time of receiving the first pension benefit,  $Ppentax$  is the amount of tax benefits for pension payouts,  $T(y_i)$  is the income tax of income ( $y(i)$ ) at time  $i$ , and  $T(pen_i)$  is the income tax when the same income ( $y(i)$ ) at time  $i$  is the pension income ( $pen_i$ ). The difference between the two variables ( $T(y_i) - T(pen_i)$ ) represents the tax reduction stemming from the pension income deduction. We used the inflation rate ( $CPI$ ) to calculate the present value (real value) of tax benefits.

We estimated here the total tax benefits for personal pension saving account, based on the sum of tax credit for contributions in the pension saving account and pension income deduction. The total tax benefit increases with the amount of contributions in the pension saving account, which ranges from KRW 13,168,000 to KRW 22,754,000 at an annual total

contribution of KRW 4 million. These figures represent 11% to 18% of the total pension account contributions (i.e., the total pension payout). The percentage of tax benefits in the total contributions increases at a lower annual contribution amount, and decreases with the subscription period. The percentage of tax benefits declines as the contribution amount increases because the pension income deduction scheme is progressive.

**Table 11\_Tax Benefits of Private Pension Savings**

(Unit: KRW 10,000)

Pension savings subscription period (years)	15	20	25	
Eligibility period (years)	7	10	12	
Amount of tax credit on pension account contributions (A1, 12% credit rate)				
Annual contributions	100	212.5	290.7	372.8
	200	425.0	581.3	745.6
	300	637.4	872.0	1,118.4
	400	849.9	1,162.6	1,491.2
(A2, 15% credit rate)				
Annual contributions	100	265.6	363.3	466.0
	200	531.2	726.6	932.0
	300	796.8	1,089.9	1,398.0
	400	1,062.4	1,453.3	1,864.1
Pension income tax reduction (B)				
Annual contributions	100	46.4	61.9	95.4
	200	160.1	218.5	303.4
	300	273.8	375.1	452.9
	400	254.4	360.9	411.3
Total tax benefits (A1+B, credit rate 12%)				
Annual contributions	100	258.9	352.5	468.2
	200	585.1	799.8	1,049.0
	300	911.3	1,247.0	1,571.4
	400	1,104.3	1,523.5	1,902.6
(A2+B, credit rate 15%)				
Annual contributions	100	312.0	425.2	561.4
	200	691.3	945.1	1,235.4
	300	1,070.6	1,465.0	1,851.0
	400	1,316.8	1,814.1	2,275.4

Note: The income tax figures include the local income tax (10% of the national income tax), Value of the first year of private pension eligibility.

Source: Author.

**Table 12\_ Relative Size of Tax Benefit on Private Pension Savings**

(Unit: %)

Pension savings subscription period (years)	15	20	25	
Eligibility period (years)	7	10	12	
Tax benefits/Total pension payout (% , 12% credit rate)				
Annual contributions	100	12.9	11.8	11.2
	200	14.6	13.4	12.6
	300	15.2	14.0	12.6
	400	13.8	12.8	11.4
Tax benefits/Total pension payout (% , 15% credit rate)				
Annual contributions	100	15.6	14.3	13.5
	200	17.3	15.9	14.8
	300	17.8	16.4	14.8
	400	16.4	15.2	13.7

Note: The total payout of private pension was calculated at a compound interest rate, and the value of money was valued as of the first year of private pension eligibility.

Source: author

The amount of tax benefits on the HP is estimated based on the present value of the property tax reduction on housing (25% of the property tax). The present value was evaluated at the time of subscription to a 20-year maturity HP plan. The property tax reduction limit is the property tax amount on a declared value of KRW 500 million property. Considering a fair price ratio of 0.6 that is applied to property tax calculation, the reduction applies to tax bases of KRW 300 million or lower, indicating that the reduction does not apply to a tax base bracket in which the highest tax rate is applied.<sup>16</sup>

$$T_{sub} = \sum_{i=0}^{T-1} \frac{0.25 \times Tholding(i)}{(1 + CPI)^i}$$

$$Tholding(i) = \text{Min}(Tholding(i), Thold(\text{max}))$$

where  $T_{sub}$  is the amount of tax benefits on HP subscription,  $Tholding(i)$  is the property tax on a property at  $i$ , and  $Thold(\text{max})$  is the property tax on a property worth

<sup>16</sup> The property tax is imposed based on a progressive structure consisting of four brackets (0.1%, 0.15%, 0.25%, and 0.4%). A 0.4% tax rate applies to any tax base amount in excess of KRW 300 million.

KRW 500 million, which is the upper limit of the tax credit eligibility.

The tax benefits on the HP ranged from KRW 3,090,000 to KRW 3,827,000. This amount accounts for between 0.5% and 1.0% of the declared value. The percentage of tax benefit increased at lower declared value, which can be explained by the progressive structure mentioned above, in conjunction with the upper limit of the tax credit.

For a property with a declared value of KRW 500 million, the HP subscription provides the subscriber a monthly pension payout of KRW 1,062,000 (KRW 230 million over 20 years). The total tax benefit was KRW 3,827,000. Per KRW 100 of pension payout, a beneficiary receives KRW 1.6 in tax benefits, which does not seem to be substantial. We assumed a 20-year eligibility period (subscribed at age 60) for better comparability to the 20-year subscription period for private pension plans. However, we did not find significant difference in terms of the average life expectancy.<sup>17</sup>

**Table 13\_Tax Benefits on HP Subscription (as of 2020)**

(Unit: KRW 10,000, %)

Declared housing price	KRW 300 million	KRW 500 million	KRW 700 million
Total pension amount (A) (monthly pension payout)	13,930.6 (63.7)	23,217.8 (106.2)	32,505.0 (148.6)
Tax benefits (B)	309.0	382.7	382.7
Tax benefits / Pension payout (B/A, %)	2.2	1.6	1.2
Percentage against declared value (%)	1.0	0.8	0.5

Note: The total property tax reduction represents a 20-year present value, and the HP payout represents the amount to be received by a lifetime beneficiary who subscribed at the age of 60.

Source: Author.

These findings indicate that tax benefits account for 11% to 16% of the total payout of private pension plans, which represents KRW 1,100 to KRW 1,600 per KRW 10,000. In comparison, the tax benefits on the HP accounts for a mere 1.6% to 2.2% of the total payout, or KRW 160 to KRW 200 per KRW 10,000. Despite the purported goal of securing retirement income, we found a significant difference in the size of tax benefits.

<sup>17</sup> According to Korean Statistical Information Service, Statistics Korea, Future Life Expectancy, <https://kosis.kr/index/index.do> (accessed on November 3, 2021), the life expectancy is 83.2 years old, as of 2020 (80.3 for men, 86.1 for women), which slightly exceeds the assumption, albeit by a smaller margin for men.

**Table 14\_Tax Benefits on Private Pension and HP**

(Unit: KRW 10,000, %)

Tax benefits on private pension (20-year contribution, 10-year eligibility)				
Annual contributions	KRW 1 million	KRW 2 million	KRW 3 million	KRW 4 million
Total pension amount (A)	2,977.8	5,955.6	8,933.4	11,911.2
Tax benefits (A1, 12% contribution rate)	352.5	799.8	1,247.0	1,523.5
Tax benefits (A2, 15% contribution rate)	425.2	945.1	1,465.0	1,814.1
Share of Tax benefits per pension payout (A1/A)	11.8	13.4	14.0	12.8
Share of Tax benefits per pension payout (A2/A)	14.3	15.9	16.4	15.2
HP tax benefits (20-year eligibility)				
Declared housing price			KRW 300 million	KRW 500 million
Total payout (B) (monthly payout)			13,930.6 (63.7)	23,217.8 (106.2)
Tax benefits (B1)			309.0	382.7
Share of Tax benefits per pension payout (B1/B)			2.2	1.6

Note: For the private pension, we assumed 20-year subscription and 10-year eligibility. For the HP, we assumed lifelong eligibility.  
Source: Calculated by the author.

## 2. Redistribution Effect of the HP

We estimated the effect of HP subscription on the alleviation of old age poverty. Specifically, we analyzed the effect of HP subscription for households with heads of household aged 50 and older. We considered households with heads of household aged 50 and older in order to examine changes in the poverty rate among people nearing their retirement, because HP subscription around the time of retirement can greatly contribute to promoting income security and mitigating old age poverty after retirement.

We developed two HP subscription scenarios, based on the urgency of income support. In the first scenario (S1), we examined the effect of a policy that encourages people with no public pension plan to subscribe to the HP program. This group does not benefit from typical inter-generational redistribution effect provided by public pension programs. In order to improve the equity of pension programs, we need to help this group subscribe to the HP program. As such, the support for HP subscription can be provided at a higher level, compared to current subscribers.

The second scenario (S2) involves expanding the eligibility of the HP program to include lower income earners, as well as people with no public pension plan. The existence of elderly low-income earners ultimately increases the government's financial burden. By helping these

people liquidate their assets, the government will be able to concurrently alleviate both old age poverty and achieve efficient fiscal management. Specifically, the policy expands the eligibility scope to include people earning 100% of the median income, or lower. That is, the policy not only covers poor households earning 50% of the median income, or lower, but also includes households earning 50% to 100% of the median income, or those who may be referred to as 'potentially poor groups.' The policy considers the fact that, old-age households are not likely to increase their future income; elderly groups still partially rely on earned income, which means that they may fall under near poverty groups. Based on these considerations, we analyzed two scenarios.

We analyzed the effect of HP subscription with focus on two variables: poverty rate and poverty gap, because poverty is a critical issue for the Korean elderly. A decline in the elderly poverty rate improves the overall income distribution. However, we estimate the elderly poverty rate only. The poverty gap is another key indicator. It refers to the gap between the poverty line and the actual income. Whereas the poverty rate represents the horizontal scope of poverty, the poverty rate represents its vertical scope. If the incomes of poor households do not deviate far from those of other households, the poverty gap will be low.

HP subscription greatly lowers the poverty rate of elderly householders, especially among heads of household aged 65 and older. The finding can be explained by the low income and the high housing asset owning households with heads of household aged 65 and older. HP subscription by people without public pension plans was found to reduce the poverty rate of households with heads of household aged 65 and older by 10.7%p. S2 found a 16.3%p poverty rate reduction among poor households earning 50% of median income or lower. These policies can drastically lower the poverty rate of elderly households with heads of household aged 65 and older. HP subscription also offers the benefit of decreasing the financial burden for the government, because it utilizes private household assets rather than public money to decrease poverty.

The poverty rate reduction effect of HP subscription declines among younger heads of household. The effect of poverty reduction stands at a mere 1.7%p for households with heads of household aged 60 to 64. The percentage point increases to just 3.4%p, even if we include households earning 100% of median income or below in the group eligible for HP subscription. These findings can be explained by the low poverty rate of the relevant age group, and the lower percentage of people without public pension plans. The poverty rate of households with heads of household aged 60 to 64 is 16.0%, which is far lower than the poverty rate of households with heads of household aged 65 and older (45.2%).

**Table 15\_ Redistribution effect of HP Subscription (2018)**

(Unit: %, households)

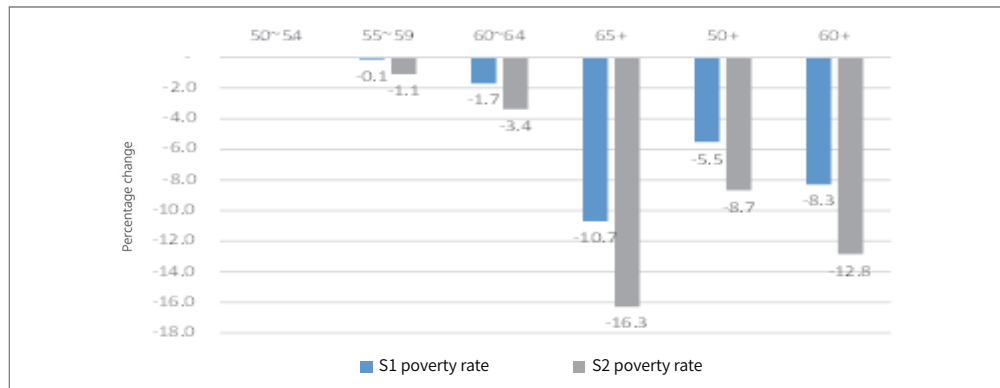
Household head age	Current distribution		S1		S2	
	50% of median income or below	50~100% of median income	50% of median income or below	50~100% of median income	50% of median income or below	50~100% of median income
Aged 50~54	11.8	27.5	11.8	27.5	11.8	27.5
Aged 55~59	12.2	27.4	12.0	27.1	11.1	25.8
Aged 60~64	16.0	30.1	14.3	28.7	12.6	26.6
65 and older	45.2	31.8	34.5	35.4	28.9	34.1
All households						
50 and older	28.8	30.0	23.3	31.5	20.1	30.2
60 and older	37.4	31.3	29.1	33.6	24.6	32.1

Note: 1. In S1, people without public pension plans subscribe to the HP. In S2, the same non-subscribers and people earning 100% of median income or lower subscribe to the program.

2. Income as of 2018. Income groups were divided based on the median value of disposable income equalized across all households  
Source: Author.

**Figure 8\_Poverty Reduction Effect of the HP**

(unit: %p)



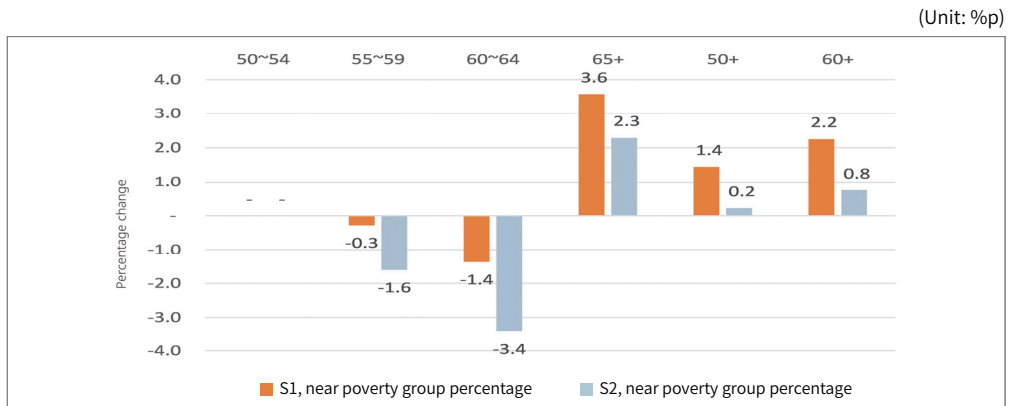
Source: Author.

HP subscription was found to improve the overall income levels of elderly households. The poor groups and the near poverty groups will have higher income. The income improvement for the near poverty groups contributes to the appropriateness of retirement income. Overall, the transition from the poor group to the near poverty group is greater among households with heads of household aged 65 and older, which results in a higher share

of near poverty groups. In fact, the percentage of poor households moving to the near poverty groups is higher than the percentage of near poverty households moving to a 100% median income, or higher income groups. The share of near poverty households among those earning 50% to 100% of median income increased by 3.6%p or 2.3%p, depending on the scenario.

The income distribution of households with heads of household aged 64 and younger revealed a different pattern, however. The lower poverty rate in the group indicates that there are more near poverty households moving up to higher income levels than poor households moving up to the near poverty groups. As a result, the percentage of near poverty households declined among households earning a 50% to 100% of median income. HP subscription lowers the percentage of near poverty groups among householders aged 60 to 64 by 1.4%p, though the difference goes up to 3.4%p when assuming that all households earning 100% of the median income or lower subscribe to the HP.

Figure 9\_Change of Near Poverty Group Share By the HP



Source: Author.

HP subscription is also expected to decrease the poverty gap. The poverty gap is defined as the total difference between the income earned by poor households and the poverty line (50% of median income). Poverty gaps are indicated in terms of monetary units. However, they change depending on the number of households included in the data. For this reason, the poverty gap rate is widely used, which is defined as poverty gap divided by poverty line. If a poor household receives an amount corresponding to the poverty gap rate, the household's income will be the same as the poverty line.

The poverty gap rate before HP subscription provide different implications. For households with heads of household aged 65 and older, which is the group with the highest poverty rate, the poverty gap rate was 34.3%. This rate is lower than the poverty gap rates of other groups: 34.7% for households with heads of household aged 50 to 54, and 35.1% for those with heads of household aged 55 to 59. In other words, despite the high percentage of poor households in the group, the difference from the poverty line is relatively small. Among households with heads of household aged 50 to 59, the poverty gap rate is high, at around 35%, despite its low relative poverty rate (11.8~12.2%). Despite being smaller in number, the poor households in this group are relatively poorer.

The poverty gap shows a greater decline in S2, which assumes subscription by non-public pension subscribers and near poverty groups, than in S1, where only the non-subscribers subscribe to the program. The decline in the poverty gap increases with the age of the household head. While the poverty gap rate declines overall, it can actually increase when some households escape poverty. In other words, in S2, only households with larger poverty gaps remain in poverty, which results in a higher average poverty gap rate among poor households than S1.

**Table 16\_Poverty Reduction Effect of HP Subscription (2018)**

(Unit: KRW 1 billion, rate)

Household head age	Current distribution		S1		S2	
	Poverty gap	Poverty gap rate	Poverty gap	Poverty gap rate	Poverty gap	Poverty gap rate
Aged 50–54	1.1	0.347	1.1	0.347	1.1	0.347
Aged 55–59	1.2	0.351	1.2	0.345	1.0	0.336
Aged 60–64	1.4	0.314	1.3	0.307	1.1	0.299
65 and older	12.2	0.343	8.6	0.316	7.4	0.324
All households						
50 and older	16.0	0.341	12.1	0.320	10.6	0.324
60 and older	13.7	0.339	9.9	0.315	8.5	0.320

Note: 1. In S1, people without public pension plans subscribe to the HP. In S 2, the same non-subscribers and people earning 100% of median income or lower subscribe to the program.

2. Income as of 2018. Income groups were divided based on the median value of disposable income equalized across all households.

3. Poverty gap: (poverty line – income); poverty gap rate:  $\sum(\text{poverty line} - \text{income}) / (n * \text{poverty line})$ ; n: number of poor households.

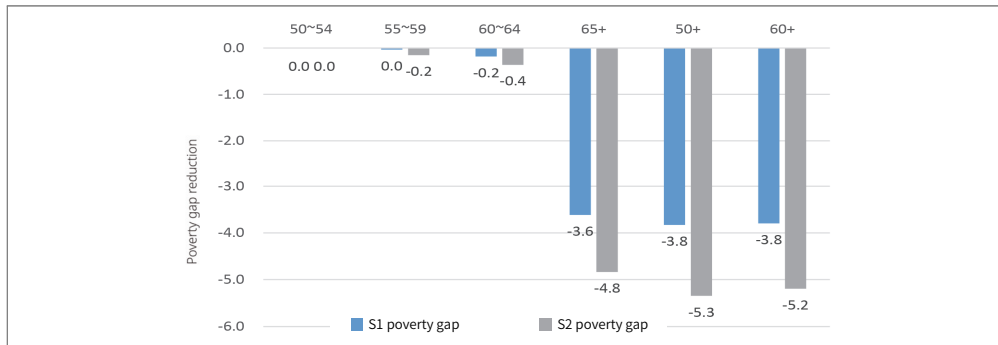
Source: Author

The effect of poverty gap reduction from HP subscription among households with heads of household aged 65 and older ranges between KRW 3.6 billion and KRW 4.8 billion,

depending on the scenario. It represents KRW 1.33 million to KRW 1.78 million per poor household. The poverty gap reduction is not that significant in the 50's and 60~64 household head groups, since the number of HP eligible household is very small.

**Figure 10\_Poverty Gap Reduction from the HP**

(Unit: KRW 1 billion)

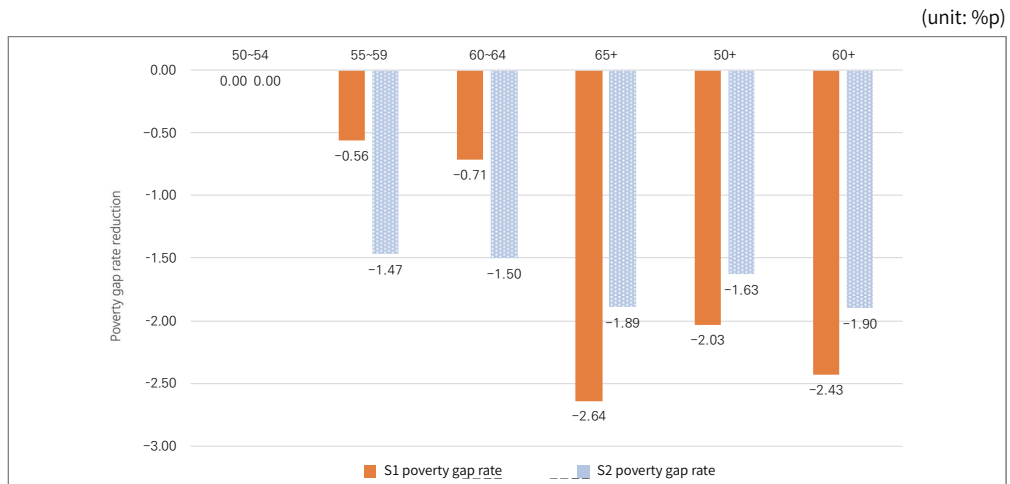


Note: 1. In S1, people without public pension plans subscribe to the HP. In S2, the same non-subscribers and people earning 100% of median income or lower subscribe to the program.  
 2. Income as of 2018. Income groups were divided based on the median value of disposable income equalized across all households.  
 3. Poverty gap =  $\sum(\text{poverty line} - \text{income})$ .

