I Z A Institute
of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 14101

COVID-19 and Employment in South Korea: Trends and Comparison with the 2008 Financial Crisis

Minhyuk Nam
Soohyung Lee

FEBRUARY 2021

I Z A Institute
of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 14101

COVID-19 and Employment in South Korea: Trends and Comparison with the 2008 Financial Crisis

Minhyuk Nam
Sogang University

Soohyung Lee
Seoul National University and IZA

FEBRUARY 2021

ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

COVID-19 and Employment in South Korea: Trends and Comparison with the 2008 Financial Crisis*

We examine the impact of COVID-19 on employment in South Korea as of June 2020. To estimate the causal effect, we use two complementary methods. First, using individual-level data without residence information, we estimate the effects by controlling for detailed characteristics of individuals. Second, using aggregate data without individual characteristics, we exploit the regional variation in the intensity of COVID-19 to measure the effects. We find that the COVID-19 pandemic decreased the employment rate by 0.82%p and increased the unemployment rate by 0.29%p. These estimated effects are 90%–140% larger than those of the 2008 Financial Crisis.

JEL Classification: E3, J2, J6

Keywords: COVID-19, financial crisis, unemployment, employment

Corresponding author:
Soohyung Lee
Seoul National University
1 Gwanak-ro, Gwanak-gu
Seoul 08826
South Korea
E-mail: soohlee@snu.ac.kr

* We thank Dr. Woo-Hyun Jang and the participants of the "Covid-19 and the Korean Economy" conference for their detailed comments. All errors are our own.

I. Introduction

The COVID-19 pandemic has a massive socio-economic impact as well as effect on people's health. For example, the OECD (2020) expects that COVID-19 pandemic will reduce the global real GDP by 4.5% in 2020 compared with 2019, and Korea's real GDP is also expected to decrease by approximately 1%. Specifically, unlike the 2008 Global Financial Crisis, COVID-19 has severely affected the demand for goods and services due to quarantine and social distancing restrictions to prevent the spread of the virus. This scenario led to negative shocks on the labor market, and in most developed countries, employment rates have been decreasing (Boskin, 2020). Nevertheless, most of the academic research conducted in South Korea is focused on preventing the spread of COVID-19, analyzing macroeconomic trends, and determining the appropriate policy responses. However, few studies rigorously measure the magnitude of negative effects on the labor market due to COVID-19 as well as the heterogeneous effects depending on region, industry, and worker characteristics. Accordingly, this paper aims to fill this gap.

We examine the impact of COVID-19 on the labor market and compare it with that of the 2008 Global Financial Crisis using the latest data, using two complementary methods. First, using individual-level data without residence information provided by Statistics Korea (KOSTAT), we estimate the effects of COVID-19 by controlling for detailed characteristics of individuals. Second, using KOSTAT's region-level data without individual characteristics, we exploit the regional variation in the intensity of COVID-19 to measure the effects. We use these two methods because the KOSTAT does not release individual-level information with their residence information. Therefore, we use two separate datasets from KOSTAT and employ two different identification strategies to measure the causal effects of COVID-19.

When we use the individual-level data, we assume that COVID-19 accounts for any systematic patterns shown since January 2020 once we control for extensive lists of individual

characteristics and time trends. Alternatively, when we use the region-level data, we exploit the severity of the COVID-19 pandemic, which is measured by the number of confirmed cases, to identify the causal effects. Finally, we compare the effects with the impact of the 2008 Financial Crisis to examine how the economic shock caused by the COVID-19 pandemic differs from that of a general economic crisis.

On the basis of the first method using individual-level data, we find that the COVID-19 outbreak decreases the employment rate by 0.82%p and increases the unemployment rate by 0.29%p These negative impacts do not vary by gender but by age group and education level. More specifically, we find that young adults aged 25–29, middle-aged 45–54, and adults with less than a junior college degree suffer the most in terms of employment rates. The share of workers in temporary employment has been significantly reduced across various demographic groups, suggesting that COVID-19 hurts those with vulnerable employment security more than others. The second method based on region-level data yields comparable results on the overall effects of COVID-19 on employment and unemployment rates, confirming our findings. We find COVID-19's heterogeneous effects across regions, and the effects are correlated with the initial conditions of the regions' industrial compositions. Finally, results based on both methods show that COVID-19 has had more severe effects on employment than the 2008 Global Financial Crisis. In particular, due to COVID-19, the employment rate decreases by 0.48%p which is approximately 140% greater than the 2008 Financial Crisis impact. In addition, the proportion of temporary workers among all employees decreases more by 0.58%p than the 2008 Financial Crisis, indicating that COVID-19 had a greater impact on workers with unstable employment statuses.

The remainder of the paper is organized as follows: Section 2 explains the institutional background. Sections 3 and 4 lay out the empirical framework of the analysis and data descriptions, respectively. Sections 5 and 6 present the results, and section 7 concludes.

II. Institutional Background

II.1 COVID-19 Pandemic

Figure 1 shows the number of confirmed cases of COVID-19 in South Korea as of August 2020. The data source is the "Coronavirus Disease-19 Cases in Korea by City/Province" data released by the Korea Disease Control and Prevention Agency (KDCA). The number of confirmed cases has kept increasing since January 20, 2020, followed by the rapid spread at the end of February.

The rapid spread of COVID-19 has had a negative impact on the economy as a whole, triggering both public concern and policies that restrict people's movement to prevent the spread of the virus. More specifically, on the supply side, the spread has caused suspension of operations and unstable supply and demand for raw materials and intermediate goods, while demand for individual goods and services decreased as well. Together, these changes have led to an economic recession (Lee & Kim, 2020). These economic shocks can also be seen from the exchange rates and export trends. Panel A of Figure 2 presents that the Korean won–US dollar exchange rate has soared, and exports have decreased since February 2020 after COVID-19 has spread widely.

The economic recession may increase the possibility of workers being laid off, as this trend has decreased corporate sales and cash flow. Figure 3 shows the trends in employment and unemployment rates from June 2017 to July 2020. From the time the South Korean government confirmed its first case of COVID-19 in late January 2020, both the employment and unemployment rates have deviated from previous trends, suggesting the negative impacts of COVID-19.