Source: Author.

The poverty gap rate, which is the difference between the relative poverty line and the actual income, is greatly lowered by the income growth effect of HP subscription. In S1, the greatest poverty gap rate reduction was observed among heads of household aged 65 and older. HP subscriptions reduced the poverty gap rate by 2.64%p, which far exceeds the 0.56%p reduction among heads of household aged 55 to 59.

In S2, in which people earning 100% of the median income or lower are encouraged to subscribe to the HP program, a lower poverty gap rate reduction is reported; the poverty gap rate declined by a mere 1.89%p among households with heads of household aged 65 and older. These findings imply that, even after HP subscription, the poverty gap among poor households remains high. In contrast, the poverty gap rate was reduced by greater margins among heads of household aged 55 to 59 and those aged 60 and 64.

**Figure 11\_Poverty Gap Rate Reduction Effect of the HP**

Note: 1. In S1, people without public pension plans subscribe to the HP. In S2, the same non-subscribers and people earning 100% of median income or lower subscribe to the program.

2. Income as of 2018. Income groups were divided based on the median value of disposable income equalized across all households.

3. Poverty gap rate:  $\sum(\text{poverty line} - \text{income}) / (n * \text{poverty line})$ ; n: number of poor households.

Source: Author.

These findings assume full subscription by all potential subscribers. The actual subscription rate will be lower than our assumption, however, which means that the effect of the poverty rate reduction will be lower than stated in our results. In addition, HP subscription may also reduce the transfer income from children. Follow-up studies are thus needed in order to understand the changes in the behaviors of subscribers and children after HP subscription.

## VI. Conclusions and Policy Implications

This study proposed possible improvements of the HP program as a policy instrument aimed at reducing old age poverty. The high poverty rates among elderly Korean citizens, combined with the high percentage of home owners, implies that there is a great potential to reduce old age poverty in the country. Our analysis on the determinants of subscription to HP showed that lowering the eligibility requirements, such as the 1-household 1-housing requirement and the KRW 900 million upper limit, can improve the likelihood of HP subscription. We also compared tax benefits provided for private pension plans and the HP

program. Tax benefits worth KRW 11 to KRW 15 are provided per KRW 100 of private pension income. For the HP program, the tax benefit per KRW 100 of pension income ranged between KRW 1.6 and KRW 2.2. This difference indicates that there is a fair and cost-effective way to reduce old age poverty, supporting the HP program. To this end, we propose the need to lower the eligibility requirements for the program, as well as the introduction of additional tax benefits such as capital gains tax reduction or a greater property tax reduction. Overall, expanding the scope of the HP program to people with no public pension plan and low-income earners constitutes a highly effective way to reducing both the old age poverty rate and poverty gap, as well as alleviating the potential risk of reduced labor income.

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# Effect of R&D Tax Credits on Technology Innovation

Hongrae Lim and Dongsook Han\*

## I. Introduction

Governments commonly implement policies that are designed to encourage research and development (R&D) efforts and subsequently promote technological innovation. These policies are justified by the nature of knowledge as a public good and based on knowledge externalities, which cause less knowledge to be produced than is socially desirable. Knowledge is inappropriable, and businesses are thus motivated to imitate the knowledge and technologies of other firms, rather than producing their own. They can also utilize the knowledge and technologies of others to advance their own research. This aspect of knowledge is called ‘knowledge spillover.’ To summarize, knowledge can be characterized as an inappropriable public good. At the same time, it can cause externalities. However, it may also mean that less knowledge is produced than what is socially desirable.

Governments across the world have utilized various policy instruments in attempts to address this issue, to which Korea is no exception. Commonly utilized policy instruments include direct support for R&D, fiscal incentives for R&D, and public procurement for innovation. Most researchers who analyzed the effect of R&D tax credits have focused on its effect on R&D investments (R&D expenses). If an increase in R&D efforts necessarily leads to the creation and sharing of more knowledge, it would justify further analyzing the effect

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of policy instruments that have a focus on R&D. However, there is no guarantee that R&D growth always increases the production of knowledge and subsequent sharing. This relationship needs to be substantiated through empirical analysis. Most studies investigating the effect of R&D tax credit on technological innovation have utilized data from technological innovation surveys. Only Dechexlèpretre et al. (2016) and Ivus et al. (2021) have analyzed data on patents, which represent the actual outcomes of technological innovation at firms.

In this study, we examine differences between firms eligible for R&D tax credits (treatment group) and non-eligible firms (control group) by analyzing their R&D expenses, patent counts, and citation-weighted patent counts (CWPCs). For this analysis, we built a dataset by combining the data on firms receiving R&D tax credits, corporate financial data that includes R&D expenses, and patent data from the Korea Institute of Patent Information (KIPI). We then analyzed the data using a doubly robust estimation and a difference-in-difference (DID) model based on multiple time periods.

## II. Institutional Background

Under the Korean R&D tax credit scheme, the government deducts a set percentage of the R&D expenses prescribed by the relevant presidential decrees from the income tax or corporate income tax for the relevant year (Article 10, Restriction of Special Taxation Act). The R&D tax credit rate varies depending on the company type, whether the firm researched/developed source technologies, and whether the incremental method or the total cost method applies. The scheme deducts a firm's R&D expenses for 'new growth and source technologies' (as prescribed in the relevant presidential decree) in the relevant tax year, multiplied by the percentage prescribed for the relevant enterprise type (30% for small and medium enterprises (SMEs), 25% for middle-standing KOSDAQ companies, and 20% for large enterprises), and three times the share of new growth/source technology R&D expenses in the total earnings in the tax year.<sup>1</sup> The incremental method deducts an amount equal to a certain percentage (50% for SMEs, 40 % for middle-standing firms, and 25% for large enterprises) of the difference between the R&D expenses in the relevant tax year over the R&D expenses in the previous year, if the former exceeds the latter. The total cost method deducts the amount of the R&D expenses in the relevant tax year multiplied by a certain rate

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<sup>1</sup> A 10/100 limit applies (15/100 for KOSDAQ-listed middle-standing firms).

(25% for SMEs, 8% to 15% for middle-standing companies and, for large enterprises, the share of R&D expenses in the firm's earnings multiplied by 0.5).

To be eligible for R&D tax credits, a firm is required to satisfy the personnel and facility requirements and to then obtain a certification for a subsidiary R&D center or R&D department. In 2012, 25,860 firms were certified to have a subsidiary R&D center. The number rose to 42,155 in 2020, 74% of which were small and venture enterprises. The number of firms with R&D departments almost tripled in the same period, from 10,544 in 2012 to 29,864 in 2020. The increased number of firms having an R&D department is mostly attributable to small enterprises. Small and venture enterprises accounted for around 74% and 8% of the 2020 figure, respectively. In light of the above, we included firms having certified R&D centers or departments in the treatment group, and the other firms in the control group.

### III. Literature Review

#### 1. Previous Literature on the Effect of R&D Tax Credit on R&D Activities

Most previous studies focused on the effect of R&D tax credit on firms' R&D expenses. In the United States, since the early years of the country's R&D tax credit scheme, researchers have been interested in empirically examining whether R&D growth exceeds the tax amount deducted through the R&D tax credit scheme, and whether R&D tax credits actually promote R&D activities. For example, Eisner et al. (1984) analyzed the R&D expenses and tax amounts of 592 firms between 1980 and 1982 in order to analyze the effect of tax credits on R&D efforts, and did not find any significant effect on R&D expenses. Hall (1993) empirically analyzed the effect of R&D tax credits on R&D expenses for around 1,000 American manufacturers between 1980 and 1991. His analysis of the firms' tax credits and financial data put the R&D tax credit elasticity of R&D expenses at around 0.3, indicating that the tax credits significantly increased the firms' R&D expenses. Rao (2016) empirically analyzed the effect of tax credits using the data from the Internal Revenue Service (IRS) and firm-level tax credit data. Using a number of instrument variables, Rao identified a positive causality between a marginal change in the tax credits and R&D spending growth, and a long-term increase in the R&D intensity.

In Japan, researchers have found that the R&D tax credit elasticity of Japanese firms is lower than for the United States and other Western countries (Koga, 2003). It has been also

confirmed that the adoption of the total cost method in 2003 increased firms' R&D expenses, especially in firms with higher debt ratios (Kasahara, Shimotsu, and Suzuki, 2014). In a study on Taiwanese companies, Chen and Gupta (2017) analyzed the effect of a tax credit rate raise in 2002 from 25% to 30%. While testing the hypothesis that the effect of the change will be different between high-tech firms and low-tech firms, they found that the rise of credit rate significantly increased the R&D intensity of high-tech firms. However, no significant effect was found among low-tech firms. Using corporate financial data, Chinese researchers also found that R&D tax credits increased firms' R&D expenses (Jia and Ma, 2017).

Other researchers have meta-analyzed country-level data. Bloom and Reenen (2002) analyzed the effect of tax credits for nine members of the Organisation for Economic Cooperation and Development (OECD) between 1979 and 1997. The authors calculated the user cost of R&D based on the tax policies of each country, and then estimated the effect of the user cost on the R&D expenses of the overall manufacturing sector. Using a fixed-effect model, the authors found that the elasticity of R&D user cost was around 0.35, which represents a significant increase in the firms' R&D expenses. They also analyzed the user-cost elasticity of capital, using a dynamic panel model to address the endogeneity issue. The findings revealed a user-cost elasticity of 0.14 in the short term, and 1 in the long term.

## **2. Previous Literature on the Effect of R&D Tax Credits on Technological Innovation**

Recognizing the limitations of R&D expenses as input for technological innovation, an increasing body of work analyzes the effect of R&D tax credits on technological innovation. Early studies mainly relied on survey data pertaining to technological innovation, whereas more recent studies have attempted to combine corporate financial and patent data. Czarnitzki et al. (2011) empirically analyzed the effect of tax credits on technological innovation based on data from Canadian 1999 Survey of Innovation on its manufacturing firms between 1997 and 1999. Propensity score matching showed that R&D tax credits significantly impacted technological innovation in most areas, including the number of product innovations, the revenues from product innovation, and the release of new products. Cappelen et al. (2012) analyzed technological innovation survey data in Norway, and found that the country's tax credits did not significantly affect patent applications or market-first product innovations. However, the tax credits significantly improved process innovation and product innovation. Lokshin and Mohnen (2012) analyzed the effect of tax credits by

combining the Dutch CBS's annual Community Innovation Survey (CIS) and R&D survey. According to their findings, the price elasticity of R&D expenses was 0.21 in the short term, and 0.56 in the long term. Researchers have also used other survey data. Chen and Yang (2019) analyzed a questionnaire survey and patent data regarding 1,256 listed companies in China from 2011 to 2012, in order to analyze the effect of tax credits on corporate innovation. They found the tax credit elasticity of R&D expenses and patent counts to be 0.246 and 0.027, respectively.

More recent studies on the issue have combined corporate financial and patent data to examine the effect of R&D tax credits. For example, Dechexleprêtre et al. (2016) empirically analyzed the effect of tax credit on innovation (patents) using national tax data, corporate accounting data, and patent data. For their analysis, the researchers used a regression discontinuity design in conjunction with the assets, revenues, and employee thresholds for SME certification. Specifically, using firm assets as the running variable, the researchers divided the firms into treatment and control groups based on the SME threshold (GBP 86 million) and then compared the patent counts of the two groups. The comparison showed a significant R&D expense growth and 30% more patents in the treatment group.

Ivus et al. (2021) is the only study wherein the researchers combined corporate financial data and patent data to examine the overall effect of R&D tax credits. They analyzed corporate data from 2001 to 2016 to empirically analyze the tax credit increase in 2011. In order to analyze the effect of the 2011 reform, the researchers then divided the analysis period between the pre-implementation period (2010 and the early years) and the post-implementation period (2011 and subsequent years). The treatment group consisted of firms that registered with the Department of Scientific and Industrial Research (DSIR) for R&D tax credits, and the control group consisted of non-registered firms. They also developed 2001–2016 panel data for 804 companies, and used a difference-in-difference (DID) model to analyze the effect of the 2011 tax credit increase. They found that the 2011 reform increased the firms' R&D spending by 57%, and their R&D intensity by 156%. Their patent application submissions to the Indian and United States patent office increased by 10% and 6%, respectively.

### 3. Significance of this Study

This study distinguishes itself from previous literature in three respects. First, with the exception of Ivus et al. (2021), most studies have focused on the effect of R&D tax credits on R&D expenses, whereas we also analyzed the effect on technological innovation. In

addition, we also analyzed the effect on the citation-weighted patent count (CWPC) to account for the patent quality. Second, we used a difference-in-difference (DID) model with multiple time periods the doubly robust estimation. Save for a few studies that use the propensity score matching method, the majority of previous studies did not include a method to reduce the potential bias between the treatment and control groups. In this study, we used propensity score matching to reduce the bias between the two groups. A doubly robust estimation also helped us reduce the bias and control for other factors affecting R&D expenses and technological innovation. Notably, the use of the multi-period DID model allowed us to explicitly consider the heterogeneity of the treatment effect. Third, this study expanded the scope of analysis by using wider range of data. While previous studies only used data from a selected group of firms, we expanded the analysis data by building a dataset that includes all firms subject to external audit requirements, in order to examine the overall effect of R&D tax credits.

## IV. Data and Method

### 1. Analysis Data

To be eligible for a designated R&D department, a firm needs to be certified to have a subsidiary R&D center or an R&D department. In light of the above, we included firms with R&D department centers or departments in the treatment group, and all other firms in the control group. In this way, we identified firms with R&D department centers using the data provided by the Korea Industrial Technology Association (KOITA).

For corporate financial data, we used the KISVALUE data provided by the NICE Information Service. KISVALUE data include information regarding listed companies and corporations subject to external audit requirements. As of October 2020, the data included information on 30,143 firms. From the KISVALUE, we collected data pertaining to the firms' assets, liabilities, revenues, gross profits, R&D activities (development expenses, depreciation, research expenses, current development expenses, and current R&D expenses), as well as a company overview between 2001 and 2019.

The data on corporate patents were collected from the Korea Institute of Patent Information (KIPI). The patent data included a patent bibliography, information on data applicants, and data citations. The patent bibliography included 2,941,232 applications

submitted to the Korea Intellectual Property Office (KIPO) between 2001 and 2019. In addition, we utilized the citation data for 8,366,159 patents between 2001 and 2020, and the applicant data for 3,254,932 applications between 2001 and 2020.<sup>2</sup> We then used the patent data to calculate the firms' patent counts and citation-weighted patent counts (CWPCs) for each of the analyzed years. We used the CWPC because the quality and value of patents can vary from patent to patent, and a simple sum of patent counts may not reflect the actual gap in quality.

## 2. Selection of Analysis Data

We combined the KISVALUE data, the data on eligible firms, and patent data to build a dataset consisting of 568,499 datapoints involving 29,921 firms for the 2001~2020 period. We were not able to use all of the constructed data, because we needed to remove outliers from the dataset. Ultimately, we selected the analysis data from the dataset in accordance with the following criteria. First, we excluded firms reporting no data on assets, liabilities, revenues, and gross profits. Second, we excluded firms having negative values for revenues, R&D expenses, and age. Third, we removed startups and closed businesses in order to exclude their effect. Fourth, we excluded firms that obtained their certification in or prior to 2001. As a result, we arrived at a final list of 98,667 datapoints.

Eligible firms may differ from non-certified firms in respects other than their tax credits, in which case a comparison between the two groups may be biased. In this study, we used propensity score matching (PSM) to reduce the possible bias between the observable differences between the treatment and control groups. For the matching method, we used one of the most utilized methods: nearest neighbor matching. We used the propensity score as the matching distance. The reference year for score matching was 2001, and the data were matched by estimating the firms' likelihood of being certified as eligible companies. The propensity scores were calculated based on the R&D activities in the previous year ( $RnD_{t-1}$ ), assets ( $A_t$ ), revenues ( $S_t$ ), gross profits ( $P_t$ ), age ( $Age_t$ ), firm type ( $Type_t$ ), industry ( $I_t$ ), and public listing status ( $L_t$ ), using the following equation.<sup>3</sup> The number of firms in the treatment

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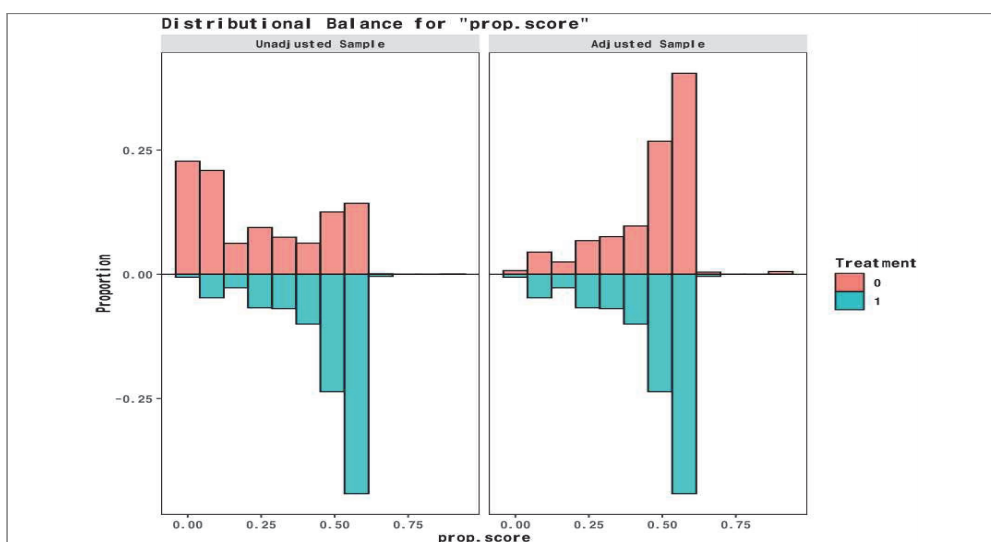
**2** Applicant and citation data in 2020 were excluded from the analysis.

**3** We attempted to use the Herfindahl-Hirschman Index (HHI), which is related to the market structure, and Tobin's Q, which affects firms' investments. However, our use of these indicators was restricted by data issues. The revenue data required for HHI calculation had a large number of missing values, which may affect the

group did not change after matching, whereas the total number of control group firms declined.

$$\ln\left(\frac{PS}{1-PS}\right) = \beta_0 + \beta_1 RnD_{t-1} + \beta_2 A_t + \beta_3 S_t + \beta_4 P_t + \beta_5 Age_t + \beta_6 Type_t + \beta_7 I_t + \beta_8 L_t + \epsilon \quad \text{Equation (1)}$$

**Figure 1\_Propensity Score Distribution Before and After Matching**



Source: Present study.

The PSM revealed similar distributions of propensity scores between the treatment and control groups. After the PSM, we narrowed the data down to 62,548 datapoints. Table 1 shows the number of datapoints in the treatment group and the control group.

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HHI results. The data for Tobin's Q also have numerous missing values, because it can be only calculated for listed companies.

**Table 1** Number of Datapoints in the Treatment and Control Groups (post-matching)

Year	2001	2002	2003	2004	2005	2006	2007
Control	3,168	3,075	2,999	2,907	2,787	2,683	2,580
Treatment	124	217	293	385	505	609	712
Total	3,292	3,292	3,292	3,292	3,292	3,292	3,292
Year	2008	2009	2010	2011	2012	2013	2014
Control	2,490	2,400	2,290	2,215	2,147	2,070	1,992
Treatment	802	892	1,002	1,077	1,145	1,222	1,300
Total	3,292	3,292	3,292	3,292	3,292	3,292	3,292
Year	2015	2016	2017	2018	2019	Total	
Control	1,934	1,862	1,788	1,725	1,646	<b>44,758</b>	
Treatment	1,358	1,430	1,504	1,567	1,646	<b>17,790</b>	
Total	3,292	3,292	3,292	3,292	3,292	<b>62,548</b>	

Source: Present study.

### 3. Descriptive Statistics for Analyzed Data

#### A. All Firms

Table 2 summarizes the descriptive statistics for the eligible and non-eligible firms. The average R&D expenses of the eligible firms stood at KRW 930 million, significantly exceeding the average expenses of the non-eligible firms. The eligible firms also reported a higher average patent count than the non-eligible firms (1.7 and 0.4, respectively). The CWPC of the eligible firms also exceeded that of the non-eligible firms (5.9 and 1.9, respectively). The eligible firms reported average assets, revenues, and gross profits of KRW 90.3 billion, 87.8 billion, and 16.4 billion, respectively. The same figures for the non-eligible firms were KRW 61.1 billion, 65.6 billion, and 10.9 billion. The average age of the eligible firms was around 21 years, slightly higher than the average age of the non-eligible firms (around 19 years).<sup>4</sup>

<sup>4</sup> It should be noted that the differences between the eligible and non-eligible firms are not statistically significant, given the large standard deviation. However, the differences in assets, revenues, gross profits, and age still indicate the need for PSM and controlling those differences when estimating the effect of R&D tax credits.

**Table 2\_Descriptive Statistics (all firms)**

	Eligibility	No. of observations	Average	SD	Min	Max
Assets (KRW 100 million)	0	44,758	611.45	2,072.82	0.21	78,933.06
	1	17,790	903.99	3,773.41	2.76	91,127.78
Revenues (KRW 100 million)	0	44,758	655.82	2,166.18	0.02	80,282.69
	1	17,790	878.25	2,914.44	0.04	72,089.88
Gross profits (KRW 100 million)	0	44,758	107.73	324.83	-4,119.68	10,529.93
	1	17,790	164.35	855.18	-6,952.18	41,222.73
Age (years)	0	44,758	19.23	11.94	0	86
	1	17,790	21.17	10.92	0	95
R&D expenses (KRW 100 million)	0	44,758	3.11	34.01	0	3,161.8
	1	17,790	9.32	34.78	0	1,641.13
Patent count	0	44,758	0.42	3.47	0	193
	1	17,790	1.71	11.2	0	514.5
CWPC	0	44,758	1.89	13.97	0	815.5
	1	17,790	5.91	31.82	0	1,387

Note: 1 for eligible firms, 0 for non-eligible firms.

Source: Present study.

## B. Large Enterprises

The average R&D expenses of all large enterprises were KRW 1,270 million. The average patent count and CWPC were 2 and 7.09, respectively. Table 3 presents the descriptive statistics for the eligible and non-eligible large enterprises. The eligible large enterprises reported larger assets, revenues, and gross profits than non-eligible firms. However, the age difference was deemed negligible. The R&D expenses of the non-eligible and eligible large enterprises were KRW 883 million and KRW 2,350 million, respectively. The eligible large enterprises also outperformed the non-eligible firms in terms of average patent count (4.61 and 1.07, respectively). The former firms' average CWPC is also higher than that of the latter group (14.18 and 4.56, respectively).<sup>5</sup>

<sup>5</sup> It should be noted that the differences between the eligible firms and the non-eligible firms are not statistically significant, given the large standard deviation. However, the differences in assets, revenues, gross profits, and age still suggest the need for PSM and controlling those differences when estimating the effect of R&D tax credit.

**Table 3\_Descriptive Statistics (large enterprises)**

	Eligibility	No. of observations	Average	SD	Min	Max
Assets (KRW 100 million)	0	10,714	1,767.86	3,977.16	1.81	78,933.06
	1	3,840	3,002.59	7,744.44	7.87	91,127.78
Revenues (KRW 100 million)	0	10,714	1,865.89	4,168.8	0.2	80,282.69
	1	3,840	2,851.31	5,837.18	1.97	72,089.88
Gross profits (KRW 100 million)	0	10,714	303	60,989	-4,119.68	10,529.93
	1	3,840	533.44	1,786.64	-6,952.18	41,222.73
Age (years)	0	10,714	24.87	14.16	0	86
	1	3,840	24.78	13.42	0	95
R&D expenses (KRW 100 million)	0	10,714	8.83	68.64	0	3,161.8
	1	3,840	23.5	71.26	0	1,641.13
Patent count	0	10,714	1.07	6.8	0	193
	1	3,840	4.61	23.51	0	514.5
CWPC	0	10,714	4.56	26.26	0	815.5
	1	3,840	14.18	63.73	0	1,387

Source: Present study.

### C. SMEs

The average R&D expenses of all SMEs were KRW 249 million. The average patent count and CWPC were 0.41 and 1.8, respectively. Table 4 summarizes the descriptive statistics for the eligible and non-eligible SMEs. The eligible SMEs reported larger revenues, revenues, and gross profits than the non-eligible firms. The eligible SMEs were found to be older than the non-eligible firms (20.18 and 17.45 years, respectively). The R&D expenses of non-eligible and eligible large enterprises were KRW 541 million and KRW 103 million, respectively. The eligible large enterprises also outperformed the non-eligible firms in terms of average patent count (0.91 and 0.21, respectively). The former firms' average CWPC was also higher than that of the latter group (3.64 and 1.05, respectively).<sup>6</sup>

<sup>6</sup> It should be noted that the differences between the eligible firms and the non-eligible firms are not statistically significant, given the large standard deviation. However, the differences in assets, revenues, gross profits, and age still suggest the need for PSM and controlling those differences when estimating the effect of R&D tax credit.

**Table 4\_Descriptive Statistics (SMEs)**

	Eligibility	No. of observations	Average	SD	Min	Max
Assets (KRW 100 million)	0	34,044	247.51	343.19	0.21	7,498.83
	1	13,950	326.31	325.09	2.76	4,940.81
Revenues (KRW 100 million)	0	34,044	274.99	307.02	0.02	8,063.65
	1	13,950	335.13	297.01	0.04	7,942.89
Gross profits (KRW 100 million)	0	34,044	46.28	76.76	-920.44	1,452.36
	1	13,950	62.76	79.54	-196.07	1,840.03
Age (years)	0	34,044	17.45	10.54	0	75
	1	13,950	20.18	9.89	0	73
R&D expenses (KRW 100 million)	0	34,044	1.3	4.94	0	127.87
	1	13,950	5.41	8.61	0	134.85
Patent count	0	34,044	0.21	1.04	0	32.5
	1	13,950	0.91	2.25	0	66.5
CWPC	0	34,044	1.05	6.06	0	244
	1	13,950	3.64	12.22	0	329

Source: Present study.

## 4. Analysis Model

### A. DID Analysis with Multiple Time Periods Using Doubly Robust Estimation

#### 1) DID with Multiple Time Periods

The traditional DID method is not suitable for analyzing data treated differently across multiple periods, or for analyzing the heterogeneity of the treatment effect. The fixed effect model poses its own issues. Calculating the weighted average of treatment effects may result in negative weights, which may then introduce bias into a policy effect estimation; as with the traditional DID method, it is not suitable for analyzing the heterogeneity of the treatment effect. Many researchers have discussed how we can analyze the heterogeneous treatment effects across different points of treatment (de Chaisemartin and D'Haultfœuille, 2020; Goodman-Bacon, 2021; Athey and Imbens, 2021; Sun and Abraham, 2021; Callaway and Sant'Anna, 2021). Some researchers have improved on the fixed effect model, while others have improved on the DID model. Both groups of researchers have attempted to solve the negative weight issue and analyze the heterogeneity of treatment effects across multiple

periods by ‘decomposing’ the treatment effects across different groups and periods. Among the disparate methods proposed by these researchers, we relied on the DID model with multiple time periods proposed by Callaway and Sant’Anna (2021).

Callaway and Sant’Anna proposed a method that can be applied to groups of data that are differently treated across two or more time periods. They proposed using the DID model to analyze the treatment effects of the groups across different periods, and to aggregate those effects across the time elapsed after treatment, the groups, and the treated periods. The following equation represents a standardized average treatment effect based on groups and time periods, and constitutes a standardized representation of the DID analysis.<sup>7</sup> The authors refer to the effect as the ‘group-time average treatment effect.’ The group-time average treatment effect is calculated by applying the DID model to data for multiple groups and time periods.

$$ATT(g, t) = E[Y_t(g) - Y_t(0) | G_g = 1] \quad \text{Equation (2)}$$

The data used in this study were divided into a treatment group and a control group based on 2001 data, followed by PSM. However, each firm chooses whether it is treated in a given time period (whether it falls under a given group). As such, the group-time treatment effect may be biased if a firm’s characteristics determine whether it belongs to a certain group. To prevent this issue, in this study, we matched the propensity scores of the analyzed firms depending on whether each firm is treated in each period. The data constructed through the PSM can thus be used to establish control variables. Our model can be expressed as the following model.<sup>8</sup>

$$ATT(g, t) = Y = \tilde{\alpha}_1^{g, t} + \tilde{\alpha}_2^{g, t} \cdot G_g + \tilde{\alpha}_3^{g, t} \cdot 1\{T = t\} + \tilde{\beta}^{g, t} \cdot (G_g \times 1\{T = t\}) + \tilde{\gamma} \cdot X + \tilde{\epsilon}^{g, t} \quad \text{Equation (3)}$$

The group-time treatment effect can clearly show the heterogeneity of treatment effects across treatment periods and groups. However, it may also make it difficult to summarize the

<sup>7</sup> Under the traditional DID method, the average treatment effect can be specified as  $ATT = E[Y_2(2) - Y_2(0) | G_2 = 1]$

<sup>8</sup> We relied on a doubly robust estimation, which will be discussed below.

findings. Callaway and Sant'Anna (2021) proposed various methods to aggregate the group-time treatment effects; the simplest method is to calculate the weighted average of the identified average group-time treatment effects. This method involves proposing the average of treatment effects experienced by all entities who participated in the treatment, regardless of the length of time exposed to the treatment.<sup>9</sup> Thus, the overall treatment effect can be calculated using the following equation.

$$\theta_W^O = \frac{1}{k} \sum_{g \in G} \sum_{t=2}^T 1\{t \geq g\} A TT(g, t) P(G = g | G \leq T) \quad \text{Equation (4)}$$

where,  $k = \sum_{g \in G} \sum_{t=2}^T 1\{t \geq g\} P(G = g | G \leq T)$  which is the weight for  $A TT(g, t)$ . The weights total at 1. The overall effect  $\theta_W^O$  is the weighted average of individual  $A TT(g, t)$ . A higher  $A TT(g, t)$  is applied to a larger group.<sup>10</sup>

The group-time treatment effect can be summarized by focusing on the treatment period. Specifically, we can calculate the time elapsed after treatment using the annual and group data, and then use the findings to propose the treatment effect of the group of entities exposed to treatment in the same period, which can be calculated using the following equation,<sup>11</sup> where  $g$  is the group (year of treatment),  $T$  is the year, and  $e$  is the period of exposure to treatment ( $e = T - g$ ). In other words, we propose the treatment effects across all groups by focusing on the time exposed to treatment.

$$\theta_{e.s} = \sum_{g \in G} 1(g + e \leq T) P(G = g | G + e \leq T) \cdot A TT(g, g + e) \quad \text{Equation (5)}$$

In the case of analyzing the heterogeneity of treatment effects, the group-time treatment effect may be aggregated and proposed for each group. In other words, we can propose the group effect of all entities in Group  $\tilde{g}$  across all periods, which can be achieved using the following equation.

**9** The method produces the same results as the fixed effect model, if there is no heterogeneity across different groups or time periods.

**10** The weight varies depending on the time of exposure to treatment, as well as the group size.

**11** In this study, we refer to the effect as the 'dynamic effect.'

$$\theta_{sel}(\tilde{g}) = \frac{1}{T - \tilde{g} + 1} \sum_{t=\tilde{g}}^T AT T(\tilde{g}, t) \quad \text{Equation (6)}$$

The group-time treatment effect can be also calculated and proposed for specific years (calendar effect), by summarizing the treatment effects in a given year across all groups using the following equation.

$$\theta_c = \sum_{g \in G} 1(\tilde{t} \geq g) P(G = g | G \leq \tilde{t}) \cdot AT T(g, g + e) \quad \text{Equation (7)}$$

## 2) Doubly Robust Estimation

The DID model relies on the parallel trends assumption, which means that the treatment and control groups do not display any trend other than the treatment effect. However, the parallel trends assumption cannot be tested.<sup>12</sup> However, we suspect that, if the variables expected to be related to the treatment effects change differently between the treatment group and the control group (i.e., if the variables of the two groups are not balanced), the assumption does not apply. In such cases, we can use a model in which the parallel trends assumption applies, after controlling for variables that change differently between the treatment and control groups (Sant'Anna and Zhao, 2020). Two methods are widely cited in this regard: the outcome regression (OR) approach, and the inverse probability weighting (IPW) approach.

To estimate policy effects without bias, the OR approach requires an accurate establishment of the regression equation (Heckman et al., 1997), and the IPW approach requires an accurate equation for the propensity score (Abadie, 2005). If the regression equation (OR approach) or the propensity score equation (IPW approach) are not accurate, the method loses its robustness. To overcome this issue, we propose the use of a doubly robust estimation method. The method combines the benefits of the OR approach and the IPW approach, and allows researchers to then ensure the robustness of findings if either equation is accurate. In the case of analyzing panel data, the DID model with doubly robust estimation can be expressed as follows (Sant'Anna and Zhao, 2020).

<sup>12</sup> An event study can be used to identify trend changes. However, fundamentally, it is not capable of testing a hypothesis.

$$\tau^{dr,v} = E[(w_1^D(D) - w_0^D(D, X; \pi))(\Delta Y - \mu_{0,\Delta}^D(X))] \quad \text{Equation (8)}$$

$$w_1^v(D) = \frac{D}{E[D]}, \text{ and } w_1^v(D, X; g) = \frac{g(X)(1-D)}{1-g(X)} \quad \text{Equation (9)}$$

$$/ E \frac{g(X)(1-D)}{1-g(X)}$$

In this study, we used the doubly robust estimation to reduce possible bias in the treatment effect estimation that may stem from fundamental differences between the treatment effect and the control group. We used the doubly robust estimation method to control for factors affecting an entity's likelihood of falling under the treatment or control group (IPW), as well as the factors that may affect the findings on R&D expenses, patent counts, and CWPCs (OR). For factors that may affect the likelihood of falling under the treatment or control group, we considered assets, revenues, gross profits, age, firm type, and industry type.

## B. Dependent Variables

In this study, we analyzed the following variables: R&D expenditures, patent counts, and CWPCs. The R&D expenditures are widely used in studies that investigate the effect of R&D tax credits. They are also widely used as an input indicator representing technological innovation. For the output variables of technological innovation, we consider here the patent count and CWPC. The patent count has been widely used to represent the output of technological innovation, though some researchers have criticized the use of patent counts for not reflecting the quality of technological innovations. Not all patents are created equal, they argue, and have suggested that we cannot rely on simple counting. In fact, after Trajtenberg (1990) found that citations represent the economic value and influence of a patent, researchers have since used the number of citations and the citation-weighted patent count (CWPC) as an indicator for the quality of a patent. As such, in this study, we used the CWPC as the indicator of patent quality.

## C. Independent and Control Variables

As explained above, we analyzed the average treatment effect (ATE) of the R&D tax credit, which indicates the average difference between the treatment effect and the control

group. As such, the definition of the treatment and control groups takes on greater significance. Here, we defined the treatment group as firms certified to operate a subsidiary R&D center or an R&D department for the purpose of receiving R&D tax credits, and defined the control group as firms without such certification. The control variables include assets, revenues, gross profits, age, firm type, industry, and public listing status. We used the control variables in three ways. First, we divided the data into the treatment group (firms treated at least once) and the control group (firms that did not receive any treatment), followed by PSM based on their 2001 data. Second, for the IPW method, we attempted to reduce bias caused by the difference in propensities of the treatment group across different years, by estimating propensity scores using the assets, revenues, gross profits, age, firm type, industry, and public listing status. Third, for the OR method, we controlled for differences in policy effects across control variables by controlling the assets, revenues, gross profits, age, firm type, industry, and public listing status.

## V. Results

### 1. Effect on R&D Expenses

#### A. Overall Effect

In order to analyze the effect of R&D tax credits on R&D expenses, we analyzed the treatment effects using the DID model with multiple time periods. Then, we summarized the effects into the average treatment effect (ATE) as shown in Table 5. The findings indicate that R&D tax credit increases the average R&D expenses of the overall enterprises by KRW 340 million. Across different firm sizes, the tax credit increases the R&D expenses of large enterprises by KRW 930 million, and SMEs by KRW 300 million.

**Table 5** Effect of R&D Tax Credits on R&D Expenses

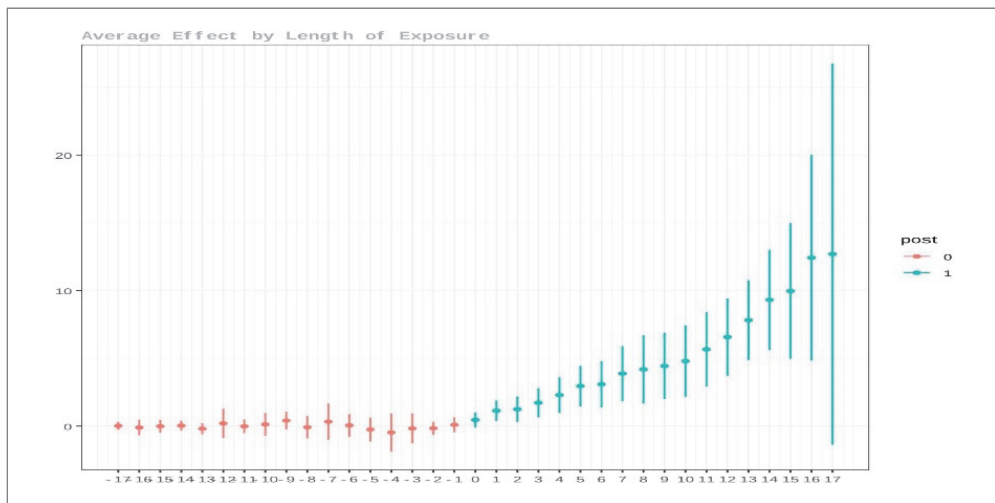
	Overall effect	SD	95% confidence interval	
All Firms	3.395	0.496	2.422	4.367
Large Enterprises	9.333	3.020	3.413	15.252
SMEs	2.962	0.177	2.614	3.310

Source: Present study.

### C. Dynamic Effect

We analyzed the dynamic effect of R&D tax credits on R&D expenses. According to our findings, the effect of R&D tax credits manifested across all periods after treatment began, resulting in a steadfast R&D expense growth over 16 years. It should be noted that, even though the dynamic effect was not calculated cumulatively, the R&D expense growth effect is seen to increase with the time exposed. Among large enterprises, the R&D tax credit did not have a significant effect during the first seven years, though a significant increase in R&D expenses was observed between the 8th and the 16th years. As for SMEs, R&D tax credits significantly increased a firm's R&D expenses for 17 years after treatment. It should be noted once again that, even though the dynamic effect was not calculated cumulatively, the R&D expense growth effect increased with the time exposed.

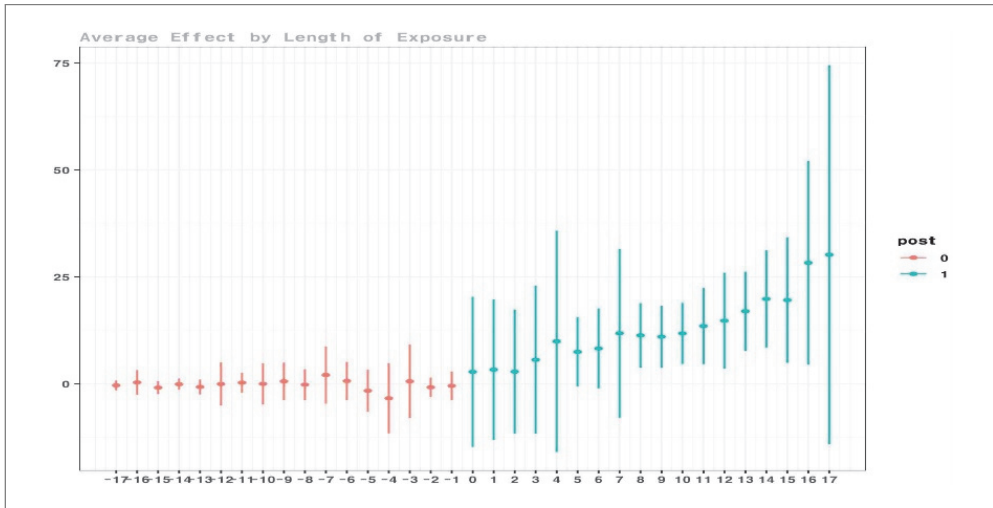
Figure 2\_Dynamic Effect of R&D Expenses (all firms)



Note: Post 0 = yearly difference before treatment, post 1 = yearly difference after treatment.