II.2 Comparing the 2008 Global Financial Crisis and the COVID-19 Pandemic

Economic Shock

The 2008 Financial Crisis was a result of the United States' sustained policies on low-interest

rates and easier lending practices. In particular, the asset bubble created by excessive credit expansion began to collapse from 2007, triggering a chain of bankruptcies. This shock spread to the U.S. real economy in the second half of 2008 and soon spread worldwide (Heo, Ahn, & Kim, 2009; National Assembly Budget Office, 2009; Shin, 2008).

Although COVID-19 and the 2008 Financial Crisis differ in their causes and how they unfolded, the South Korean economy exhibits similar patterns before and after both crises. As seen in Panel B of Figure 2, various macroeconomic indicators had worsened since just before the Lehman Brothers crisis in August 2008. Specifically, the Korean won–US dollar exchange rate had soared, whereas exports plunged. This decrease in exports hurts the real economy by causing a slowdown in employment and investment for South Korea, whose economy heavily relies on manufacturing and export sectors. This pattern can also be seen in Figure 4, which outlines the trends in employment indicators at the time. Similar to Figure 3, the trends in the labor market after the 2008 Financial Crisis were worse than the two years before the crisis.

Comparison of Policy Responses

This section compares the Korean government's monetary and fiscal policy responses to COVID-19 and the 2008 Financial Crisis. Regarding COVID-19, the Korean government raises the country’s Crisis Alert Level to the highest (Level 4) and operates the Central Disaster and Safety Countermeasure Headquarters to carry out government-wide quarantine responses.

Starting from March 2020, the South Korean government has been imposing varying degrees of social distancing. The latter was first implemented to prevent further spread of the virus from March 22 to May 5 (Ministry of Health and Welfare, 2020a). Consequently, by the end of April, the number of daily confirmed cases decreased to approximately 10. The government relaxed social distancing. As the spread of the virus reemerged in the metropolitan areas, stricter social distancing measures (level 2) were implemented from August 13 to October 12 (Ministry of Health and Welfare, 2020a). Although these policies include

shortening business hours, they are not as restrictive as lockdowns in the US or the UK.

Nonetheless, these imposed restrictions as well as people voluntarily refraining from everyday activities have led to many businesses experiencing reduced demand for goods, resulting in an economic recession. Accordingly, the Korean government has been implementing various monetary and fiscal policies to stimulate the economy (see Table 1). For instance, as part of its monetary policy, the Bank of Korea lowered the benchmark interest rate by 0.75%p from March to May 2020, provided liquidity to the financial market by purchasing treasury bonds worth 3 trillion won by April 2020, and purchased repurchase agreements worth 3.5 trillion won from securities firms in March 2020 for the first time since the 2008 Financial Crisis (Bank of Korea, 2020). Meanwhile, the Korean government signed a $60 billion currency swap deal with the US to enhance the stability of its foreign exchange market. In addition, it implemented three additional fiscal policies by July 2020, worth approximately 59 trillion won in total (Ministry of Economy and Finance, 2020a; Ministry of Economy and Finance, 2020b; Ministry of Economy and Finance, 2020c). Starting from April 2020, the government provided stimulus checks to all residents to boost household consumption and help local businesses by providing consumption coupons (Ministry of Economy and Finance, 2020b).

To mitigate unemployment risks, the government introduced various labor policies addressing three angles, namely, employee retention, job creation, and support for the unemployed. First, the government expanded employment support funds to promote the retention of employees. This system covers up to 90 percent of an employee's salary by the government’s Employment Insurance Fund until September 2020 for business owners who, instead of laying off, retain employees on paid leave or leaves of absence. Second, for job creation, the government has planned to provide 1.56 million jobs for the public sector in May 2020. Lastly, to support those unemployed, the government expanded employment insurance

coverage from June 2020 through the "Emergency Employment Stability Subsidy" (Government of the Republic of Korea, 2020).

Except for the stimulus checks, these policy responses to the recession induced by COVID-19 are in line with those used during other economic recessions, including the 2008 Financial Crisis. For example, during the 2008 Financial crisis, the Korean government implemented extensive monetary and fiscal policies, similar to its response during the economic downturn caused by COVID-19 in 2020 (see Table 1). For the monetary policy, the Bank of Korea cut its benchmark interest rate six times, lowering it to 2 percent in February 2009 from 5.25 percent in September 2008. The Bank of Korea also signed foreign exchange swap agreements with the US, China, and Japan, thereby expanding the supply of won and foreign currencies (National Assembly Budget Office, 2009). Meanwhile, in November 2008, the government announced the “Comprehensive Policy Measures to Overcome the Ongoing Economic Crisis,” which included 14 trillion won worth of fiscal policies to stimulate the real economy. The government also revised the 2009 budget by increasing the total expenditure by 10 trillion won. The budget focused on social overhead capital (SOC) projects (9.2 trillion won in total) as well as providing grants and loans to small businesses and merchants (6.8 trillion won in total) (Ministry of Strategy and Finance, 2008; National Assembly Budget Office, 2008). This measure differs from 2020, as the government reduced the SOC budget by nearly 0.3 trillion won, while most of the revised budget was focused on health, welfare, and employment (13.9 trillion in total) along with industry, small- and medium- enterprises and the energy sector (7.9 trillion in total). Lastly, the labor policies implemented in 2008 include creating 1.84 million jobs for vulnerable groups, subsidizing firms to hire young adults, and providing loans for low-income earners to start a business.

III. Data and Sample

III.1 Data Source and Sample

For this study, we use the Labor Force Survey datasets provided by KOSTAT. The survey is representative and collects monthly information on an individual's employment status and his/her characteristics. We restrict the sample from February 2006 to January 2009 and from July 2017 to June 2020. The period between July 2017 and June 2020 is used to examine the impact of COVID-19 on the labor market. By including the period from February 2006 to January 2009, we empirically examine the extent to which the labor market impacts of COVID-19 may be different from those of the 2008 Financial Crisis.