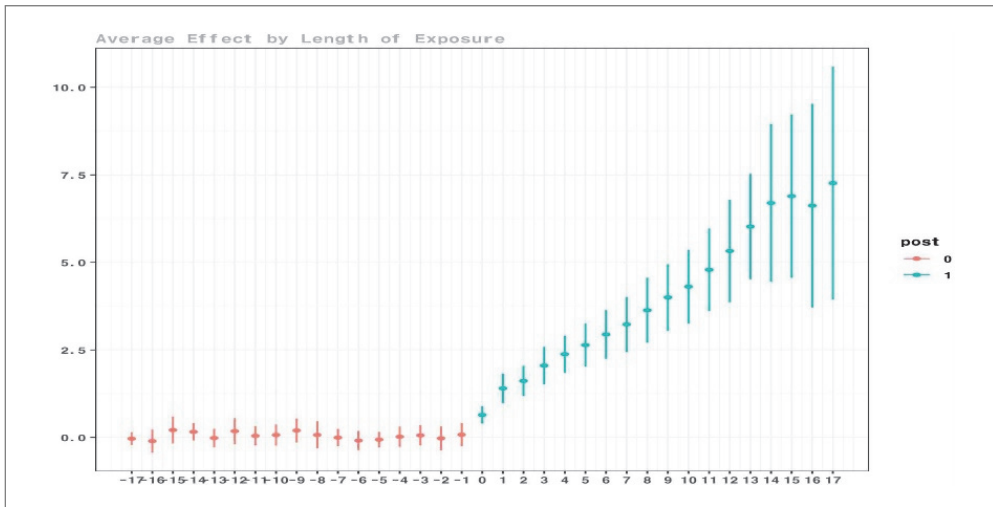
Source: Present study.

Figure 3\_Dynamic Effect of R&D Expenses (large enterprises)



Note: Post 0 = yearly difference before treatment, post 1 = yearly difference after treatment.  
 Source: Present study.

Figure 4\_Dynamic Effect of R&D Expenses (SMEs)



Note: Post 0 = yearly difference before treatment, post 1 = yearly difference after treatment.  
 Source: Present study.

Table 6\_Dynamic Effect of R&amp;D Expenses

Yearly difference	All firms	Large enterprises	SMEs
-17	0.016	-0.384	-0.035
-16	-0.106	0.313	-0.105
-15	-0.016	-0.923	0.211
-14	0.034	-0.117	0.161
-13	-0.194	-0.757	-0.015
-12	0.199	-0.066	0.178
-11	-0.017	0.258	0.046
-10	0.124	-0.031	0.070
-9	0.408	0.562	0.198
-8	-0.086	-0.229	0.072
-7	0.324	2.037	-0.004
-6	0.051	0.631	-0.089
-5	-0.254	-1.637	-0.063
-4	-0.472	-3.390	0.020
-3	-0.173	0.563	0.060
-2	-0.164	-0.833	-0.025
-1	0.095	-0.497	0.078
0	0.458	2.775	0.643
1	1.133**	3.298	1.402**
2	1.241**	2.826	1.615**
3	1.721**	5.604	2.053**
4	2.285**	9.905	2.379**
5	2.952**	7.456	2.639**
6	3.084**	8.247	2.943**
7	3.873**	11.797	3.230**
8	4.180**	11.308**	3.633**
9	4.432**	10.989**	4.000**
10	4.790**	11.753**	4.308**
11	5.657**	13.487**	4.790**
12	6.567**	14.729**	5.326**
13	7.812**	16.952**	6.023**
14	9.316**	19.830**	6.696**
15	9.962**	19.548**	6.891**
16	12.419**	28.265**	6.621**
17	12.688	30.161	7.265**

Note: \*\*p<0.05

Source: Present study.

## 2. Effect on Patent Count

### A. Overall Effect

In order to analyze the effect of R&D tax credits on the patent count, we analyzed the treatment effects using the DID model with multiple time periods. We then summarized the effects into the average treatment effect (ATE) as shown in Table 7. The findings indicate that R&D tax credit increased the average patent count of the overall enterprises by 0.52, with large enterprises reporting an average patent count growth of 1.74, and SMEs reporting growth of 0.36.

**Table 7** Effect of R&D Tax Credits on Patent Count

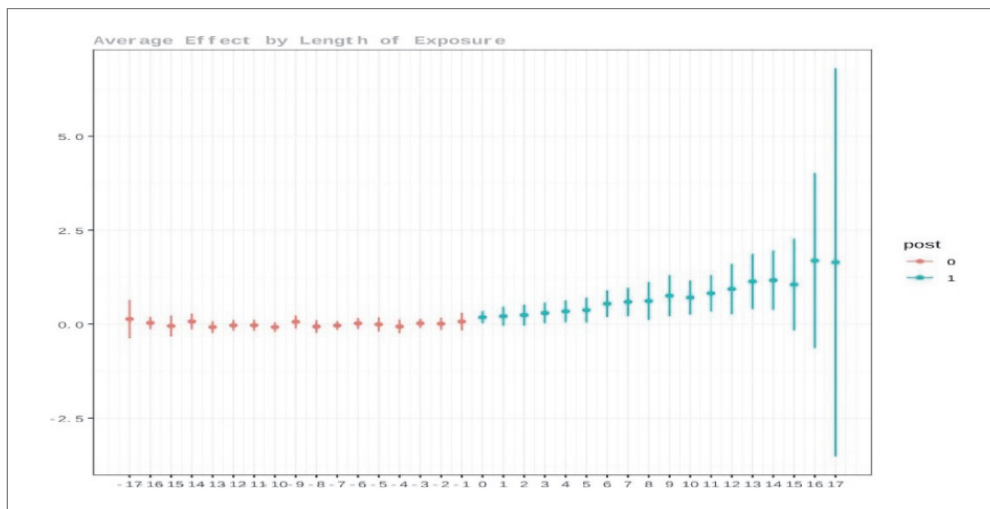
Items	Overall effect	SD	95% confidence interval	
All Firms	0.517	0.097	0.327	0.708
Large Enterprises	1.743	0.605	0.557	2.930
SMEs	0.355	0.054	0.250	0.460

Source: Present study.

### B. Dynamic Effect

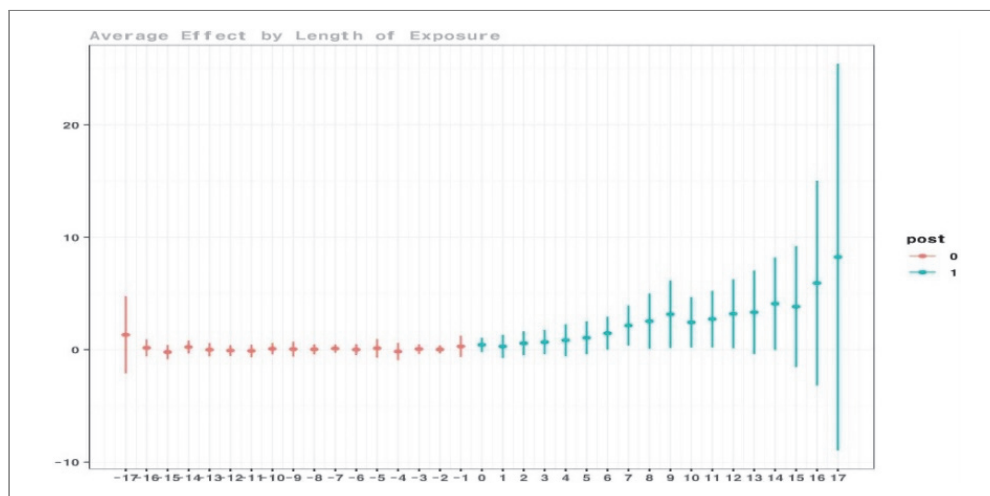
We analyzed the dynamic effect of R&D tax credits on the patent count. According to our findings, the effect of R&D tax credits manifested across all periods after treatment began, resulting in a steadfast R&D expense growth over 14 years. It should be noted once again that, even though the dynamic effect was not calculated cumulatively, the effect on the patent count increased with the time exposed. Among large enterprises, the R&D tax credits did not have a significant effect during the first five years, though a significant increase in patent count was observed between the 6th and the 12th years. Among SMEs, the tax credits significantly increased the patent count for 15 years after treatment. Notably, whereas the effect on R&D expenses increased over time, its effect on the patent count did not.

Figure 5\_Dynamic Effect on Patent Count (all firms)



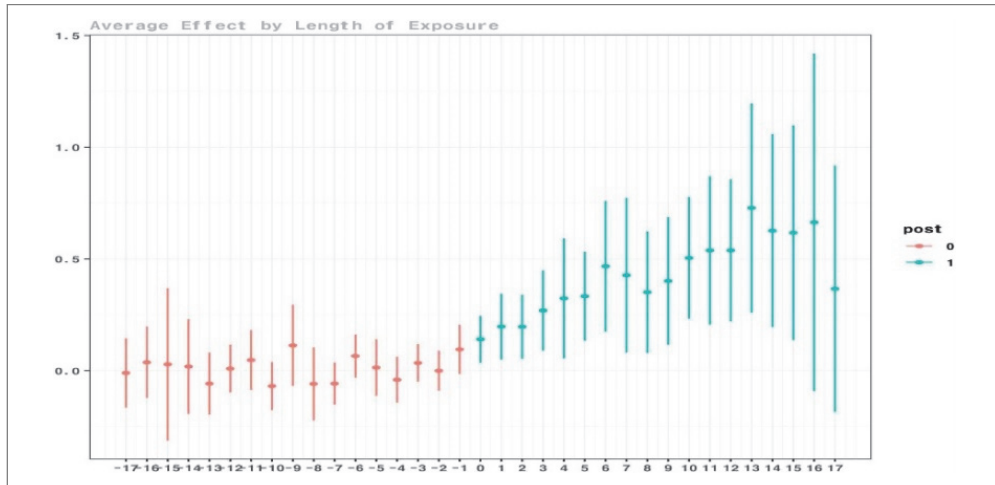
Note: Post 0 = yearly difference before treatment, post 1 = yearly difference after treatment.  
Source: Present study.

Figure 6\_Dynamic Effect on Patent Count (large enterprises)



Note: Post 0 = yearly difference before treatment, post 1 = yearly difference after treatment.  
Source: Present study.

Figure 7\_Dynamic Effect on Patent Count (SMEs)



Note: Post 0 = yearly difference before treatment, post 1 = yearly difference after treatment.

Source: Present study.

Table 8\_Dynamic Effect on Patent Count

Yearly difference	All enterprises	Large enterprises	SMEs
-17	0.137	1.312	-0.010
-16	0.035	0.159	0.037
-15	-0.048	-0.220	0.028
-14	0.072	0.233	0.018
-13	-0.078	-0.011	-0.058
-12	-0.032	-0.080	0.009
-11	-0.029	-0.111	0.048
-10	-0.078	0.074	-0.069
-9	0.062	0.046	0.113
-8	-0.063	0.029	-0.059
-7	-0.034	0.096	-0.058
-6	0.021	0.001	0.066
-5	-0.006	0.124	0.014
-4	-0.062	-0.169	-0.041
-3	0.022	0.058	0.035
-2	0.012	0.017	0.000
-1	0.069	0.292	0.095

**Table 8\_Dynamic Effect on Patent Count(continued)**

Yearly difference	All enterprises	Large enterprises	SMEs
0	0.184**	0.423	0.141**
1	0.212	0.290	0.197**
2	0.242**	0.566	0.196**
3	0.297**	0.669	0.269**
4	0.342**	0.838	0.324**
5	0.374**	1.046	0.333**
6	0.543**	1.459**	0.467**
7	0.592**	2.145**	0.427**
8	0.616**	2.530**	0.351**
9	0.755**	3.151**	0.401**
10	0.710**	2.427**	0.504**
11	0.821**	2.722**	0.538**
12	0.935**	3.188**	0.538**
13	1.136**	3.323	0.728**
14	1.168**	4.088	0.626**
15	1.054	3.822	0.617**
16	1.690	5.920	0.664
17	1.646	8.240	0.366

Note: \*\*p<0.05

Source: Present study.

### 3. Effect on CWPC

#### A. Overall Effect

In order to analyze the effect of R&D tax credits on the CWPC, we analyzed the treatment effects using the DID model with multiple time periods. We then summarized the effects into the average treatment effect (ATE) as shown in Table 9. The findings indicate that the R&D tax credits increased the average CWPC of the overall enterprises by 1.2. However, the R&D tax credits did not significantly affect the average CWPC of large enterprises. On the other hand, SMEs reported a 0.76 increase in average CWPC.

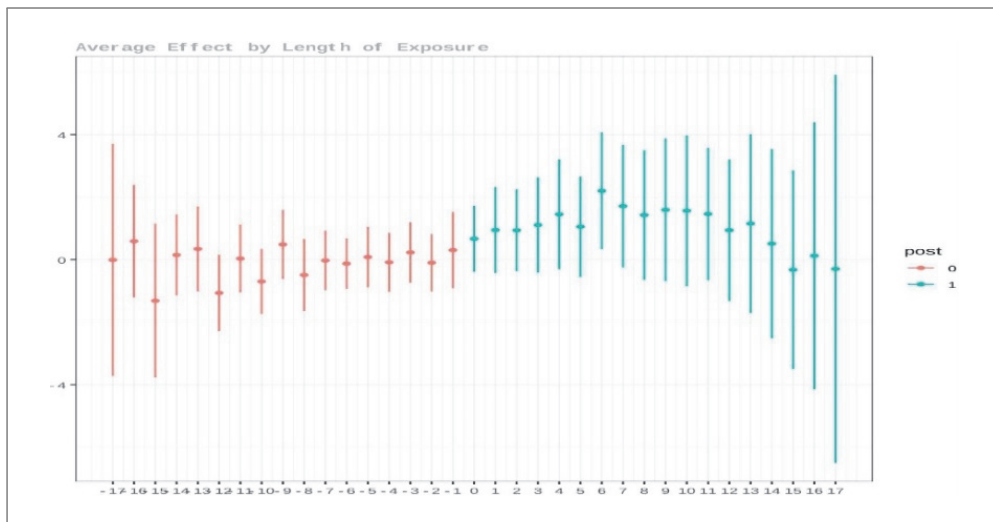
**Table 9\_Effect of R&D Tax Credit on CWPC**

	Overall effect	SD	95% confidence interval	
All Firms	1.197	0.464	0.288	2.107
Large Enterprises	4.603	2.413	-0.126	9.333
SMEs	0.756	0.340	0.090	1.423

Source: Present study.

## B. Dynamic Effect

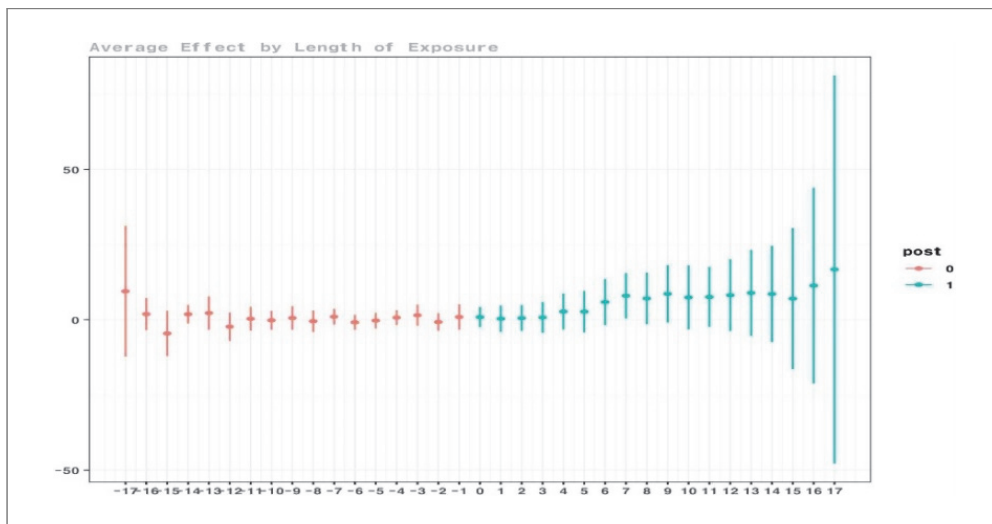
The findings on dynamic effect indicate that the R&D tax credits significantly increased the CWPC of the analyzed firms, only in the 6th year after treatment. As for large enterprises, the findings These findings indicate that the R&D tax credits significantly increased their average CWPC only in the 7th year after treatment. As for SMEs, the R&D tax credit significantly increased their average CWPC only in the 3rd, 4th, and 6th years after treatment. These findings thus suggest that the patents benefiting from R&D tax credits were not cited as much as others, which may imply their low quality.

**Figure 8\_Dynamic Effect on CWPC (all firms)**

Note: Post 0 = yearly difference before treatment, post 1 = yearly difference after treatment.

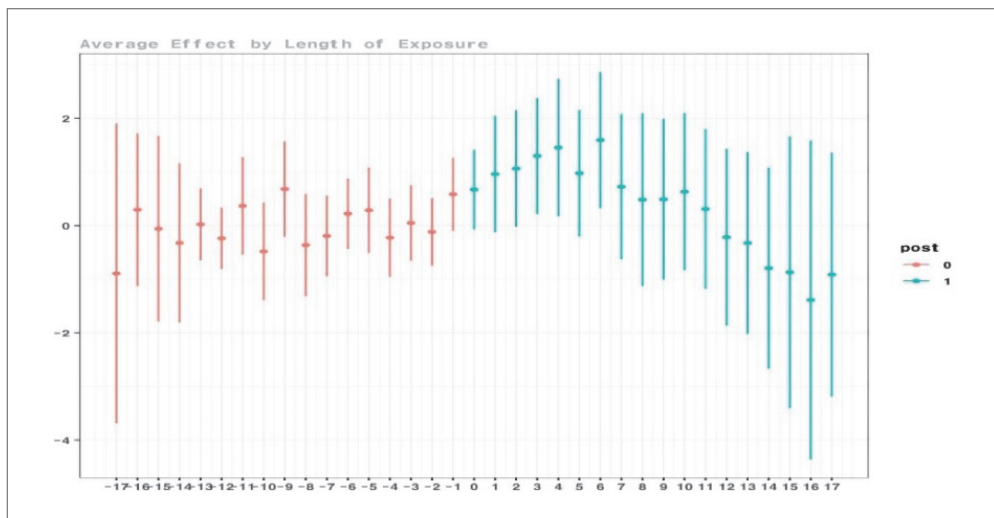
Source: Present study.

Figure 9\_Dynamic Effect on CWPC (large enterprises)



Note: Post 0 = yearly difference before treatment, post 1 = yearly difference after treatment.  
Source: Present study.

Figure 10\_Dynamic Effect on CWPC (SMEs)



Note: Post 0 = yearly difference before treatment, post 1 = yearly difference after treatment.  
Source: Present study.

Table 10\_Dynamic Effect on CWPC

Yearly difference	All enterprises	Large enterprises	SMEs
-17	-0.009	9.509	-0.892
-16	0.591	1.926	0.297
-15	-1.314	-4.498	-0.058
-14	0.150	1.882	-0.324
-13	0.341	2.275	0.024
-12	-1.065	-2.261	-0.237
-11	0.035	0.366	0.368
-10	-0.698	-0.136	-0.480
-9	0.486	0.619	0.682
-8	-0.490	-0.446	-0.363
-7	-0.028	1.039	-0.192
-6	-0.127	-0.818	0.223
-5	0.082	-0.238	0.286
-4	-0.086	0.764	-0.225
-3	0.232	1.546	0.049
-2	-0.100	-0.715	-0.117
-1	0.305	0.959	0.583
0	0.668	0.914	0.673
1	0.948	0.394	0.960
2	0.938	0.611	1.064
3	1.108	0.822	1.299**
4	1.452	2.773	1.455**
5	1.054	2.735	0.976
6	2.199**	5.937	1.594**
7	1.711	8.004**	0.723
8	1.426	7.139	0.484
9	1.592	8.657	0.490
10	1.564	7.488	0.633
11	1.458	7.619	0.310
12	0.941	8.205	-0.217
13	1.153	8.961	-0.325
14	0.511	8.609	-0.793
15	-0.324	7.094	-0.870
16	0.124	11.400	-1.386
17	-0.297	16.782	-0.914

Note: \*\*p<0.05

Source: Present study.

## VI. Conclusion

In this study, we examined differences between firms eligible for R&D tax credits (treatment group) and non-eligible firms (control group) by analyzing their R&D expenses, patent counts, and citation-weighted patent counts (CWPCs). As dependent variables for the effect of policies, we used the patent count, which represents the quantity of knowledge created, and the CWPC, which represents the quality of technological innovation. To analyze the resultant effects, we constructed a dataset for the 2001~2019 period. We combined the data for firms eligible for R&D tax credits, corporate financial data including the information on R&D expenses, and patent data from KIPO. Then, after PSM, we defined the treatment and control groups for further analysis. We relied on a doubly robust estimation to reduce the bias caused by the effect of the likelihood of falling under the treatment group in each year and the effect of the control variables on the dependent variables.

The following paragraphs summarize the overall/dynamic effect of R&D tax credits on R&D expenses, patent counts, and CWPCs.

The findings indicate that R&D tax credits increased the average R&D expenses of the overall enterprises by KRW 340 million. Across different firm sizes, the tax credits increased the R&D expenses of large enterprises by KRW 930 million, and SMEs by KRW 300 million. Given the fact that the average R&D expenses of large enterprises stands at KRW 1,270 million and that of SMEs was KRW 249 million, the tax credits increased the R&D expenses of large enterprises and SMEs by 73% and 136%, respectively. The dynamic effect analysis subsequently found that R&D tax credits steadfastly increased R&D expenses over 16 years. The findings also indicated that R&D tax credits increased the average patent count of the enterprises by 0.52, with large enterprises reporting an average patent count growth of 1.74, and SMEs reporting a growth of 0.36. Given the average patent counts of large enterprises and SMEs (2 and 0.41, respectively), the tax credit increased the average patent counts of large enterprises and SMEs by 87% and 86%, respectively. The analysis of the dynamic effect on patent counts found that the R&D tax credits increased patent counts steadfastly for 14 years after the treatment began.