We chose these sample periods for the following reasons. Regarding COVID-19, confirmed cases of COVID-19 appeared occasionally since January 2020, while the date of the latest data available at the time of our analysis was June 2020. Therefore, we consider the treatment period for COVID-19 to be January to June 2020. We then construct a fiscal year including the 6 months after the treatment period, that is, July 2019 to June 2020. To address seasonality and time trends of busines cycles, we expand our sample to include the 2 years prior to the previously mentioned fiscal year (i.e., July 2017 to June 2019). Notably, we do not extend the sample period further back because we want to constrain our sample period to within a time period governed by the same president.[1] Similarly, for the 2008 Financial Crisis, we select the 6 months after the crisis started, add 6 months to construct a fiscal year, and then add 2 more fiscal years prior to the start of the crisis. We assume that the 2008 Financial Crisis started in August 2008, coinciding with the layoff announcements by the Lehman Brothers. As shown in Panel B of Figure 2, the foreign exchange rate reveals that the Korean won began to slowly depreciate from the beginning of 2008, and its depreciation accelerated from August

[1] The former president Park Geun-hye was impeached in March 2017, and the current president Moon Jae-in, who is from the opposing political party, was inaugurated in May 2017.

2008. Korean exports also plummeted two months after that time. Therefore, we consider the period from August 2008 to January 2009 as the treatment period for the 2008 Financial Crisis and use the period from February 2006 to January 2009 for our empirical analyses.

Unfortunately, KOSTAT does not disclose information about survey respondents' residences and prohibits researchers from supplementing this dataset with other dataset to infer residences. Instead, KOSTAT provides two separate datasets: individual-level data without residential information and region-level data without residents' characteristics. Thus, we separately use both datasets to estimate the effects, especially the heterogeneous impact of COVID-19. For instance, we use individual-level data to estimate the COVID-19 effects controlling worker's characteristics such as gender, age, and education level. Conversely, we utilize region-level data to control for regional attributes to exploit the variation on the intensity of COVID-19 by region.

Specifically, when we use individual-level data, we define cells by gender (male and female—2 groups), age group (ages 15–24, ages 25–59 in five-year units, and over the age of 60—9 groups) and education level (middle school graduate or lower, high school graduate, junior college graduate, university graduate, and graduate degree or above—5 groups). We then compute the employment and unemployment rates for a given cell. By contrast, when using region-level data, labor market outcomes are measured for each region (17 in total) in a given month. To guarantee representativeness, we use weights on the bases of each cell's share of the population relative to the total population. Specifically, for the employment rate, we use the number of people aged 15 or older in each cell. For the unemployment rate, we use the number of individuals in the labor force in each cell.

III.2 Labor Market Trends

Before proceeding with the detailed regression analysis, this section examines the labor market trends for the first six months of the COVID-19 outbreak and the 2008 Financial Crisis.

We consider the onset of COVID-19 to be January 2020. Although only a few confirmed cases of COVID-19 were reported in January, the nominal exchange rate soared starting from January (see Panel A of Figure 2). This pattern suggests that COVID-19 started affecting the Korean economy since January 2020. Panels A and B in Figure 3 summarize the employment and unemployment trends over the past three years. After the spread of COVID-19, the employment rate, which is the share of employees among adults aged 15 or older, has significantly decreased than that in the past two years. Meanwhile, little change has occurred in the unemployment rate, which is the share of employees in the labor force (i.e., employed and unemployed individuals who are actively seeking employment). Therefore, we use the employment rate rather than the unemployment rate as a primary indicator to identify trends in the labor market following the outbreak of COVID-19 in the Korean labor market.

Panels A and B of Table 2 report the employment trends across demographic groups and regions. Specifically, columns (1) and (5) of Panels A and B report the average employment and unemployment rates for each group from January to June 2020 when COVID-19 was prevalent. For each group, column (2) reports the difference between column (1) and the average employment rates in the first half of 2019 and that of 2018. This difference shows the change in employment rates after adjusting for seasonality, which is a commonly used index among policy makers and news media in South Korea to detect business cycles. Similarly, column (5) reports unemployment rates during COVID-19, while column (6) reports the change in unemployment rates since COVID-19 after adjusting for seasonality.

After the outbreak of COVID-19, the employment and unemployment rates decreased by 0.51%p and increased by 0.06%p respectively, compared with the same period in 2018 and 2019 (see Panel A of Table 2). These differences are statistically significant at 1% and 10% levels. However, these changes may not reflect the true effects of COVID-19 because they do not consider trends on the bases of workers' characteristics and business cycle effects.

Next, we examine the labor market trends in the six months immediately following the 2008 Financial Crisis. As explained in Section III.1, we regard the onset of the crisis as August 2008. Panels A and B of Figure 4 show the employment and unemployment rates for three years before and after the 2008 Financial Crisis. We find that the employment rate declined quickly relative to the unemployment rate, which again confirms our earlier finding that the employment rate is more responsive to a negative economic shock.

Columns (3) and (7) of Table 2 show the average employment and unemployment rates for the first six months of the 2008 Financial Crisis (August 2008–January 2009). Columns (4) and (8) report the differences between the rates at the beginning of the Financial Crisis and the average rates during the preceding two years (i.e., August 2007–January 2008, August 2007–January 2007). During the first 6 months of the 2008 Financial Crisis, the employment rate decreased by 0.62%p and the unemployment rate decreased, not increased, by 0.04%p. This pattern suggests that the impact of the 2008 Financial Crisis on the labor market may differ from that of COVID-19 shown in columns (2) and (6).

IV. Econometric Framework and Identification Strategy

IV.1 Baseline Model and Comparison with the 2008 Financial Crisis

We set up three regression models to estimate the impact of COVID-19 on the labor market. Every regression analysis is weighted by the adult population in each cell.

To estimate the overall impact of COVID-19 on the labor market, we use following regression model:

$$Y_{c,m,t} = \theta \cdot 1(m \times t \in Recession) + \alpha_c + \beta_m + \gamma_t + \varepsilon_{c,m,t}. \qquad (1)$$

Subscripts c, m, and t refer to cell, month, and fiscal year, respectively. The fiscal year t starts from July and ends in June. $Y_{c,m,t}$ is the dependent variable: employment rate of the

population aged 15 or over, unemployment rate of the individuals who participate in the labor market, or the share of a certain occupation among those employed. Variable $1(m \times t \in Recession)$ is a dummy variable with a value of one if the corresponding observation is affected by COVID-19 (i.e., from January to June 2020). Parameters α_c, β_m, γ_t represent cell-, month-, year- fixed effects, respectively. Variable $\varepsilon_{c,m,t}$ captures the unexplained random shock clustered at cell level to allow for the correlation within cells.

We define two types of cell as we cannot access administrative data with individual characteristics and their regions of residence. When we use the individual-level data without residence information, we define cells on the bases of workers' gender (2 categories), age (9 groups), and education level (5 groups), a total of 90. Conversely, when we use the region-level data, each cell represents one region.

Interestingly, the size of the population in each cell differs. Thus, we apply weights when estimating our models. When we examine employment rates, we construct weights on the bases of the size of each cell relative to the population aged 15 and over. When we examine unemployment rates, we construct weights on the bases of the size of each cell relative to the number of individuals who participate in the labor force.

We use equation (2) to compare the differences between the economic impact of COVID-19 and the 2008 Financial Crisis.

$$Y_{c,m,t} = \theta_1 \cdot 1(m \times t \in Recession) + \theta_2 \cdot 1(m \times t \in Covid) + \alpha_c + \beta_m + \gamma_t + \varepsilon_{c,m,t}. \quad (2)$$

For this exercise, we extend the sample period by including the observations from February 2006 to January 2009 to estimate the impact of the 2008 Financial Crisis. Variable $1(m \times t \in Recession)$ is a dummy variable with a value of one if affected by either the 2008 Financial Crisis (i.e., from August 2008 to January 2009) or the 2020 COVID-19 pandemic (i.e., from January to June 2020). Variable $1(m \times t \in Covid)$ is the same dummy variable

from equation (1) and has a value of one if affected by COVID-19. Our parameters of interest are θ_1 and θ_2. Parameter θ_1 represents the average effect of an economic crisis on the labor market outcomes, while θ_2 captures the relative impact of COVID-19 to that of the 2008 Financial Crisis. If the estimated θ_2 is statistically different from zero, then, we can conclude that the impact of COVID-19 is different from that of the Financial Crisis. Lastly, we also include year-fixed effects as well as month-fixed effects interacting with both periods (Financial Crisis and COVID-19). The latter is to allow for the possibility that seasonal effects may differ between the two periods.

IV.2 Individual-level Analysis

Heterogeneous Effects by Demographic Characteristics

We examine whether the effects of COVID-19 on the labor market may vary depending on individual characteristics. Specifically, we add to our baseline model the interaction terms with the indicator variables for COVID-19 by individual characteristics (i.e., $1[m \times t \in Covid] \times 1[g \in k]$).

$$Y_{g,c,m,t} = \sum_{k=1}^{G} \theta_k \cdot 1(m \times t \in Covid) \times 1(g \in k) + \alpha_c + \beta_m + \gamma_t + \varepsilon_{c,m,t}. \qquad (3)$$

$Y_{g,c,m,t}$ is the dependent variable of group g, with the demographic characteristics of cell c, in month m of fiscal year t. Variable $1(m \times t \in Covid) \times 1(g \in k)$ is an interaction term between two indicators with a value of one if the corresponding observation is affected by COVID-19 and if group g corresponds to k. As in equation (1), parameters α_c, β_m, γ_t capture cell-, month-, fiscal year- fixed effects, respectively. Variable $\varepsilon_{c,m,t}$ is an error term that allows for correlation within the same cell, for which cluster standard errors are used.

Heterogeneous Effects by Industry

We examine whether the effects of COVID-19 on the labor market differ depending on industry characteristics. In this analysis, we define cells by individual characteristics and industries

(total of 18) in each time period. We modify equation (3) by substituting group g to industry i as follows:

$$Y_{i,c,m,t} = \sum_{j=1}^{I} \theta_j \cdot 1(m \times t \in Covid) \times 1(i \in j) + \alpha_c + \beta_m + \gamma_t + \varepsilon_{i,c,m,t}. \quad (4)$$

Variable $Y_{i,c,m,t}$ is the outcome from industry i in cell c at month m of fiscal year t. We examine two outcome variables: the logarithm of the number of employees working for industry i and the share of the number of employees in industry i out of the total number of workers (i.e., the employment share) in cell c in month m of fiscal year t.

If COVID-19 had an equal impact on the dependent variables regardless of industry, all θ_j will not be statistically different from zero. However, if COVID-19 has affected employment in the service industry more than other industries as demand for services has declined, then, $\theta_{j=service\ sector}$ will be statistically different from zero. Parameters α_c, β_m, γ_t capture cell-, month-, fiscal year- fixed effects, respectively. $\varepsilon_{i,c,m,t}$ is an error term clustered at the cell level.

IV.3 Region-level Analysis

Heterogeneous Effects by Region

In this model, we use regional aggregate data to determine whether differences existed in the impact of COVID-19 on the labor market depending on regional characteristics. Specifically, we estimate equation (5):

$$Y_{r,m,t} = \sum_{k=1}^{R} \theta_k \cdot 1(m \times t \in Covid) \times 1(r \in k) + \alpha_r + \beta_m + \gamma_t + \varepsilon_{r,m,t}, \quad (5)$$

where $Y_{r,m,t}$ is the dependent variable of region r in month m of fiscal year t. $1(m \times t \in Covid) \times 1(r \in k)$ is an interaction term between two indicators with a value of one if the corresponding observation is affected by COVID-19 and if region r corresponds to k. Parameters α_r, β_m, γ_t represent region-, month-, and fiscal year- fixed effect, respectively. As regionally aggregated data exclude individual characteristics, we use region-fixed effects.

Variable $\varepsilon_{r,m,t}$ is an unexplained random shock that can be correlated with another shock in the same region. To capture this possibility, we cluster the standard errors at the region level.