These findings indicate that the R&D tax credits increased the average CWPCs of the enterprises by 1.2. Even though the R&D tax credits did not significantly affect the average CWPC of large enterprises, the average CWPC of SMEs grew by 0.76. The SMEs reported an average CWPC of 1.8, which indicates that the tax credits increased the average CWPC of SMEs by 38%. As for the dynamic effect of the tax credits, the R&D tax credits significantly

increased their average CWPC only in the 6th year after treatment. No significant effect was found in the other years.

In sum, the R&D tax credits significantly increased R&D expenses, especially the R&D expenses of SMEs. It also significantly increased the number of patents held by companies. However, the size of the effect was not large. Lastly, the R&D tax credits increased the citation-weighted patent counts (CWPCs) of SMEs and large companies. However, the effect was not significant in many of the treatment years.

These findings suggest that the R&D tax credits promote R&D activities. However, while some of the efforts result in patents, their average quality is not particularly high. As such, we can arrive at different conclusions about the effectiveness of the tax credit policies, depending on the purpose of the policies. For instance, if the policies are aimed at promoting R&D activities, we can conclude that they were highly successful. If their purpose is to create and share knowledge and promote technological innovation, we can conclude that they were mildly successful. However, if the purpose is to advance technologies and achieve high-quality technological innovation, it is doubtful that the policies accomplished this purpose.

Policy goals can change, depending on the nation's economic situation. As of 2019, among OECD countries, Korea was 5th in total R&D expenses (USD 76.43 billion), second in R&D expense-GDP ratio (4.64%), and third in R&D expenses per capita. On the other hand, we often hear about the 'Korea R&D paradox,' which refers to Korea's reliance on overseas technologies, lack of patent commercialization, and the absence of significant growth in business performance or economy in general. It is becoming increasingly important to conduct an in-depth review of whether R&D tax credits contribute to this paradox.

It should be noted that this study is limited in a number of respects. First, under the DID model with multiple time periods, an entity in the treatment group can be analyzed only if it continues to remain in the group. As a result, some firms may lose their eligibility.<sup>13</sup> However, in this study, we did not exclude non-eligible firms from the treatment group. This means that our findings on the effect on R&D expenses, patent counts, and CWPCs may have been underestimated. We thus need an approach capable of accurately estimating the effect, taking into account firms who lose their eligibility.

Second, the applicable type of tax credit can vary depending on the calculation method (tax cost or incremental) and the nature of R&D expenses (expenses for new growth/source

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**13** As of October 2021, a total of 75,689 R&D centers/departments were certified. In the same year, 633 (0.8%) lost their certification. The low percentage suggests that the impact of the lost certification is not significant.

technologies). In this study, however, we only considered whether a firm was eligible for R&D tax credits. We thus need to study how the effect changes depending on whether the expenses are calculated in the total costs or increments, or whether the expenses are for new growth or source technologies. We can then analyze the effect of tax credits for new growth and source technologies by focusing on the firms operating in the relevant sector (industry).

Third, we excluded startups from the study in order to remove their effect on the policy effects. In other words, our findings are based on the performance of firms who continued to operate between 2001 and 2019. However, it should be noted that 20-year or older firms do not represent the entire group of businesses. We therefore need follow-up studies that include startups, or to separately estimate the effect of R&D tax credits on startups.

Fourth, some firms in the treatment group may not engage in R&D activities (compliance issues), which suggests that the treatment effect may actually be underestimated. In other words, our findings on the effect on R&D expenses, patent count, and CWPC may have been underestimated. We need to determine how we can accurately overcome the compliance issue and arrive at accurate estimates.

Fifth, we estimated the overall effect of R&D tax credits. However, R&D tax credits change over time. As such, we may be able to analyze the effect of the tax credit policies by focusing on institutional changes.

Sixth, businesses may receive a wide range of benefits other than R&D tax credits. For example, firms can join either government-funded R&D projects or industry-academia projects aimed at technological innovation. However, this study only estimated the effect of R&D tax credits, which means that we cannot rule out the possibility that our findings were affected by other policies. As such, we need to develop a tool to conduct a comprehensive analysis of policies designed to promote technological innovation.

Seventh, in this study, we analyzed the effect of R&D tax credits on technological innovation. We also need to examine the further effect on human capital development and education/training.

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# Supply of Public Rental Housing in Neighborhoods: Effects on Consumption and Population Composition

Changsu Ko, Jinsoo Bae, and HeePyung Cho\*

## I . Introduction

Housing is generally considered one of the most important factors in citizens' lives. As such, a government should do its best to protect its people's right to housing. In particular, as it is extremely difficult to protect the housing rights of low-income and vulnerable groups using private sector housing alone, many governments supply government-funded 'public rental housing.' According to the Ministry of Land, Infrastructure, and Transport (MOLIT), the Korean government has made a number of steadfast efforts to protect the people's right to housing. For example, the share of public rental housing had long been below the OECD average of 8%. However, the government managed to raise the ratio to 7.6% in 2019. According to the government's comprehensive medium and long-term housing welfare plan announced in 2020, the government plans to further increase the supply of public rental housing, with the goal of reaching 10% by 2025.<sup>1,2</sup>

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- 1 Ministry of Land, Infrastructure, and Transport, "Housing Welfare 2.0 Changes People's Lives, and Works with Communities and Residents," Press Release, March 20, 2020, [https://www.molit.go.kr/USR/NEWS/m\\_71/dtl.jsp?cmspage=1&cid=95083693](https://www.molit.go.kr/USR/NEWS/m_71/dtl.jsp?cmspage=1&cid=95083693) (accessed on October 21, 2021)
- 2 As this study is focused on public rental housing, the term 'rental housing' used in this article refers to 'public rental housing'.

A steadfast supply of public rental housing requires housing policies that are acceptable to local residents. However, media outlets have reported that residents living in the vicinity of public rental housing project sites are none too pleased with these projects. One of the reasons for a negative perception toward public rental housing coming to their neighborhoods is the concern that such projects may drive down housing prices and rent, and boost the crime rate in the neighborhood.<sup>3</sup>

To address these concerns, we need to understand if and how the supply of public rental housing negatively affects a neighborhood. Then, regardless of whether adverse effect exists, if local residents report a negative perception toward public rental housing, policy makers need to design policies that are more acceptable to them. To this end, one way to achieve a higher level of acceptance is to reduce the density of public rental housing units. Supplying rental housing units in small numbers across different areas could be more conducive to alleviating negative reactions than simply supplying a large number of units in a certain area. In fact, one can expect that most of the perceived negative effect of public rental housing can be addressed by lowering the density of public rental housing.

Among the many types of rental housing supplied by the public sector, 'buy-to-rent housing' is expected to show the lowest density. In most buy-to-rent housing projects, the project operator such as the Korean Land and Housing Corporation (LH) purchases existing housing units and supplies them to people in need.<sup>4</sup> As such, buy-to-rent housing projects do not involve much in terms of perceivable changes in the neighborhood as build-to-rent housing projects, in which housing units are provided through new construction projects. Therefore, buy-to-rent projects are likely to be deemed more acceptable for local residents. One could also expect that, in buy-to-rent housing projects, the beneficiaries of the projects (i.e., low-income households) are less concentrated than in build-to-rent housing projects, which means that there is a lower risk of slumification and residents may be less concerned about the policy.<sup>5</sup> However, in reality, many residents do not seem to welcome the expansion

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**3** *Chosun Biz*, "Protests from Local Residents Bring the Youth Housing Program to a Halt... 'The Government's Hasty Implementation Contributed to this Predicament,'" [https://biz.chosun.com/site/data/html\\_dir/2020/01/13/2020011301884.html](https://biz.chosun.com/site/data/html_dir/2020/01/13/2020011301884.html) (accessed on March 3, 2021)

**4** This paragraph relied on the following news report. *Sisain*, "'Buy-to-rent Houses' Attracts Attention Amid the Shortage of Deposit-based Rental Housing," December 15, 2020, <https://www.sisain.co.kr/news/articleView.html?idxno=43377> (accessed on March 3, 2021)

**5** However, in some cases, buy-to-rent housing units may be concentrated in a certain area, which may lead to concerns about slumification. See pp. 130 and 142 of the following report for a discussion of the issue.

of buy-to-rent housing. For example, in 2018, residents in Gangseo-gu, Gangbuk-gu, Seongbuk-gu, Jungnang-gu, Yangcheon-gu, and Dobong-gu in Seoul, Korea protested against the purchase of existing units for buy-to-rent projects by the Seoul Housing & Communities Corporation (SH).<sup>6</sup>

The purpose of this study can be summarized as follows. First, this study seeks to analyze the economic impact of buy-to-rent housing on a neighborhood. As mentioned above, buy-to-rent housing typically has the lowest density among the different types of public rental housing. As such, an empirical analysis of its negative impact on the economy may provide significant policy implications. For example, if a negative impact does indeed exist, policy makers can consider increasing the acceptability of buy-to-rent housing by supplying facilities preferred by residents in the project areas. If such negative impact does not exist, the government may need to implement public relations campaigns designed to increase the acceptability of the project.

Second, this study compares the effect of build-to-rent housing on the neighborhood with the effect of build-to-rent housing to see if the existence and extent of the negative impact of public rental housing varies depending on the type of housing. If the economic impact varies depending on the density and other characteristics of public rental housing, policy makers need to develop housing supply plans that take into account such heterogeneity and then design the relevant policies in a way that minimizes such impact on, and improves policy acceptability for, local residents living in the neighborhood.

It should be noted that the supply of rental housing to low-income groups is likely to remain one of the key policy agendas for the Korean government. As such, this situation warrants a continuous stream of policy studies on the pros and cons of different types of public rental housing projects. This study seeks to contribute to these efforts by analyzing the heterogeneous effect of different public rental housing types. We hope that the findings of this study will then provide reference points for public rental housing policies aimed at increasing their acceptability, while also pursuing the inherent goal of improving housing welfare.

Compared to previous literature, this study contributes to the discussion on the issue by strictly controlling the endogeneity that may arise in the course of estimating the

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6 *Hankyoreh*, “Public Rental Housing Programs for Low Income Earners Fail to Scale the ‘Wall of Reality’,” October 18, 2018, <https://www.hani.co.kr/arti/opinion/editorial/866453.html> (accessed on February 21, 2022)

economic effect of public rental housing on a neighborhood.<sup>7</sup> The empirical analysis presented in this study includes data from both before and after the supply of public rental housing. In particular, the analysis uses narrowly defined geographical units, each comprising merely around 150 financially active members of the population. This reliance on such small geographical units offers considerable benefits. We can expect that the public rental housing project sites are selected based on consideration of the economic conditions in different candidate areas. For example, in buy-to-rent housing projects in which the project operator purchases existing housing units, the purchase price would be one of the key considerations that go into planning the housing supply. The purchase price naturally reflects the economic conditions of the area in which the housing units are located. Next, we can expect that the area in which rental housing units are supplied poses different trends of economic conditions relative to the other areas. An empirical study that does not control for these different trends is very likely to produce biased results. Using small geographical units, this study ensures that it compares the areas where rental housing units are supplied with other areas that have similar economic characteristics, thereby minimizing the likelihood of bias. For the purpose of this analysis, we defined the area within a 500 m radius from a public rental housing project site as the treatment group that can be affected by the project, and the area between a 500 m radius and a 1,000 m radius as the control group.

In this study, we are interested in two key variables: the average consumption levels of residents aged between their 20s and 50s, and the shares of the same age group in the total sample population. The consumption level reflects changes in economic conditions caused by the population inflow and outflow almost instantaneously, which serves as a great advantage for this study, which analyzes changes in a relatively short time series. Consumption levels are affected by the age composition of the local population as well as socioeconomic variables, including income levels. To control for the age effect, we used the average consumption level of residents in their 20s and 50s as one of the variables. We also separately analyzed the share of residents between their 20s and 50s in each area, in order to draw implications of changes in age composition.<sup>8</sup>

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<sup>7</sup> Some of the previous studies are summarized in Chapter II.

<sup>8</sup> The ‘population’ included in the data analyzed in this study mostly refers to the financially active population. As such, when describing the analyzed data and the findings of this study, we use the term to refer to the financially active population, not the total population.

The findings of this analysis can be summarized as follows. The supply of new buy-to-rent housing did not have a statistically significant effect on the share of population aged between their 20s and 50s and their income levels. On the other hand, the supply of build-to-rent housing was estimated to have had a negative impact on the average consumption level and the share of the population aged between their 20s and 50s in the area affected by the projects. The size of the estimated effect increased with the proximity between the project site and the affected area. The difference in the estimated effect of buy-to-rent housing and build-to-rent housing was at least partially attributable to the difference in the number of public housing units supplied in an area, which is the density of the housing units.

These findings have the following implications for policy makers. The failure to detect any negative effect caused by buy-to-rent housing suggests the need for PR efforts that are designed to help people understand that the negative effect of public rental housing can be minimized by lowering their density, thereby alleviating their negative perception toward public rental housing projects.

The high correlation between the size of the effect and the density of public housing means that policy makers need to consider keeping the density of public housing units as low as possible in their housing supply plans. However, it should also be noted that keeping the public housing density low may be less favorable than the high-density option in terms of land purchase and construction expenses. Considering common budget constraints, the low-density option may mean that a lower number of public rental housing units can be supplied. Ultimately, we need to keep looking for an optimal scale of public housing projects—based on the available budget and the density of housing units. If a low-density option is not available, the acceptability of the high-density option can be improved by supplying amenities preferred by local residents along with housing, and which is supported by proactive PR campaigns.

This study consists of the following chapters. Chapter II provides an overview of public rental housing policies in Korea, as well as a summarized list of previous studies that touch on the same issue. Chapter III describes the data used for the empirical analysis, and Chapter IV presents the findings. Chapter V provides the conclusion.

## II . Public Rental Housing Policies in Korea and Previous Literature

### 1. Public Rental Housing Policies in Korea

This section provides a brief overview of public rental housing policies in Korea. In legal terms, ‘rental housing’ can be categorized into public rental housing and private rental housing, which are respectively governed by the Special Act on Public Housing and the Special Act on Private Rental Housing.<sup>9,10,11</sup> According to Article 2 of the Special Act on Public Housing, public housing consists of public rental housing and public housing for sale. Public rental housing is then further divided into public build-to-rent housing and public buy-to-rent housing.<sup>12</sup> Public rental housing can be defined as housing supplied by an entity specified in Article 4 of the Act, with financial support provided by the central or local government or the Housing and Urban Fund for the purpose of renting them the housing unit or selling them the unit after the rental terms are completed.<sup>13</sup> Build-to-rent housing refers to rental housing built and supplied by a public housing project operator appointed under Article 4, and buy-to-rent housing is rental housing acquired (through purchase, etc.) and supplied by the same operator. Figure 1 summarizes the descriptions above.

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**9** This paragraph relied on City Planning Standing Team, Planning Division, Seoul Metropolitan City (2016).

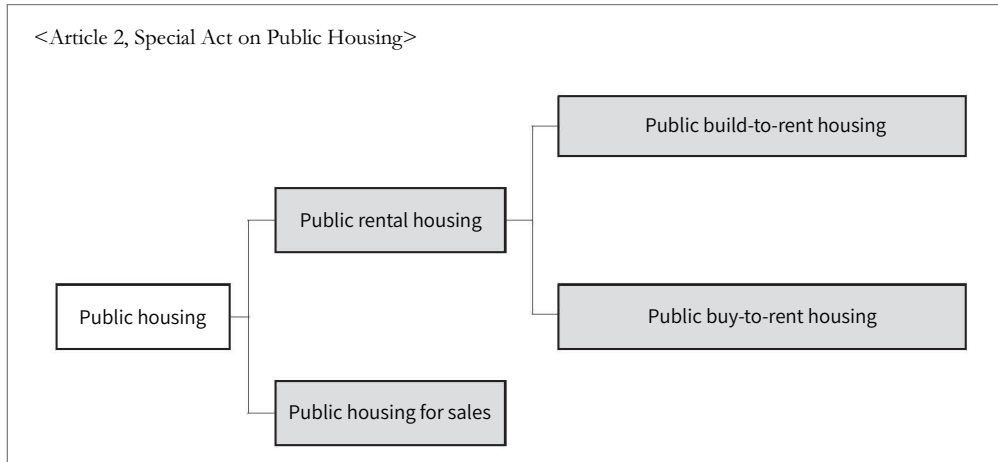
**10** National Law Information Center, Special Act on Public Housing, <https://www.law.go.kr/%EB%B2%95%EB%A0%B9/%EA%B3%B5%EA%B3%B5%EC%A3%BC%ED%83%9D%ED%8A%B9%EB%B3%84%EB%B2%95>, enforced on February 9, 2021 (accessed on March 1, 2021)

**11** National Law Information Center, Special Act on Private Rental Housing (Private Rental Housing Act), <https://www.law.go.kr/%EB%B2%95%EB%A0%B9/%EB%AF%BC%EA%B0%84%EC%9E%84%EB%8C%80%EC%A3%BC%ED%83%9D%EC%97%90%EA%B4%80%ED%95%9C%ED%8A%B9%EB%B3%84%EB%B2%95>, enforced on December 22, 2020 (accessed on March 1, 2021)

**12** As this study focuses on public rental housing, the term ‘rental housing’ refers to public rental housing, unless specified otherwise. For the same reason, ‘build-to-rent housing’ denoted ‘public build-to-rent housing,’ and ‘build-to-rent housing’ denotes ‘public build-to-rent housing.’

**13** Public housing project operators can include public organizations and corporations including the central government, local governments, LH, regional LH offices, Korea Rural Community Corporation (KRC), Korea Railroad Corporation (Korail), Korea National Railway (KR), Government Employee Pension Service (GEPS), Jeju Free International City Development Center (JDC), and Korea Housing and Urban Guarantee (HUG), and private businesses including corporations where the public sector invested in more than 50% of its equities, or corporations where the public sector all of the equities (Ministry of Land, Infrastructure, and Transport, 2020)

Figure 1\_Public Housing Structure



Source: Ministry of Land, Infrastructure, and Transport (2020), p. 212.

The following paragraphs briefly lists the types of public rental housing based on MOLIT (2020).<sup>14</sup> Table 1 lists the types of public housing under the Enforcement Decree of the Special Act on Public Housing and the Housing Act.<sup>15</sup> According to the relevant laws, there are seven types of public rental housing: Permanent Rental Housing, National Rental Housing, Happiness Housing, Long-term Rental Housing, Public Rental-to-sale Housing, Buy-to-Rent Housing, and Rent-to-Rent Housing.<sup>16</sup>

<sup>14</sup> Ministry of Land, Industry and Transport, 2020 Housing, *2020 Housing Services Manual*, [http://www.molit.go.kr/USR/policyData/m\\_34681/dtl.jsp?search=&srch\\_dept\\_nm=&srch\\_dept\\_id=&srch\\_usr\\_nm=&srch\\_usr\\_titl=Y&srch\\_usr\\_cntn=&search\\_regdate\\_s=&search\\_regdate\\_e=&psize=10&scategory=&p\\_category=&dcmspage=1&id=4475](http://www.molit.go.kr/USR/policyData/m_34681/dtl.jsp?search=&srch_dept_nm=&srch_dept_id=&srch_usr_nm=&srch_usr_titl=Y&srch_usr_cntn=&search_regdate_s=&search_regdate_e=&psize=10&scategory=&p_category=&dcmspage=1&id=4475) (accessed on March 1, 2021)

<sup>15</sup> National Law Information Center, Enforcement Decree of Special Act on Public Housing, <https://www.law.go.kr/%EB%B2%95%EB%A0%B9/%EA%B3%B5%EA%B3%B5%EC%A3%BC%ED%83%9D%ED%8A%B9%EB%B3%84%EB%B2%95%EC%8B%9C%ED%96%89%EB%A0%B9> (accessed on March 1, 2021)

<sup>16</sup> The terms for public rental housing types were translated from the Korean terms: 영구임대주택 (Permanent Rental Housing), 국민임대주택 (National Rental Housing), 행복주택 (Happiness Housing), 장기전세주택 (Long-term Rental Housing), 분양전환 공공임대주택 (Public Rental-to-sale Housing), 기존주택 매입 임대주택 (Buy-to-Rent Housing), and 기존주택 전세임대주택 (Rent-to-Rent Housing).

**Table 1\_ Types of Public Rental Housing**

Category		Description
Public rental housing	Permanent rental housing	Public rental housing supplied for 50-year or longer or permanent residence to provide secure housing to lowest-income groups, under Article 2 (1) 1 of the Enforcement Decree of Special Act on Public Housing
	National rental housing	Public rental housing supplied for 30-year or longer or permanent residence under Article 2 (1) 2 of the Enforcement Decree of Special Act on Public Housing
	Happiness housing	Public rental housing supplied to secure housing for university students, young people starting their career, and newlywed couples under Article 2 (1) 3 of the Enforcement Decree of Special Act on Public Housing
	Long-term Rental Housing	Public rental housing supplied under <i>jeonse</i> (deposit-based rental) under Article 2 (1) 4 of the Enforcement Decree of Special Act on Public Housing
	Public Rental-to-sale Housing	Public rental housing supplied for the purpose of selling them after a certain period of rental under Article 2 (1) 5 of the Enforcement Decree of Special Act on Public Housing
	Buy-to-Rent Housing	Existing housing units purchased and supplied as public rental housing to low-income earners, young adults, and newlywed couples under Article 2 (1) 6 of the Enforcement Decree of Special Act on Public Housing
	Rent-to-Rent Housing	Existing housing units rented and supplied as public rental housing to low-income earners, young adults, and newlywed couples under Article 2 (1) 7 of the Enforcement Decree of Special Act on Public Housing
Public Housing for Sale		Public housing supplied for sale, of which size is equivalent to, or less than, the National Housing under Article 2, subparagraph 5 of the Housing Act

Source: MOLIT (2020), p. 212.

Based on the press release announced by MOLIT, Table 2 shows the number of housing units built over the last five years by housing type. The annual number of units supplied increased from 125,000 in 2016 to 150,000 in 2020. Of the three main types (build-to-rent, buy-to-rent, and rent-to-rent housing), build-to-rent housing recorded around 70,000 units per year. Among the build-to-rent housing types, the yearly supply of happiness housing increased particularly fast, whereas the other build-to-rent housing types recorded similar or lower supplies year over year. The yearly supply of happiness housing has continued to increase, and as of 2020 currently comprises around 35% of all build-to-rent housing units.

**Table 2\_No. of Public Rental Housing Units Supplied By Type(completed units, 2016~2020)**

(Unit: 10,000 units)

Year	Total	Build-to-rent					Buy-to-rent	Joense Rental
		Sub-total	National Rental	Happiness Housing	Permanent Rental	Rent-to-sale Housing, etc.		
2016 <sup>17</sup>	12.5	7.0	3.1	0.4	0.3	3.2	1.2	4.3
2017 <sup>18</sup>	12.7	7.0	1.9	1.2	0.3	3.6	1.4	4.3
2018 <sup>19</sup>	14.8	7.0	Press release not included				1.9	5.9
2019 <sup>20</sup>	13.9	6.0	0.85	2.4	0.25	2.5	3.1	4.8
2020 <sup>21</sup>	15.0	7.2	2.26	2.5	0.37	2.09	2.8	5.0

Note: Derived from the MOLIT press release.

The supply of buy-to-rent and rent-to-rent housing generally increased between 2016 and 2020, from 12,000 units to 28,000 and from 43,000 to 50,000, respectively. The total supply of public rental housing increased by 25,000 units over the last five years, of which build-to-rent housing took up 8% (2,000 units), buy-to-rent housing was 64% (16,000 units), and rent-to-rent was 28% (7,000 units). The percentage of buy-to-rent housing increased at a fast pace.

Given the supply plans going forward, the percentage is expected to grow even further. The rental housing supply plan announced in 2021 includes a supply of 70,000 built-to-rent housing units, 36,000 buy-to-rent housing units, and 40,000 rent-to-rent units in 2021, and

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- 17** Ministry of Land, Infrastructure, and Transport, “Public Rental Housing Supply Hit a New Record High in 2016 at 125,000 Units,” Press Release, January 3, 2017, [https://www.molit.go.kr/USR/NEWS/m\\_71/dtl.jsp?id=95078688](https://www.molit.go.kr/USR/NEWS/m_71/dtl.jsp?id=95078688) (accessed on March 2, 2021)
- 18** Ministry of Land, Infrastructure, and Transport, “127,000 Public Rental Housing Units Supplied in 2017, Exceeding the Target By 7,000 Units,” Press Release, January 2, 2018, [http://www.molit.go.kr/USR/NEWS/m\\_71/dtl.jsp?lcmspan=1&id=95080169](http://www.molit.go.kr/USR/NEWS/m_71/dtl.jsp?lcmspan=1&id=95080169) (accessed on March 2, 2021)
- 19** Ministry of Land, Infrastructure, and Transport, “148,000 Public Rental Housing Units Supplied in 2018, Exceeding the Target By 18,000 Units,” Press Release, January 31, 2019, [http://www.molit.go.kr/USR/NEWS/m\\_71/dtl.jsp?lcmspan=1&id=95081885](http://www.molit.go.kr/USR/NEWS/m_71/dtl.jsp?lcmspan=1&id=95081885) (accessed on March 2, 2021)
- 20** Ministry of Land, Infrastructure, and Transport, “139,000 Public Rental Housing Units Supplied in 2019, Exceeding the Target By 3,000 Units,” Press Release, February 2, 2020, [http://www.molit.go.kr/USR/NEWS/m\\_71/dtl.jsp?lcmspan=1&id=95083495](http://www.molit.go.kr/USR/NEWS/m_71/dtl.jsp?lcmspan=1&id=95083495) (accessed on March 2, 2021)
- 21** Ministry of Land, Infrastructure, and Transport, “150,000 Public Rental Housing Units Supplied in 2020, Exceeding the Target By 9,000 Units,” Press Release, February 2, 2021, [https://www.molit.go.kr/USR/NEWS/m\\_71/dtl.jsp?lcmspan=1&id=95085138](https://www.molit.go.kr/USR/NEWS/m_71/dtl.jsp?lcmspan=1&id=95085138) (accessed on March 2, 2021)

70,000, 37,000, and 41,000 units of the same housing types in 2022.<sup>22</sup> Given the outcomes to date, the plan indicates that the supply of build-to-rent housing will mostly remain the same, whereas the percentage of buy-to-rent housing will increase and that of rent-to-rent housing will decline.

## 2. Previous Literature

This section briefly overviews previous studies in and outside of Korea. Many of the studies analyzing the impact of public rental housing on surrounding areas focus on housing prices (including *jeonse* prices) in the areas. They mostly focus on testing the hypothesis that the supply of public rental housing causes the concentration of low-income earners to increase, which may cause a negative perception in the neighborhood and ultimately drive down housing prices. However, given the diversity of the types and scale of public rental housing projects and the characteristics of different project sites and the neighborhood, it is difficult to reach a clear conclusion regarding whether the supply of public rental housing negatively affects housing prices in a neighborhood.

A number of previous studies examined the effect of public rental housing on sales prices. Park and Kim (2009) used a multiple regression model to analyze the asking price per square meter in housing complexes within or near a 600 m radius from a National Rental Housing Complex, and found that the price was significantly lower. However, they pointed out that this finding may have been caused by differences in housing characteristics. Hong and Lee (2006) also used a multiple regression model to show that, for housing units in the vicinity of public rental housing, sales prices increased with proximity to the rental housing. For housing units remotely located from the rental housing, they found a negative(-) effect that was not statistically significant. Ko and Lee (2017) used the difference-in-difference (DID) method to analyze the effect of happiness housing on the prices of housing in the neighborhood. They found that the existence of happiness housing raised the apartment house prices in the adjacent areas to over the apartment house prices in the outer areas, and the extent of the increase declined with the distance from the happiness housing units.<sup>23</sup>

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<sup>22</sup> Ministry of Land, Infrastructure and Transport, “[Explanation] The Federation of Korean Industries Claim That 85% of the Long-Term Public Rental Housing Supplied by this Administration Are Fake, But It Is Not True,” Press Release, February 26, 2021, [http://www.molit.go.kr/USR/NEWS/m\\_71/dtl.jsp?id=95085235&src=text&kw=000004](http://www.molit.go.kr/USR/NEWS/m_71/dtl.jsp?id=95085235&src=text&kw=000004) (accessed on March 2, 2021)

<sup>23</sup> Apartment houses within 250 m from happiness housing were 6.5% more expensive than those in the outer area, and those within 500 m were 4.3% more expensive.

Other researchers analyzed the effect of public rental housing on *jeonse* (deposit-based rent) prices. Yang (2017) used the difference-in-difference method to analyze the effect of long-term rental housing in Seoul (called SHIFT) on the *jeonse* prices in nearby apartment units. Based on their findings, it was argued that while the supply of long-term rental housing had the effect of lowering *jeonse* prices in the neighborhood, the public housing project may improve the general living environment in the areas adjacent to the project site, which may serve as a deterrent against price decline. Lee and Park (2016) used panel data from 25 *gus* (regions) in Seoul to analyze how the percentage of public rental housing<sup>24</sup> affected housing prices and *jeonse* prices. The analysis showed that, while an increase in the percentage of public rental housing is seen to negatively affect the growth of *jeonse* prices, it positively affected the growth of sales prices.

Given the findings of these studies, it is difficult to conclude that the supply of public rental housing will negatively affect sales prices and *jeonse* prices in a neighborhood. This lack of clarity may stem from differences in the targets of the analysis, data used, analysis period, and study methods among these studies, and also suggests the need for more studies in order to comprehensively understand the effect of public rental housing projects on a neighborhood.

Many researchers outside of Korea have highlighted the effect of public housing projects on sales prices, and they too present widely varying conclusions, depending on the target and the method of analysis. Landau (2018) analyzed block group data from 12 cities in the United States<sup>25</sup> using the fixed effect model, and found that housing prices decline with the distance from public housing, while housing units were cheaper when they were farther away from downtown commercial districts. Bradlow et al. (2018) used data from the South African Republic and the difference-in-difference (DID) method to prove that sales prices within a 400 m radius from public housing declined by 16% relative to the control group, and this trend persisted for three years. Goujard (2011) analyzed the effect of ‘social housing’ projects in Paris, France on the housing prices in a neighborhood. According to their analysis, a 10%p increase in the percentage of social housing raised the housing prices within 50 m from the social housing units, but drove prices down for housing units between a 350 m and 500 m radius from the project site.

As mentioned above, these studies attempted to test the hypothesis that the supply of public

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<sup>24</sup> Specifically, the percentage of long-term rental housing in stock with a mandatory rental period of ten or more years.

<sup>25</sup> A single block group had a population between 600 and 3,000.

rental housing increases the concentration of low-income earners, which may cause a negative perception in the neighborhood and drive down housing prices. However, the housing price decline is closer to a secondary effect caused by negative perceptions, and that the body of work is still lacking in terms of the issue of how the supply of public housing negatively affects the vicinity. This lack of academic attention may partially come from the fact that the effects widely attributed to public housing (e.g., undermined image of the local area, negative effect on the educational premium of the area, effect on public safety, etc.) are difficult to quantify or that researchers lack the data required to analyze those perceived effects in full.

Despite this difficulty, many researchers have studied the effect of public housing supply on variables other than housing prices. Sandler (2017) used the difference-in-difference method to analyze the effect of the removal of public housing between 1995 and 2010 on the crime rate of a neighborhood. The analysis found that the removal lowered the crime rates in the areas (within a 1/4 mile radius) by 8.8% relative to the control group. Bruhn (2018) took a similar approach to perform a time series analysis on the removal of public housing and the crime rate in Chicago. However, he arrived at a contrasting conclusion, and found that the crime rate in the city increased by 0.5%. Tach and Emory (2017) analyzed the effect of the HOPE VI Program, which involved the redevelopment of deteriorated public housing, on the poverty rate and racial mix in the target neighborhoods and adjacent areas. Their findings indicated a 10%p decline in the poverty rate in the target areas, which exceeded the decline of poverty rate in the control group that did not benefit from the program. This particular study is similar to this study in that it analyzed the effect of public housing redevelopment on the poverty rate, which represents the economic situation in the area being analyzed.

The following paragraphs review studies focusing on specific types of public rental housing. The recent diversification of public rental housing and the continued growth of buy-to-rent housing has resulted in an increase in studies analyzing the effect of these changes on neighborhoods. Particularly relevant to this study are those focusing on the economic effect of buy-to-rent housing on a neighborhood. This study analyzes the consumption level and income as dependent variables. We were not able to find any study on the consumption level or income, two studies analyzed the effect on *jeonse* prices. Lee and Koo (2008) used a multiple regression method based on the hedonic price model to analyze how the supply of multi-household buy-to-rent housing affects the perception of residents in the neighborhood and the *jeonse* prices therein. The findings confirmed that *jeonse* prices declined with proximity to the buy-to-rent housing units by around KRW 90,000 per meter. Their study is significant because it reported the negative effect of distance from buy-to-rent housing, even in close

proximity. However, they did not analyze the effect of newly supplied housing on *jeonse* prices. Rather, they only analyzed the relationship between *jeonse* prices and existing buy-to-rent housing. The choice of location for multi-household buy-to-rent housing units may have been restricted by budget constraints, which would have forced the project operator to purchase the cheapest multi-household housing units in the neighborhood. As such, the price decline reported by Lee and Koo could have been caused by unobserved characteristics such as noise and air quality. We believe that their findings can be supplemented by using an analysis of changes in the supply of buy-to-rent housing based on panel data constructed on a local level.

Park and Park (2014) analyzed the effect of build-to-rent, buy-to-rent, and rent-to-rent public rental housing on the *jeonse* prices of apartment units measuring 85 m<sup>2</sup> or smaller. They used a fixed effect model and control variables, including the supply volume of rental housing on the *si/gun/gu* level, the supply of other residential buildings, and the interest rate to estimate the effect of rental housing. However, their findings did not indicate any statistically significant effect. Given the fact that their study analyzed the effect of rental housing on the *si/gun/gu* level, Park and Park's study seemed to focus more on the effect of rental housing supply on *jeonse* prices rather than economic changes in the neighborhood brought on by the supply of buy-to-rent housing. In particular, the focus of their study somewhat diverges from that of this study because they analyzed the prices of apartment units, which are not the closest substitute for buy-to-rent housing.

### III. Data and Summary Statistics

#### 1. Data

##### A. Overview

In this study, we defined the treatment group as areas located in the vicinity of public rental housing project sites and thus were highly affected by the supply of the public rental housing. Then, we defined the control group as areas that are also located in the vicinity of the project sites and share various similarities, though were less—or not—affected by the supply of the rental housing. We constructed various variables for areas comprising each group, and sought to use statistical methods to identify differences in the consumption level and age composition between the two groups after the supply of public rental housing.

Such an analysis requires two types of data. First, we need data on the supply of public

rental housing, including detailed location information. In particular, the data must include the timing and location of the rental housing supply, because we need to compare the situation before and after the supply of rental housing (event), and distinguish between the treatment group and the control group based on the location of the rental housing project.

Public rental housing is mostly supplied by LH and regional housing corporations operating under local governments, such as SH. We obtained data pertaining to rental housing supply projects by requesting the relevant data from the rental housing suppliers at the Public Data Portal and the Open Data Portal.<sup>26,27</sup> We also needed data pertaining to consumption level and population composition, which reflect the economic situation in each area. For this study, we constructed the data regarding the area-specific consumption level and population composition using the K-Atlas data purchased from Real Estate 114.<sup>28,29</sup> Figure 2 shows the structure of the atlas data. In the figure, Banpo Xi Apartment in Seocho-gu, Seoul is highlighted, along with the annual income level and monthly credit card consumption in the selected area. The selected area is indicated by the white background, and surrounded by other areas with names starting with letter A. The areas indicated in the figure comprise a K block, which is the main unit of empirical analysis used in this study.

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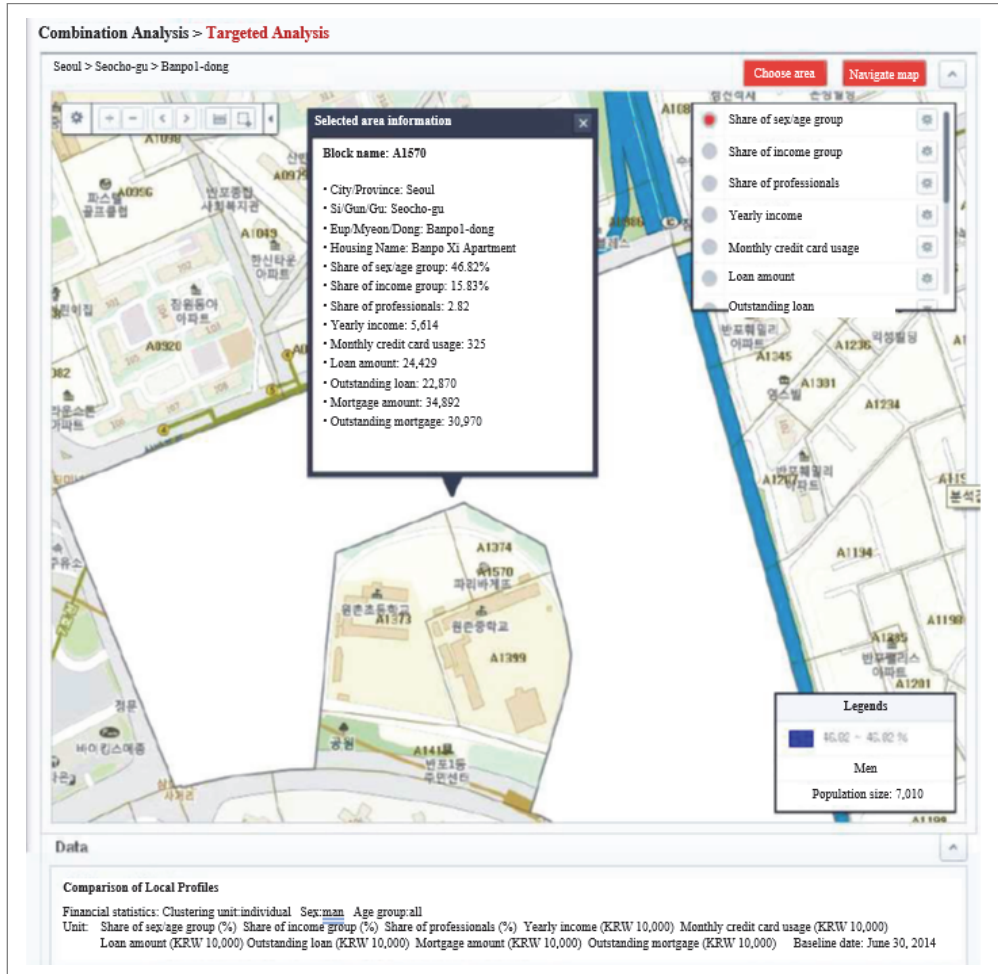
<sup>26</sup> Public Data Portal, <https://www.data.go.kr/> (accessed on March 9, 2021)

<sup>27</sup> Open Information Portal, <https://www.open.go.kr/> (accessed on April 13, 2021)

<sup>28</sup> <http://image.r114.co.kr/images/%EC%86%8C%EA%B0%9C.pdf> (accessed on March 3, 2021)

<sup>29</sup> K-Atlas data are based on the data from the Korea Credit Bureau (KCB).

Figure 2\_Composition of K-Atlas Data



Source: K-Atlas Introduction<sup>30</sup> 11p.

K blocks are defined in a way such that each block does not contain a too great or too minimal population, while also considering the road system and other geological features. An apartment complex comprises a single K block, regardless of the population.

<sup>30</sup> <http://image.r114.co.kr/images/%EC%86%8C%EA%B0%9C.pdf> (accessed on March 3, 2021)

Information such as consumption level and estimated income in a K block can be compiled for the population living and working in the block. In addition, information can be compiled for specific age groups (e.g., younger than 20, 20s, 30s, 40s, 50s, and 60s or older) and occupations (e.g., self-employed, wage earner, etc.). The data also include the percentage of each age group in the total (sample) population in a K block, which means that we can identify changes in the age composition as well. However, as obtaining data from each K block requires a substantial amount of time, we used information pertaining to the total resident population and residents aged between their 20s and 50s.

The monthly credit card consumption level, which we used as one of the main variables in this study, was compiled based on the individual usage data from all credit card companies in Korea. As such, no adjustment was made to the data obtained from the data providers. On the other hand, the income level data were adjusted by the data providers based on the annual income data registered by the financial companies, along with the income estimated based on occupation, age, and credit card usage.<sup>31</sup>

While the K-Atlas data include monthly data, they only provide the data at five time points: baseline time point (varies depending on the time of access), six months from the baseline, a year from the baseline, two years before the baseline, and three years before the baseline. For this reason, it is difficult to build continuous time series data, which is one of the limitations of the K-Atlas data.

## B. Data Construction

We constructed the data used in this study by combining the rental housing data and the K-Atlas data. We confined the areas of analysis to Gyeonggi-do and Daegu Metropolitan City (Daegu), which is justified by the following reasons. We need to match the rental housing project sites and K blocks to construct the data. However, the K-Atlas data did not include geographical information such as the latitude, longitude, and center point of each K block. As such, we had to manually identify the geographical information of each K block and then match them with the addresses of the rental housing units, which required a large amount of time. Given the limited study schedule, we thus needed to restrict the areas of the analysis.

We chose Gyeonggi-do and Daegu because: (1) detailed data on public rental housing

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<sup>31</sup> <http://www.k-atlas.co.kr> (accessed on March 3, 2021)

supplied by LH and regional corporations were available for these areas<sup>32</sup>; (2) the significance of public rental housing is accentuated in urban areas with a higher population density; and (3) Gyeonggi-do and Daegu consist of heterogeneous areas in terms of level of urbanization and housing site development, which allows for a more diversified analysis.