Heterogeneous Effects by Intensity of COVID-19

We estimate the extent to which the intensity of COVID-19 may account for the labor market outcomes in a region by interacting $1(m \times t \in Covid)$ with the number of cumulative confirmed cases of COVID-19. The rest of the settings remain the same as that of equation (5).

$$Y_{r,m,t} = \theta \cdot 1(m \times t \in Recession) \times \#confirmed\ case_{r,m,t} + \alpha_r + \beta_m + \gamma_t + \varepsilon_{r,m,t}. \quad (6)$$

V. Results based on Individual-level Analyses

V.1 Baseline Analysis

Table 3 reports the estimated effects on employment and unemployment rate and the share of temporary and self-employed workers among employees. We find that the outbreak of COVID-19 decreased the employment rate by 0.82%p (or 1.35%) but increased the unemployment rate by 0.29%p (or 7.63%) than the prior period. These negative effects of COVID-19 are significant at the 1% and 5% levels, respectively.

Notably, our estimates of the negative impacts are much larger than the simple difference between pre- and post- COVID-19 periods (–0.51%p and 0.06%p, respectively). The latter approach is commonly used by policy makers and news media in South Korea when they evaluate the effects of COVID-19. Thus, our results convey the necessity for policy makers to require extra careful analysis when assessing labor market conditions.

To gauge the impact of COVID-19 on the labor market as a number of job losses, we conduct a back-of-the envelope calculation to calculate the number of people who lost their jobs. As of June 2020, the number of adults aged 15 years or older is approximately 44.78 million. Their employment rate has dropped by 0.82%p, which implies that nearly 370,000

adults have lost their jobs. Meanwhile, the number of individuals participating in the labor force during the same period is 28.28 million, implying that a 0.29%p rise in unemployment would result in nearly 80,000 job losses. In other words, only 80,000 out of 370,000 adults (22%) continue to seek employment while being unemployed, whereas the remaining 290,000 (78%) are out of the labor force and will not be captured in the unemployment rate. This finding suggests that the employment rate is an important variable for assessing labor market conditions in South Korea.

Columns (3) and (4) in Table 3 present the effect of COVID-19 on temporary and self-employed workers. We find that COVID-19 decreased the share of temporary workers among those employed by 0.72%p, which is significant at the 1% level. However, no significant impact is observed on the proportion of self-employed workers. This finding suggests that COVID-19 has had a more negative effect on temporary workers, whose employment conditions are unstable relative to full-time workers or self-employed.

Studies from various countries have reported the impact of COVID-19 on the labor market. Similar to ours, studies from not only the US (Bartik et al., 2020; Béland, Brodeur, & Wright, 2020; Coibion, Gorodnichenko, & Weber, 2020; Forsythe et al., 2020; Gupta et al., 2020; Kong & Prinz, 2020; Kurmann, Lale, & Ta, 2020) but also European countries, such as Ireland, (Crowley, Doran, & Ryan, 2020), Greece (Betcherman et al., 2020), and Northern Europe (Juranek et al., 2020), as well as South Africa (Budlender et al., 2020) and Sub-Saharan Africa (Balde, Boly, & Avenyo, 2020) have also found that COVID-19 has had a consistently negative impact on the labor market.

V.2 Comparison with the 2008 Financial Crisis

Column (1) in Table 4 reports that both COVID-19 and the 2008 Financial Crisis have, on average, reduced employment rates by 0.34%p, while COVID-19 additionally decreased employment rate by 0.48%p, which is significant at the 10% level. The same pattern is found

on unemployment rate (column [2] in Table 4). This finding suggests that the extent of the economic impact of COVID-19 on the labor market appears to be worse than that of the 2008 Financial Crisis. In particular, the decline in employment rates resulting from the outbreak of COVID-19 amounts to approximately 140% of the impact of a usual economic crisis. This magnitude is much larger than the simple difference between the two crises as shown in Table 2. This finding again indicates that simply comparing averages over past periods could underestimate the impact of the COVID-19.

Specifically, columns (3) and (4) in Table 4 show the estimates for the share of temporary workers and the share of self-employed workers. COVID-19 additionally lowers the share of temporary workers out of all employees by approximately 0.58%p, whereas no significant effect exists on the share of self-employed workers. These results suggest that COVID-19 has affected temporary workers more severely than the 2008 Financial Crisis.

Our results are consistent with studies conducted in the US that analyzed the differences between COVID-19 and the 2008 Financial Crisis. Coibion, Gorodnichenko, and Weber (2020) find that the number of unemployed people, including those who gave up seeking employment, was higher than the unemployment indicators suggested using census data, and that this effect is more serious than during the 2008 Financial Crisis.

V.3 Heterogeneous Effects by Individual Characteristics

Heterogeneous Effects by Demographic Characteristics

Table 5 presents a heterogeneous effect of the COVID-19 outbreak depending on the demographic characteristics of the workers. Each Panel reports the estimates on employment and unemployment rate and the share of temporary and self-employed workers, by gender, age, and education level, respectively.

Panel A of Table 5 shows the gender-specific effects. As shown in columns (1)–(3), the effect of COVID-19 on the employment rate, unemployment rate, and the share of

temporary workers did not differ significantly by gender. Although we find gender-specific effects in terms of the share of self-employed workers, this result is only statistically significant at the 10% level. Thus, we conclude that little evidence proves that COVID-19 has had differential impacts on men and women.

Column (1) in Panel B of Table 5 shows the heterogeneous impact of COVID-19 on employment rates by age group. Compared with the omitted age group (those aged 60 or older), those aged 15–24 (-3.15%p) were most severely affected in terms of employment rate, followed by those aged 45–49 (-2.70%p), 25–29 (-2.49%p), and 50–54 (-2.14%p).[2] In terms of unemployment rates, the omitted group (those aged 60 or older) and those aged 15–24, 50–54, and 55–59 exhibit statistically the same negative impact due to COVID-19, whereas other age groups show statistically smaller increases in unemployment rates. As shown in column (3), the share of temporary workers decreased for nearly all age groups, suggesting that temporary workers have been most affected by the unstable employment conditions.

Panel C of Table 5 reports the heterogeneous effects of the outbreak of COVID-19 by education level, compared with high school graduates. As shown in column (1), the employment rate of adults whose education attainment is lower than that of junior colleges, on average, have no difference from that of high school graduates (-1.41%p). By contrast, relative to high school graduates, adults with college or graduate school degrees showed higher employment rates by 1.42%p and 1.75%p. Overall, COVID-19 has had no effect on employment rates among college graduates or those with higher academic degrees. These results are consistent with those in column (2), which shows adults with a college degree or higher experiencing a large reduction in the unemployment rate than high school graduates.

[2] Notably, we do not emphasize our finding of the adverse effect on 15–24 aged workers because most South Koreans enroll in colleges (over 70% of high school graduates). Thus, their labor market attachment is marginal (e.g., 26.1% of employment rate) relative to prime-aged (i.e., aged 25–54) workers (76.0%).

However, in column (3), the share of temporary workers increased from 1.48 to 1.55%p than that of high school graduates, suggesting that the increase in the employment rate of highly educated people after COVID-19 is accounted for by their employment in temporary jobs. Therefore, their economic well-being may be worse due to COVID-19.

Our findings are consistent with previous literature estimating the heterogeneous effects of COVID-19 on the demographic characteristics of workers (Bartik et al., 2020; Béland, Brodeur, & Wright, 2020; Budlender et al., 2020; Crowley, Doran, & Ryan, 2020; Fairlie, Couch, & Xu, 2020; Gupta et al., 2020). Béland, Brodeur, and Wright (2020) report that the impact of COVID-19 on the labor market was more damaging for younger age groups, lower education levels, and Hispanic workers. Using the data from the US, Bartik et al. (2020) find that COVID-19 increased the number of leaves of absence for disabled workers and that their reinstatement rate was lower than other workers. Similar results are found in studies using data from Ireland (Crowley, Doran, & Ryan, 2020) and South Africa (Budlender et al., 2020), suggesting that the COVID-19 outbreak is likely to lead to a worldwide increase in inequality in the labor market.

Heterogeneous Effects by Industry

We further examine whether the effect of COVID-19 on the labor market differed by industry. Table 6 reports the results. Columns (1)–(3) and (4)–(6) present the results of the estimates of the natural logarithm of the number of workers in each industry and the share of each industry in a given cell. All analyses are weighted by the number of employed people aged 15 or older in each cell. We use the manufacturing industry, which is where the largest number of workers are employed (16.90%), as the omitted category out of the 18 industries.

As shown in column (1), COVID-19 has reduced the number of workers across all industries by approximately 6.3%. In particular, the number of workers in the public administration sector is reduced by 12.7% more than the manufacturing sector. This

phenomenon seems to be the result of the reduction or suspension of the operation of public facilities following social distancing policies. Conversely, the number of workers increases in health, transportation, agriculture, leisure services, and international and foreign institutions by 10%–20% than the manufacturing sector. This finding can be attributed to the increase in demand for medical personnel and for online shopping and leisure services due to social distancing. However, concluding that COVID-19 provides stable job opportunities in leisure service industries would be difficult, as an increase in the number of workers in these industries also leads to an increase in temporary workers according to column (2) of Table 6.

Columns (4)–(6) of Table 6 provide estimates of whether the share of a particular industry's workers, among adults aged 15 or older with the same gender, age, and education level, has changed due to COVID-19. This information allows us to examine if the outbreak of COVID-19 has further damaged certain industries. Unlike the previous analysis as shown in column (4), the proportion of employers in the health industry alone increases by approximately 0.57%p, along with a decrease in approximately 0.60%p in the wholesale and retail sectors. Consequently, the decrease in employment resulting from COVID-19 appears to have had a similar effect across industries, except for the wholesale, retail, and health sectors.

Our findings from South Korea are different from other studies, which report a negative impact on the accommodation and service sectors using various data collected in the US (Bartik et al., 2020; Forsythe et al., 2020; Gupta et al., 2020). Confirming which socioeconomic factors have caused these differences is difficult. However, we speculate that these differences may be due to different policy responses. Specifically, unlike in the US, the South Korean government has never imposed stringent lockdowns. Furthermore, the Korean governments provided all households with consumption coupons redeemable only at local businesses from April to August 2020, which may have compensated for the negative effects of COVID-19.

VI. Results based on Region-level Analyses

This section exploits the time and geographical variation in the extent of confirmed cases of COVID-19 to estimate the causal impact of COVID-19 on the labor market. Given that the region-level data contain no information on the characteristics of individual workers, cell fixed effects are replaced by regional fixed effects. Considering that we use a different sample from the one used in Section V and we cannot control for individual characteristics, we first present the baseline results showing that the region-level dataset generates comparable results to those based on individual-level data.

VI.1 Baseline and Comparison with the 2008 Financial Crisis

Table 7 reports the baseline results and differences between the effects of COVID-19 and the 2008 Financial Crisis on the employment and unemployment rates using data aggregated by province level. The effects of COVID-19 are estimated using the regression model shown in equation (1) with the region-fixed effects. The results show that COVID-19 reduces employment rate by 0.82%p but increases the unemployment rate by 0.27%p (column [1] and [3] of Table 7). These results are not statistically different from the previous results where individual workers' characteristics are controlled as presented in columns (1) and (2) of Table 3 (–0.82%p and 0.29%p, respectively), confirming that the results remain robust.

Columns (2) and (4) of Table 7 show how the impact on the labor market caused by COVID-19 is different from the impact of the 2008 Financial Crisis. Similar to the previous results, COVID-19 has an adverse impact on the labor market, reducing the employment rate by approximately 0.40%p more than an average economic crisis at a 5% significance level. Although the coefficient for the unemployment rate is insignificant at the conventional level, a positive coefficient implies that the unemployment rate increased due to COVID-19 than those in the other economic crises. This results again imply that the impact of COVID-19 on the labor

market is much severe than that of the 2008 Financial Crisis.