We used the data between November 2017 and May 2020. On account of the limitations described above, at the time of writing this article, we were able to construct the K-Atlas data only at the following time points: November 2017, December 2017, January 2018, November 2018, December 2018, January 2019, November 2019, December 2019, January 2020, May 2020, June 2020, July 2020, November 2020, December 2020, and January 2021. We ultimately excluded the data after (and not including) May 2020, because the data pertaining to the rental housing supply and location were not available.

## 2. Summary Statistics

### A. Summary Statistics on Rental Housing Supply

This section describes the summary statistics on the supply of public rental housing. Specifically, we present the summary statistics for three suppliers: LH, Gyeonggi Housing & Urban Development Corporation (GH), and Daegu Urban Corporation (DUCO) for the years 2017, 2018, and 2019.

Table 3 shows the number of buy-to-rent housing units purchased and the number of build-to-rent housing units supplied in the three years. The data indicate that LH purchased far more buy-to-rent housing units than the regional housing corporations. The supply of buy-to-rent housing is seen to increase, with LH leading the surge in 2019. In Gyeonggi-do, the number of buy-to-rent housing units supplied by LH increased more than 1.5 times between 2018 and 2019, from 3,800 units to 6,500 units. As for build-to-rent housing, though it still comprised a higher percentage than buy-to-rent housing, the number of build-to-rent housing units supplied by LH somewhat declined over the last three years of this study. Another distinguishing feature of build-to-rent housing is the relatively small number of units supplied by the regional housing corporations. This gap may be attributable to the fact that the regional housing corporations lack the financial resources to cover build-to-rent housing projects, in which the expenses for land compensation and infrastructure development are

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<sup>32</sup> Some local governments do not provide full address of public rental housing supplied by regional corporation.

high. It is worth noting that GH reported a particularly high number of units supplied in 2019, which can be explained by the happiness housing project, which was actively pursued by the local government.<sup>33</sup>

**Table 3** No. of Buy-to-Rent and Build-to-Rent Housing Units Purchased and Supplied

(Unit: no. of units)

Year	Total	Gyeonggi-do		Daegu	
		LH	GH	LH	DUCO
No. of Buy-to-rent housing units purchased					
2017	3,621	2,612	234	643	132
2018	5,138	3,841	350	794	153
2019	8,528	6,500	385	1,493	150
No. of Build-to-rent housing units supplied					
2017	41,962	37,618	16	4,094	234
2018	26,093	23,060	71	2,962	0
2019	21,547	16,620	2,966	1,961	0

Note: Calculated based on data from LH and the regional housing corporations.

The next paragraphs focus on the geographical distribution of public rental housing. As the empirical analysis of this study is performed at a geographical level lower than the basic local government level (*si/gun/gu*), we compiled the summary statistics on the buy-to-rent housing supply at the *eup/myeon/dong* level (Table 4) and the summary statistics of the build-to-rent housing units (Table 5).

Table 4 shows a higher number of *eup/myeon/dong* areas in which buy-to-rent housing units were supplied. If the supply of buy-to-rent housing is concentrated in certain *eup/myeon/dong* areas, it would add to the difficulty of identifying comparable control groups. Having more diverse characteristics of the supply project areas is more conducive to improving the accuracy of the empirical analysis. Here, the standard deviation (SD) of the supply volume is close to the mean value, which indicates that there are significant gaps in rental housing supply across the *eup/myeon/dong* areas.

<sup>33</sup> *Ilyo Seoul*, “Gyeonggi Housing & Urban Development Corporation Supplies 1,744 Units of ‘Gyeonggi Happiness Housing’ in 2019,” February 21, 2019, <http://www.ilyoseoul.co.kr/news/articleView.html?idxno=289325> (accessed on July 10, 2021)

**Table 4** Summary Statistics on the Supply of Buy-to-rent housing (*Eup/Myeon/Dong*)

Year	Gyeonggi-do			Daegu		
	Eup/Myeon/Dong	Mean	SD	Eup/Myeon/Dong	Average	SD
Supplied by LH						
2017	97	26.93	29.84	37	17.38	13.30
2018	116	33.11	38.15	42	18.90	16.02
2019	181	35.91	44.86	53	28.17	38.32
Supplied by Regional Corporation						
2017	18	13.00	7.50	10	13.20	7.21
2018	26	13.46	7.42	11	13.91	7.69
2019	31	12.42	5.02	9	16.67	10.40

Note: 1. Calculated based on the data from LH and the regional housing corporations.

2. Data compiled at *eup/myeon/dong* level; unit: no. of units.

3. Calculation did not consider the years in which there was no supply.

According to Table 5, the number of supply project areas is smaller for build-to-rent housing, which seems obvious given the fact that build-to-rent housing units are typically supplied in the form of large-scale complexes, which raises the number of units supplied per project. However, this may also imply that it is difficult to identify control areas that have similar characteristics to the build-to-rent housing project areas.

**Table 5** Summary Statistics on the Supply of Build-to-rent housing(*Eup/Myeon/Dong*, LH)

Year	Gyeonggi-do			Daegu		
	Eup/myeon/dong	Average	SD	Eup/myeon/dong	Average	SD
LH						
2017	26	1,446.85	1,078.58	4	1,023.50	417.88
2018	22	1,048.18	702.66	5	592.40	280.43
2019	17	977.65	433.34	2	980.50	761.55
Regional Corporation						
2017	1	16.00	.	1	234.00	.
2018	2	35.50	28.99	.	.	.
2019	8	370.75	807.96	.	.	.

Note: 1. Calculated based on the data from LH and the regional housing corporations.

2. Data compiled at *Eup/Myeon/Dong* level; unit: no. of units

3. Calculation did not consider the years in which there was no supply.

## B. Summary Statistics on the K-Atlas Data

This section explains the K block level statistics for the K-Atlas data. Gyeonggi-do has 31,171 K blocks, and Daegu has 8,055 blocks (39,226 in total). The number of K blocks identified across all 15 time points between November 2017 and January 2021 was 26,323 in Gyeonggi-do and 6,482 in Daegu (32,805 in total).

**Table 6\_Summary Statistics for the K Block Level (November 2019)**

Variable	Gyeonggi-do		Daegu	
	Average	SD	Average	SD
Sample size	141.16	268.16	100.66	212.60
Percentage of people aged between their 20s and 50s	76.36	9.21	72.54	11.07
Household income (year, KRW 10,000)	7,175.06	2,365.34	6,686.55	2,198.98
Personal income of people aged between their 20s and 50s (year, KRW 10,000)	4,230.85	1,010.67	4,044.80	1,081.63
Household consumption (year, KRW 10,000)	399.87	142.34	367.09	159.46
Personal consumption of people aged between their 20s and 50s (year, KRW 10,000)	197.91	61.77	183.85	74.05

Note: 1. Calculated based on the K-Atlas data.

2. Variables other than the sample size were weighted by the number of people subject to analysis.

Table 6 provides the preliminary statistics on key variables for the K block level as of November 2019. The table indicates sizable gaps in population size between K blocks, which can be explained by considering the population and other various geographical elements when designating K blocks, the continuous population change occurring after the K block delimitation, and apartment complexes being defined as standalone K blocks despite their large population. The percentage of the financially active population aged between their 20s and 50s and the consumption levels can also vary significantly among the different K blocks, even in the same metropolitan region. This finding implies that the economic situations may significantly vary even in small areas.

In this study, we analyzed the consumption data rather than income data, for the following reasons. According to Real Estate 114 and KCB, the estimated incomes of sampled individuals and households are adjusted on a regular basis. The adjustment considers each individual's occupation and source of income (e.g., wage earner, self-employed, etc.), minimum wage, inflation, and changes in credit card usage. The adjustment is made for all areas in Korea and for specific time points. As such, unnatural changes in income may occur at specific time points depending on the adjustment algorithm.

In particular, it should be noted that the adjustment considers occupations, credit card usage and other individual characteristics. The direction and scale of the adjustment may vary depending on the socioeconomic conditions of the samples. As such, differences in the adjustment may be related to the location selected for the public rental housing projects, as they may be related to socioeconomic situations. In such cases, it is difficult to arrive at reliable estimations on account of endogeneity. To address this issue, we relied on consumption level rather than income data.

## IV. Results

### 1. Data and Empirical Analysis Strategies

#### A. Data Construction

An accurate estimation of the effect of rental housing on the neighborhood requires an analysis of each K block, which is a geographical unit smaller than an *eup/myeon/dong*. However, the K-Atlas data used in this study did not provide detailed geographical information about K blocks, including their shapefile. To address such data limitations and attempt an analysis at the K block level, we calculated the coordinates of each K block centroid, based on the K block boundaries of the K-Atlas as of July 2021. Then, we calculated the coordinates of buy-to-rent and build-to-rent housing units supplied between 2018 and 2019, and then calculated the lineal distance between each rental housing unit to the center point of each K block.

We used the distances between rental housing units and K blocks to narrow the scope of analysis to K blocks located within 1,000 m from each rental housing unit. Then, based on the intuitive assumption that an area closer to rental housing would be subject to greater influence, we defined the K blocks within a 500 m radius from each rental housing as the treatment group, and the K blocks between a 500 m and a 1,000 m radius as the control group. In order to separate the effect of low-income earners moving into public rental housing units and to focus on the potential spillover effect of public rental housing on the adjacent areas, we excluded all K blocks where public rental housing was supplied at least once between 2017 and 2020.

## B. Empirical Analysis Strategies

In order to estimate the effect of public rental housing on the neighborhood, we used the difference-in-difference (DID) method as described in this chapter. The DID method was used in this study to identify the effect of public rental housing policies, by comparing the differences between before and after the supply of rental housing in the treatment group, with the same differences in the control group. We estimated the following DID equation based on six samples with different supply years, pre-periods, and post-periods (see Table 7).

**Table 7\_Sample Structure for Empirical Analysis**

Sample	Buy-to-rent supply	Before	After
1	2018	2017.11., 2017.12.	2019.1., 2019.11., 2019.12.
2	2018	2017.11., 2017.12.	2019.1., 2019.11., 2019.12., 2020.1., 2020.5.
3	2018	2017.11., 2017.12.	2020.1., 2020.5.
4	2018, 2019	2017.11., 2017.12.	2020.1., 2020.5.
5	2019	2017.11., 2017.12., 2018.1., 2018.11., 2018.12.	2020.1., 2020.5.
6	2019	2018.1., 2018.11., 2018.12.	2020.1., 2020.5.

Source: Authors

$$y_{i,t}^p = \beta_{buy-to-rent} \cdot Proximity\ to\ buy-to-rent\ housing_i^p \times Post_t + \beta_{Build-to-rent} \cdot Proximity\ to\ build-to-rent\ housing_i^p \times Post_t + \alpha_i^p + \gamma_{st}^p + \varepsilon_{i,t}^p \quad (1)$$

where  $i$  is a K block,  $s$  is a *si/gun/gu*,  $t$  is time, and  $p$  is the public rental housing unit (build-to-rent or buy-to-rent) supplied during the analysis period. Samples 1 to 3 consist of rental housing supplied in 2018, Samples 5 and 6 consist of rental housing supplied in 2019, and Sample 4 consists of rental housing supplied in 2018 or 2019 (see Table 7). Dependent variable  $y$  represents the log of average consumption of people aged between their 20s and 50s, and the percentage of people aged between their 20s and 50s.<sup>34</sup> The key explanatory variables are the dummy variable for proximity to buy-to-rent housing ( $Proximity\ to\ buy-to-rent\ housing_i^p$ ) and the dummy variable for proximity to build-to-rent housing ( $Proximity\ to\ build-to-rent\ housing_i^p$ ), each multiplied by the dummy variable for

<sup>34</sup> We restricted the scope of analysis to income and consumption of people aged between 20s and 50s in order to control changes in population composition in each age group.

the post-supply period (*Post*). The dummy variable for proximity has a value of 1 for a K block  $i$  located within 500 m from rental housing  $p$ , and a value of 0 for a K block between 500 m and 1,000 m.

In this analysis, we defined a treatment group (K block within 500 m from rental housing) and a control group (K block between 500 m and 1,000 m from rental housing) for each individual rental housing unit  $p$ . If different rental housing units (in particular, buy-to-rent housing units) are located in the vicinity of each other, K blocks close to the rental housing units may be counted more than once in the analysis. To avoid the over-representation of overlapping K blocks, we used the inverse of the number of the K block used in the quantitative analysis, that is,  $\frac{K \text{ block sample size}}{K \text{ blocks used in analysis}}$ , as a weight value.

In (1), we controlled the term on the interaction between the fixed effect of K blocks and the fixed effect of rental housing ( $\alpha_i^p$ ) and the term on the interaction between the fixed effect of time X and *si/gun/gu* and the fixed effect of rental housing ( $\gamma_{st}^p$ ).<sup>35</sup> This approach is based on the assumption that the trend of the average consumption level and population composition is different in each neighborhood around rental housing ( $p$ ) (K blocks within a 1,000 m radius from the rental housing). The effect of rental housing ( $\beta_{Buy-to-rent}$ ,  $\beta_{Build-to-rent}$ ) estimated by controlling for fixed effects interacting with the fixed effect of rental housing is partially similar to the weighted mean of the policy effect estimated by applying the DID method to the control group and treatment group of each rental housing ( $p$ ).

In addition to the DID method, we performed an event study to identify the effect of the rental housing supply over time.

$$y_{i,t}^p = \sum_{l \in L} \beta_{buy-to-rent}^l \cdot Proximity \text{ to buy-to-rent housing } i^p + \sum_{l \in L} \beta_{Build-to-rent}^l \cdot Proximity \text{ to build-to-rent housing } i^p + \alpha_i^p + \gamma_{st}^p + \varepsilon_{i,t}^p \quad (2)$$

where  $L$  represents a set of observation dates for the K-Atlas: November 2017, December 2017, January 2018, November 2018, December 2018, January 2019, November 2019, December 2019, January 2020, and May 2020. The event study analysis is similar to the DID

<sup>35</sup> The fixed effect of time X *Si/Gun/Gu* is used to control other elements that may apply in different areas and at different time points, including government policies.

analysis, and is useful for representing the dynamics of how rental housing affects the treatment group. The DID analysis compares the average effect before and after the supply of rental housing, whereas the event study analysis represents all of the effect that rental housing has at specific times from November 2017 to May 2020. Here, we standardized the effect in the month preceding each year when rental housing was supplied at 0. For example, when estimating the effect of rental housing supplied in 2019, we standardized its effect in December 2018 at 0 ( $\beta_{Buy-to-rent2018.12.} = 0, \beta_{Build-to-rent2018.12.} = 0$ ). As a result, the event study estimation coefficient ( $\beta_{Buy-to-rentt}$ ,  $\beta_{Build-to-rentt}$ ) represents the effect relative to the effect in December 2018.

## 2. Results

### A. Event Study Analysis

This section explains the empirical results on the effect of public rental housing on the surrounding neighborhoods. Figures 3 to 5 show the effect of rental housing, based on Equation (2), on the effect on average consumption levels of people aged between their 20s and 50s in adjacent K blocks and their share of the total population. The estimated effect of buy-to-rent housing ( $\widehat{\beta_{Buy-to-rentt}}$ ) is represented by black dots, and the estimated effect of build-to-rent housing ( $\widehat{\beta_{Build-to-rentt}}$ ) is represented by grey dots. The 95% confidence level of each estimate is shown as a vertical line. Figures 3 to 5 represent the effect of rental housing supplied in 2018, 2019, and 2018~2019 on a neighborhood, that is, K blocks within a 500 m radius.

Figure 3 shows the effect of rental housing supply in 2018 on a neighborhood (Samples 1 to 3) As mentioned above, the observation period for the K-Atlas data are restricted to between November 2017 and May 2020. As such, analyzing the effect of rental housing supplied in 2018 does not provide a sufficient insight into the ‘pre-trends’ before the supply. However, it allows us to see the long-term ‘post-trends.’ It is likely that the effect of rental housing on a local population composition takes time to manifest. As such, for the purpose of estimating the effect of rental housing, it is deemed reasonable to focus on the effect of rental housing supply in 2018, rather than the rental housing supply in 2019.

Specifically, Panel A in Figure 3 represents the analysis of the effect of rental housing supply in 2018 on the monthly credit card consumption of people aged between their 20s and 50s in the adjacent K blocks. In the neighborhoods around buy-to-rent housing project sites, monthly consumption does not appear vary significant between before and after the supply. However, in the neighborhoods around build-to-rent housing projects, the monthly

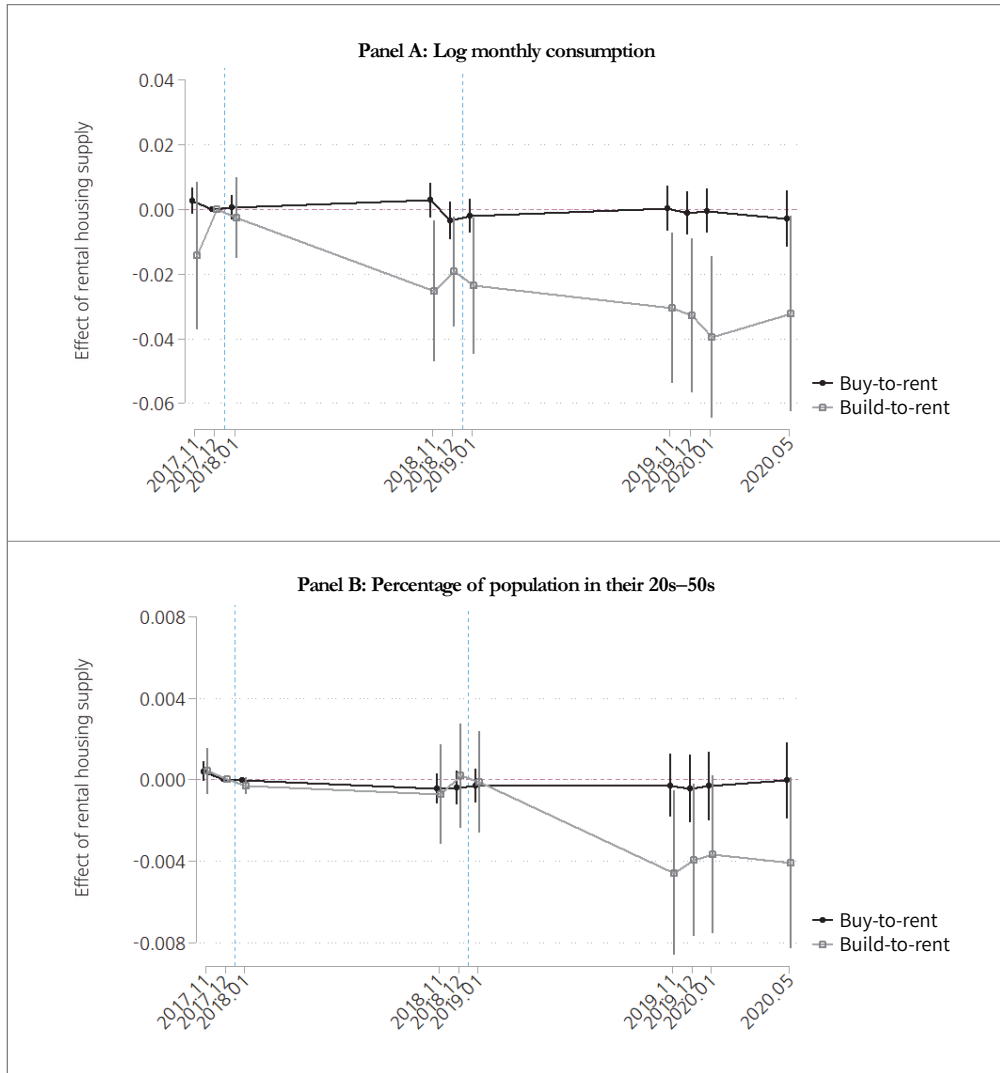
consumption gradually declined between 2018 and 2019.

Panel B in Figure 3 shows the effect of rental housing supply in 2018 on the population composition in the neighborhoods. The population composition of people aged between their 20s and 50s in the neighborhoods around buy-to-rent housing does not change significantly; starting in 2019, the share of people aged between their 20s and 50s slightly increased. On the other hand, in neighborhoods around build-to-rent housing project sites, the share of people aged between their 20s and 50s did not decline significantly in 2018; in 2019, the share of people aged between their 20s and 50s declined by around 0.4%p.

Figure 4 shows the effect of rental housing supply in 2019 on the neighborhood (Samples 5 to 6). Analyzing the effect of rental housing supplied in 2019 does not provide a sufficient insight into the long-term post-trends after the supply. If rental housing affects the population composition in the neighborhoods, it is likely that the effect will take some time to manifest. As such, we cannot properly estimate the effect of rental housing. Furthermore, the COVID-19 pandemic hit Korea in the first half of 2020, which further thwarted real estate transactions and relocations, which may have also undermined the effect of rental housing. However, if we focus on the rental housing supplied in 2019, we can analyze the pre-trends before the supply, which means that we can examine the validity of our quantitative analysis method.