VI.2 Heterogeneous Effects by Region

Table 8 provides the results of whether COVID-19 has a heterogeneous effect on the employment and unemployment rates using data aggregated by metropolitan areas and provinces. The omitted category is Seoul. In terms of employment rate (column [1]), COVID-19 hit Daegu (-1.92%p) the hardest, followed by Jeju (-1.57%p), and then Chungnam (-1.50%p). By contrast, regions such as Daejeon, Sejong, Jeonbuk, and Jeonnam show no reduction in employment rates. Aforementioned regions are the ones with the least confirmed cases at the domestic level as of June 2020. The next section discusses the detailed analysis of these findings. However, as demonstrated in column (2), Daegu did not experience more severe increase in the unemployment rate than that of Seoul. This trend is due to a decrease in labor force participation rate by 2.30%p in the first half of 2020 than the same period of last year. Our finding is consistent with that of Coibion, Gorodnichenko, and Weber (2020), which through data collected from the US, identifies that the small impact of COVID-19 on the unemployment rate is due to an increase in discouraged workers.

The heterogeneous effects across regions may be explained by different industrial structures. To verify this finding, we examine the correlation between the estimated COVID-19 effect by region and its industrial structure. We use coefficients reported in column (1) in Table 8 to capture the impact of COVID-19. Industry structure is proxied by using the average employment share in each industry sector in 2016, which is the period before the analysis period used to estimate the effects of COVID-19. Panels A and B in Figure 5 present the scatter plots to illustrate the relationship between the coefficients and the proportion of workers in the manufacturing and service sectors, respectively. Both graphs show a strong negative correlation between the employment share of the aforementioned industries and the effect of COVID-19 on the employment rate. In other words, the more workers employed in those

industries, the more likelihood of having a greater impact from COVID-19.

VI.3 Heterogeneous Effects by Intensity of COVID-19

We exploit the variation in the intensity of the COVID-19 outbreak by region to estimate the causal impact of COVID-19 on the labor market outcomes. In column (1) of Table 9, we measure the intensity of COVID-19 in each region using the cumulative number of confirmed cases per 10,000 residents. In column (2), we use the number of new confirmed cases per 10,000 residents at the end of each month. Columns (3) and (4) measure the degree of occurrence by taking the natural logarithm of the estimated values in columns (1) and (2), respectively.

Column (1) shows that one additional confirmed case per 10,000 residents decreases the employment rate by 0.12%p, and this estimate is robust with alternative measures to capture the intensity of COVID-19 in each region. Our finding is consistent with that of Béland, Brodeur, and Wright (2020), which reports the negative effects on employment, unemployment, and working hours according to the intensity of COVID-19 by region.

VII. Conclusion

This research examines the initial impact of COVID-19 on the labor market and compares it to that of the 2008 Global Financial Crisis. We find that the COVID-19 outbreak hurts the overall labor market, decreasing the employment rate but increasing the unemployment rate. Furthermore, we confirm that these negative effects are more severe than those resulting from the 2008 Global Financial Crisis.

The impact on the job market is particularly severe for young adults aged 25–29, middle-aged adults aged 45–54, and adults with less than a junior college degree. The share of temporary workers among all workers has significantly decreased, suggesting that COVID-19 has hurt those with the most vulnerable employment security. Finally, regions with more

confirmed cases of COVID-19 experience a considerable decrease in employment rates but substantial increase in unemployment rates, confirming that COVID-19 accounts for our findings based on time-variations using individual-level data.

REFERENCES

Balde, R., Boly, M., & Avenyo, E. (2020). Labor Market Effects of COVID-19 in Sub-Saharan Africa: An Informality Lens from Burkina Faso, Mali, and Senegal (No. 022). United Nations University-Maastricht Economic and Social Research Institute on Innovation and Technology (MERIT).

Bank of Korea. 2020. The Overview of COVID-19 policy Responses (as of September 24, 2020). Available at: https://www.bok.or.kr/portal/main/contents.do?menuNo=201061.

Bartik, A. W., Bertrand, M., Lin, F., Rothstein, J., & Unrath, M. (2020). Measuring the Labor Market at the Onset of the COVID-19 Crisis (No. w27613). National Bureau of Economic Research.

Beland, L. P., Brodeur, A., & Wright, T. (2020). COVID-19, Stay-at-Home Orders, and Employment: Evidence from CPS Data.

Betcherman, G., Giannakopoulos, N., Laliotis, I., Pantelaiou, I., Testaverde, M., & Tzimas, G. (2020). Reacting Quickly and Protecting Jobs: The Short-Term Impacts of the COVID-19 lockdown on the Greek Labor Market.

Boskin, M. (2020). How Does the COVID Recession Compare?. Available at: https://www.weforum.org/agenda/2020/08/how-does-the-COVID-recession-compare/.

Budlender, J., Jain, R., Bassier, I., & Zizzamia, R. (2020). The Labor Market and Poverty Impacts of COVID-19 in South Africa.

Coibion, O., Gorodnichenko, Y., & Weber, M. (2020). Labor Markets during the COVID-19

Crisis: A Preliminary View. SSRN Electronic Journal.

Crowley, F., Doran, J., & Ryan, G. (2020). The Impact of COVID-19 Restrictions on Workers: Who is Most Exposed? (No. SRERCWP 2020-3). SRERC Working Paper Series.

Fairlie, R. W., Couch, K., & Xu, H. (2020). The Impacts of COVID-19 on Minority Unemployment: First Evidence from April 2020 CPS Microdata (No. w27246). National Bureau of Economic Research.

Forsythe, E., Kahn, L. B., Lange, F., & Wiczer, D. (2020). Labor Demand in the Time of COVID-19: Evidence from Vacancy Postings and UI Claims. *Journal of Public Economics*, 189, 104238.

Government of the Republic of Korea. 2020. COVID-19 Economic Policy Measures (as of September 25, 2020). Available at: http://www.korea.kr/special/policyCurationView.do?newsId=148872965#L2-5.

Gupta, S., Montenovo, L., Nguyen, T. D., Rojas, F. L., Schmutte, I. M., Simon, K. I., Weinberg, B.A., & Wing, C. (2020). Effects of Social Distancing Policy on Labor Market Outcomes (No. w27280). National Bureau of Economic Research.

Heo, C-G., Ahn, S-K, & Kim, C-B. (2009). Waves of the Global Financial Crisis and countermeasures. Policy Research 2009-02. Korea Economic Research Institute.