Panels A and B in Figure 4 represent the effect of rental housing supply in 2019 on the average consumption levels and the share of people aged between their 20s and 50s in the adjacent K blocks. For both the build-to-rent housing and the buy-to-rent housing, the control group and the treatment group reported similar flat trends in the period before the rental housing supply in 2019 (2017~2018). These results indicate that our estimation method is valid, and that the DID estimates of the effect of rental housing are not likely to be biased. No significant changes in the share and average consumption level of people aged between their 20s and 50s were observed in 2019, except for a decline in consumption levels in neighborhoods around the build-to-rent housing units in 2019. These estimates are quite similar to the results on the effect of 2018 housing rental supply represented in Figure 3. The estimates for May 2020 are not significantly different from January 2020, and the lack of effect is likely to have been partially caused by the COVID-19 pandemic.

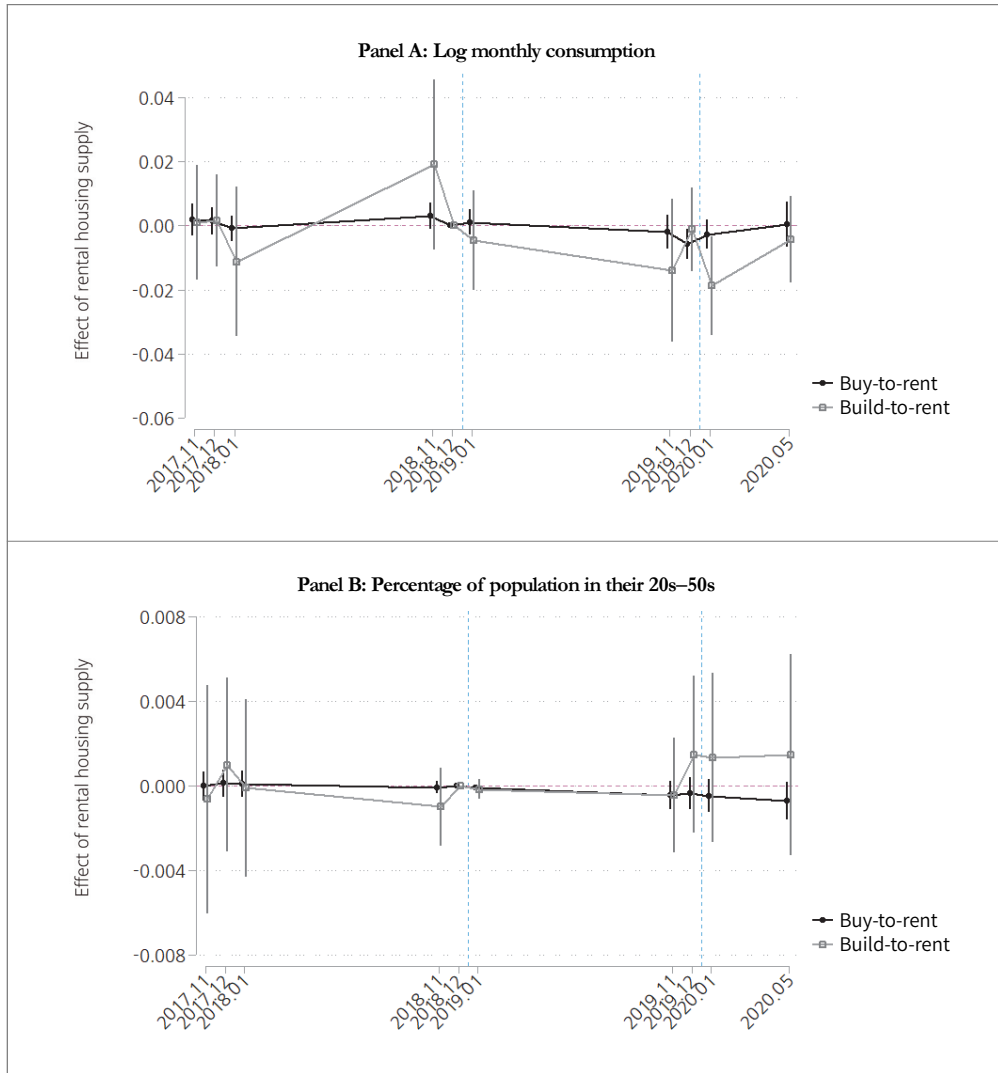
**Figure 3\_Effect of Rental Housing Supplied in 2018 on the Neighborhood(Samples 1 to 3)**



Note: 1. Rental housing was supplied in the period between vertical dotted lines (2018).

2. Standard errors are clustered at the rental housing level; vertical line represents the 95% confidence level.

Source: Authors

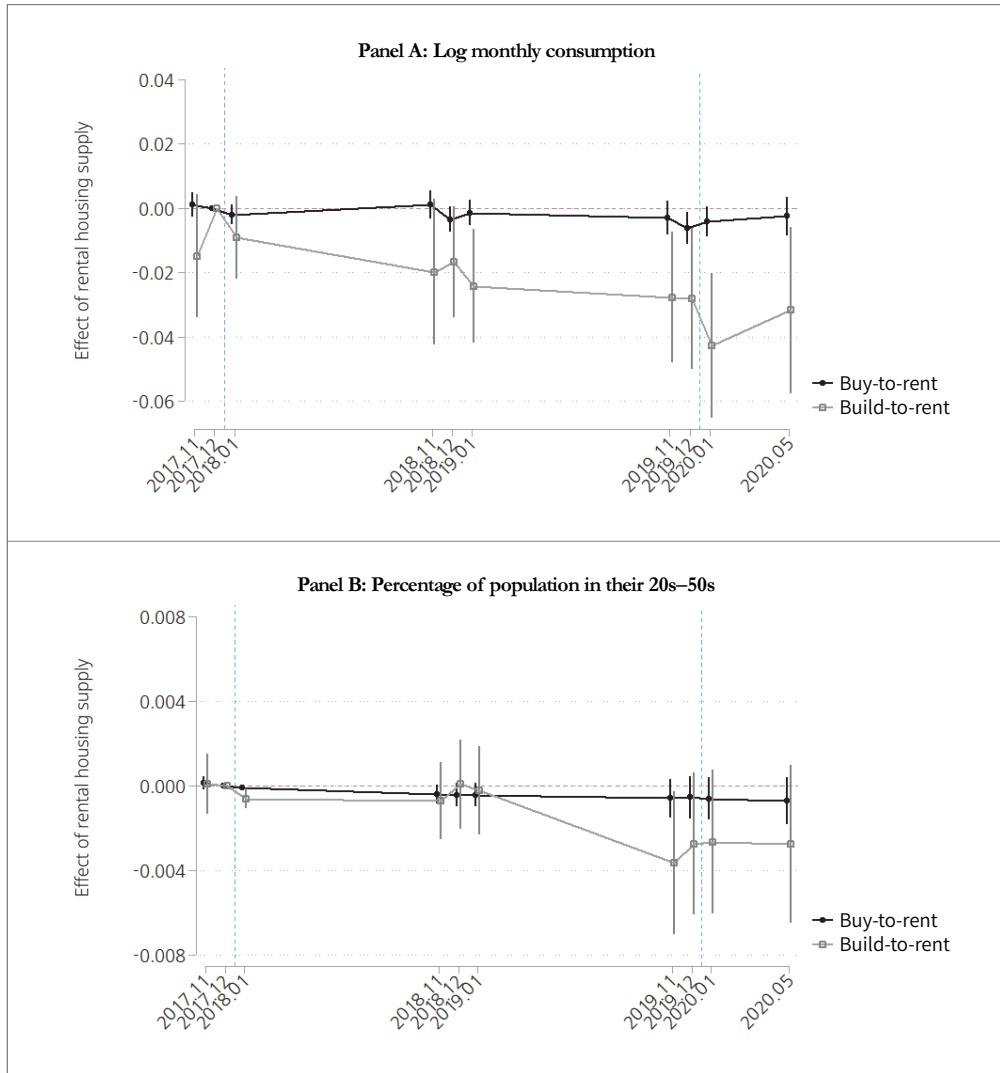
**Figure 4\_Effect of Rental Housing Supplied in 2019 on the Neighborhood(Samples 5 to 6)**

Note: 1. Rental housing was supplied in the period between vertical dotted lines (2019).

2. Standard errors are clustered at the rental housing level; vertical line represents the 95% confidence level.

Source: Authors

Figure 5\_Effect of Rental Housing Supplied in 2018 or 2019 on the Neighborhood (Samples 4)



Note: 1. Rental housing was supplied in the period between vertical dotted lines (2018-19).

2. Standard errors are clustered at the rental housing level; vertical line represents the 95% confidence level.

Source: Authors

Figure 5 represents the effect of rental housing supplied in 2018 or 2019 over time (Sample 4). The estimates are mostly the average of the effect of 2018 rental housing supply shown in Figure 3 and the effect of 2019 rental housing supply shown in Figure 4. As mentioned above, no significant changes were observed in relation to the average consumption levels and population composition of people aged between their 20s and 50s in the neighborhood. However, the average consumption level and share of people aged between their 20s and 50s were estimated to have declined in neighborhood around build-to-rent housing.

Overall, the supply of buy-to-rent housing had a limited effect on the average consumption level and the percentage of people aged in their 20s and 50s in the neighborhood. These results mainly stem from the fact that an average buy-to-rent housing building only accommodates around 10 households, which is markedly lower than the number of households in an average build-to-rent building. As such, the effect of buy-to-rent housing is weaker than that of build-to-rent housing. In addition, residents in the surrounding neighborhoods may not be well aware of the existence of buy-to-rent housing. In conjunction with the small number of households in each building, it is difficult to identify a building as buy-to-rent housing from its outside appearance. However, residents in some areas with high concentrations of buy-to-rent housing units may be aware of their existence, in which case the effect of buy-to-rent housing may be greater than the estimates presented in this study.

On the other hand, in neighborhoods around build-to-rent housing sites, based on the average consumption levels and the share of people aged between their 20s and 50s, it seems natural that build-to-rent housing has a greater effect than buy-to-rent housing, given the larger number of units supplied per project. In addition, in many cases, the existence of build-to-rent housing is known to local residents—even before construction. During construction, the construction site is rich in the telltale signs of a build-to-rent housing project, and their effect on the surrounding neighborhood may be even greater once new residents start moving into the completed units.

The average monthly consumption levels and the share of people aged between their 20s and 50s declined for the following reasons. First, in many cases, the build-to-rent housing project sites are located where consumption levels and the percentage of people aged their 20s and 50s had been declining even before the onset of construction (preexisting tendencies). In fact, build-to-rent and buy-to-rent housing units are built mostly in lower-income areas. However, when we look at the rental housing supply in 2018, it is difficult to identify the preexisting trends on account of the short pre-periods. Our analysis of the rental housing units supplied in 2019 did not find marked preexisting trends either.

Second, the supply of build-to-rent housing accompanies the inflow of many stores and other infrastructure in the area, which may change the monthly consumption trends and the share of young adults and middle-aged people. The inflow of numerous stores and discount shops may also drive down the retail prices paid by local consumers, resulting in a decline in their total consumption level. On the other hand, the inflow of some stores such as coffeehouses and restaurants may increase the number and amount of consumption. The construction of housing units and the inflow of stores may also be accompanied by other amenities such as welfare facilities, which may attract older residents that prefer such amenities to live in the neighborhoods. However, we do not believe that amenities have played a crucial role in the decisions of the elderly to relocate.

Third, the increased supply of rental housing may push down rents and housing prices in the neighborhoods, and even change the population composition in the area. Lower rents mean low-income households have more access to the area, which then decreases the average income and consumption levels. Furthermore, lower rents may also encourage the inflow of elderly residents, who are not likely to be restricted by their commuting needs or their children's education. This inflow of low-income and elderly residents lowers the average consumption level and the share of people aged between their 20s and 50s.

The last possible reason is based on the changes in population composition in the nearby areas caused by the relocation of households who view build-to-rent housing as a disamenity. In other words, high-income and high-consumption level households who do not welcome rental housing tend to leave the area, and are replaced by households with relatively a low income and consumption level. The reason for viewing rental housing as a disamenity may vary, and can include concerns about their children's schools and housing prices. In particular, the share of people aged between their 20s and 50s may decline when households with children move to other areas in an attempt to look for better school districts.

Additional factors that need considering when interpreting results on build-to-rent housing include: it takes considerable time to construct build-to-rent housing; and the construction of build-to-rent housing is always carried out as a part of innovative city projects, regional redevelopment projects, and other district-level development plans. Some residents may move to the nearby areas only temporarily during construction, and move into the rental housing once the construction is complete. It is ultimately difficult to consider and control for all these situations occurring in the vicinity of build-to-rent housing project sites.

To directly address this issue, we need to collect all data before the beginning of the construction project, all data before the housing site development (if it is developed at the

same time as the housing), and the data after the situation has stabilized after construction. However, given the periods of data used in this study, the data obtained are bound to be restricted. As such, our results on build-to-rent housing should be interpreted with caveats.

Lastly, when interpreting our results in this analysis, we need to consider the movement of the residents living in public rental housing. If potential tenants of newly supplied buy-to-rent housing reside in a nearby neighborhood, and they are distinguished from other population groups in terms of income and age, they may affect the estimates presented in this study. For example, given the eligibility requirements for average public rental housing, the tenant group is likely to earn less income or be older than other population groups.

The effect of population movement on our estimates is ultimately determined by how much of the population movement came from the treatment group area, and how much of it came from the control group area. However, it is generally impossible to obtain the data required to accurately verify such effects, and thus we were not able to analyze the issue directly. However, given the fact that the spatial scope of this study was restricted to a radius of a mere 1,000 m, the location of public rental housing tenants before their relocation to the housing is not likely to be significantly different between the treatment group and the control group.<sup>36</sup>

## B. DID Analysis

Table 8 shows the average effect of the supply of build-to-rent housing and build-to-rent housing on neighborhoods within 500 m from the rental housing, based on estimates from Equation (1). The DID estimation coefficients represent the average effect before the supply estimated from the event study analysis (Figures 3, 4, and 5) and the average effect after the supply. For this quantitative analysis, the years of rental housing supply, the period before the supply, and the period after the supply were defined in multiple ways using Samples 1 to 6. Panels A and B in Table 8 shows the effect of rental housing supply on the log average consumption and the share of people aged between their 20s and 50s.

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**36** However, it should be noted that, the issue of endogeneity may not be fully addressed even if we analyze the data at the K block level, especially if large differences in population movement are observed within the K blocks within the 1,000 m radius.

**Table 8\_Effect of Rental Housing Supply on Nearby Neighborhoods**

	Sample 1 (1)	Sample 2 (2)	Sample 3 (2)	Sample 4 (4)	Sample 5 (5)	Sample 6 (6)
<b>Panel A: Log monthly consumption</b>						
Close to buy-to-rent X after	-0.0009 (0.0015)	-0.0018 (0.0023)	-0.0017 (0.0025)	-0.0015 (0.0015)	-0.0009 (0.0020)	-0.0009 (0.0020)
Close to build-to-rent X after	-0.0069 (0.0064)	-0.0185** (0.0072)	-0.0143* (0.0087)	-0.0169** (0.0078)	-0.0095 (0.0062)	-0.0095 (0.0062)
p value of coefficient difference	0.35	0.03	0.16	0.05	0.19	0.19
<b>Panel B: Percentage of population in 20s–50s</b>						
Close to buy-to-rent X after	-0.0002 (0.0003)	-0.0002 (0.0006)	0.0000 (0.0006)	-0.0003 (0.0003)	-0.0005 (0.0004)	-0.0005 (0.0004)
Close to build-to-rent X after	-0.0014** (0.0006)	-0.0032** (0.0014)	-0.0022** (0.0010)	-0.0013 (0.0010)	0.0013 (0.0021)	0.0013 (0.0021)
p value of coefficient difference	0.07	0.05	0.06	0.36	0.40	0.40
<b>Sampling method</b>						
Before	2017	2017	2017	2017	2017-18	2018
Year of rental housing supply	2018	2018	2018	2018-19	2019	2019
After	2019	2019-20	2020	2020	2020	2020
<b>Fixed effect</b>						
K block x rental housing	Y	Y	Y	Y	Y	Y
Time X city X rental housing	Y	Y	Y	Y	Y	Y

Notes: 1. Used SD calculated at the rental housing level.

2. Used the population of each K block for weighting.

3. Yearly income and monthly credit card usage were calculated based on samples obtained from those aged between their 20s and 50s.

Source: Authors

According to Panel A in Table 8, buy-to-rent housing did not have a significant effect on the average consumption level of people aged between their 20s and 50s living in the nearby neighborhoods. The estimation coefficients are negative across all samples, but not significant. Their size is around 1/10 of those for the build-to-rent housing. The build-to-rent housing was estimated to lower the average consumption level of the nearby neighborhood. The effect of build-to-rent housing supplied in 2018 (Samples 1 to 3) was greater than that of the housing supplied in 2019, which seems to stem from the differences in the lengths of the post-periods. For example, Sample 2 was used to estimate the effect of build-to-rent housing supplied in 2018, which indicated a 1.9% decline in the consumption levels in the adjacent neighborhoods. Given the fact that the average monthly consumption level of the

adjacent neighborhoods was KRW 1.92 million in 2017, the 1.9% decline translates to a decline of around KRW 36,000 per month.

Panel B shows that buy-to-rent housing did not have significant effect on the percentage of people aged between their 20s and 50s in the adjacent neighborhoods. After the supply of build-to-rent housing in 2018, the share of people aged between their 20s and 50s in the neighborhoods declined by around 0.3%p. As can be seen from the difference between the estimation coefficients between Samples 1 and 2, the decline in the share of young adults and middle-aged people accelerated in 2019, when the supply of 2018 build-to-rent housing was completed. The decline of the share of people aged between their 20s and 50s is not seen in Samples 5 and 6, which may be attributable to the lack of sufficient data in the post-periods and due to the COVID-19 outbreak in the first half of 2020.

To summarize, Table 8 shows that buy-to-rent housing did not affect the average consumption levels or the share of people aged between their 20s and 50s in the adjacent neighborhoods, whereas the build-to-rent housing supplied in 2018 lowered the consumption levels and the share of young adults and middle-aged people in the areas. These results of the DID estimation are consistent with those of the event study analysis.

## V. Conclusions and Policy Implications

This study analyzed the economic effect of public rental housing projects on nearby neighborhoods using the average consumption levels of people aged between their 20s and 50s and their share in the financially active population in the area. By restricting the age group for the consumption level analysis, we sought to control the effect of changes in age composition. We supplemented the analysis with an analysis of the effect on the share of people aged between their 20s and 50s.

The results indicate that buy-to-rent housing did not have a significant effect on the average consumption levels and share of people aged between their 20s and 50s in the adjacent K blocks. On the other hand, the supply of build-to-rent housing was estimated to have lowered the average consumption level and the share of population aged between their 20s and 50s in K blocks affected by the projects.

Our results suggest that buy-to-rent housing, which is supplied in a smaller amount per project, may have various advantages over build-to-rent housing, including in its acceptability to local residents. Build-to-rent housing offers numerous benefits including the fact that

the government can choose the housing development site and take into account local transportation networks and other various factors, budgets can be used more efficiently because more units are supplied in a designated area, and it is easier to build amenities for tenants—including Social Welfare Centers, as needed. It should be noted that many of these benefits are associated with the higher density of build-to-rent housing units.

However, lowering the density of build-to-rent housing increases the costs of supplying them. As such, they may not be an optimal choice for policy makers who need to consider the number of units supplied as well as lowering the density. Policy makers should thus consider density as an important factor when developing supply plans. In the case of supplying a large number of rental housing units in a designated area, they should also consider including the construction of transport facilities, parks, libraries, and other infrastructure that positively affect the nearby areas.

The empirical analysis presented in this study suffers from some limitations caused by the lack of data. First, the period available for empirical analysis was around a year after each supply, which restricted our ability to analyze their dynamic and long-term effects. The factors analyzed in this study, consumption levels and age structure, are expected to be deeply related to the movement of households with diverse socioeconomic backgrounds. However, population movement entails considerable costs, including those incurred by lease contracts and other requirements, which means that it takes time for such movement to be reflected in actual data. For this reason, due to the limited period available for analysis, we were not able to sufficiently consider the medium and long-term effect of public rental housing.

Although not covered in this study, important policy and academic issues remain for future studies. One of the issues is the mechanism through which the supply of public rental housing exerts economic effects. For example, the share of people aged between their 20s and 50s may be affected by public rental housing because of issues related to school districts. If so, it would be a meaningful academic endeavor to investigate whether such an effect stems from local residents' perception about good school districts, or whether the choice of school districts meaningfully affects learning outcomes, and to then develop policy options based on these results. Another possible approach for a future study is a more in-depth analysis of heterogeneity. For example, we could analyze whether the effect of public rental housing varies depending on the characteristics found in actual public rental housing projects, such as the number of units, the existence of community facilities, access to transport services, school districts, and other conditions. These results would provide useful reference points for developing public rental housing policies in the future.

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