Juranek, S., Paetzold, J., Winner, H., & Zoutman, F. (2020). Labor Market Effects of COVID-19 in Sweden and its Neighbors: Evidence from Novel Administrative Data. NHH Dept. of Business and Management Science Discussion Paper, (2020/8).

Kong, E., & Prinz, D. (2020). The Impact of Non-pharmaceutical Interventions on Unemployment during a pandemic. Available at SSRN 3581254.

Kurmann, A., Lale, E., & Ta, L. (2020). The impact of COVID-19 on US Employment and Hours: Real-time Estimates with Homebase Data. Available at: http://www.andrekurmann.com/hb_COVID.

Lee, J. & Kim, J. (2020). Current Status and Implications of Domestic and International Economic Stimulus Measures related to COVID-19. Issues and Points (No. 1697). National Assembly Legislative Research Office.

Ministry of Health and Welfare, the Republic of Korea. Coronavirus Infectious Disease-19 Central Disaster and Safety Countermeasure Headquarters Regular Briefing. Press reference. 22 August 2020.

Ministry of Health and Welfare, the Republic of Korea. Coronavirus Infectious Disease-19 Central Disaster and Safety Countermeasure Headquarters Regular Briefing. Press reference. May 3, 2020.

Ministry of Strategy and Finance, the Republic of Korea. Comprehensive Measures to Overcome Economic Challenges. Press release. 3 November 2008.

Ministry of Economy and Finance, the Republic of Korea. The 1st Supplementary Budget in 2020. Press release. March 17, 2020.

Ministry of Economy and Finance, the Republic of Korea. The 2nd Supplementary Budget in 2020. Press Release. April 30, 2020.

Ministry of Economy and Finance, the Republic of Korea. The 3rd Supplementary Budget in 2020. Press release. 3 July 2020.

National Assembly Budget Office, the Republic of Korea. (2008). Analysis of the Revised Budget for 2009.

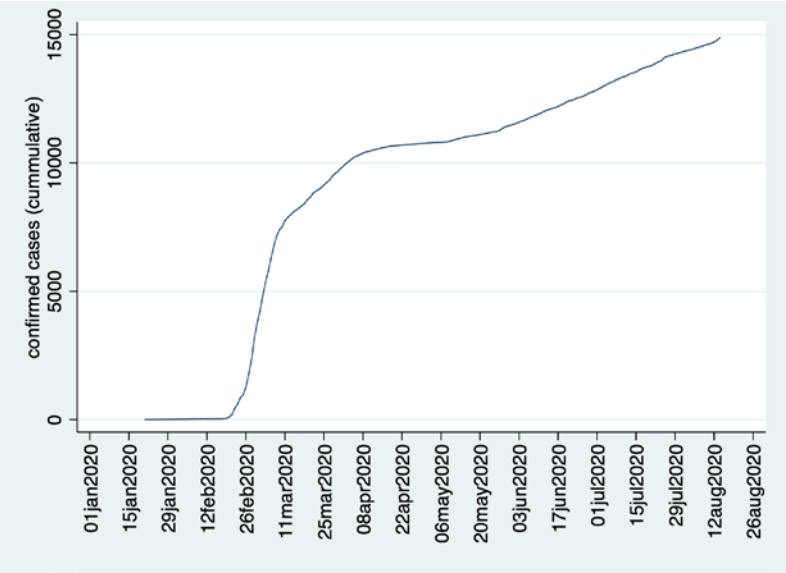
National Assembly Budget Office, the Republic of Korea. (2009). Impact of the Global Financial Crisis and Policy Responses.

OECD. (2020). OECD Economic Outlook, Interim Report September 2020. OECD Publishing, Paris. Available at: https://doi.org/10.1787/34ffc900-en.

Shin, D. (2008). Impact of the Global Financial Crisis and Policy Responses. National Assembly Economic Crisis Response Team Publication Series (No. 2). National

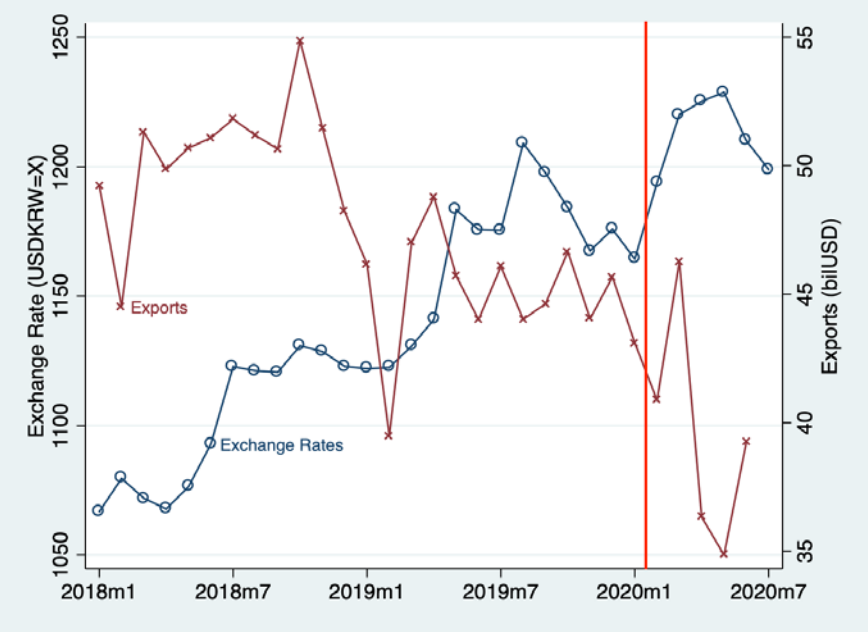
Assembly of the Republic of Korea.

Figure 1: Cumulative Confirmed Cases of COVID-19 in South Korea



Source: Korea Disease Control and Prevention Agency (KDCA),
"Coronavirus Disease-19 Cases in Korea by Metropolitan Areas/Provinces," 2020.01–2020.08.

Figure 2: Trends of Exchange Rates and Exports
Panel A. Comparison of Periods Before and After COVID-19



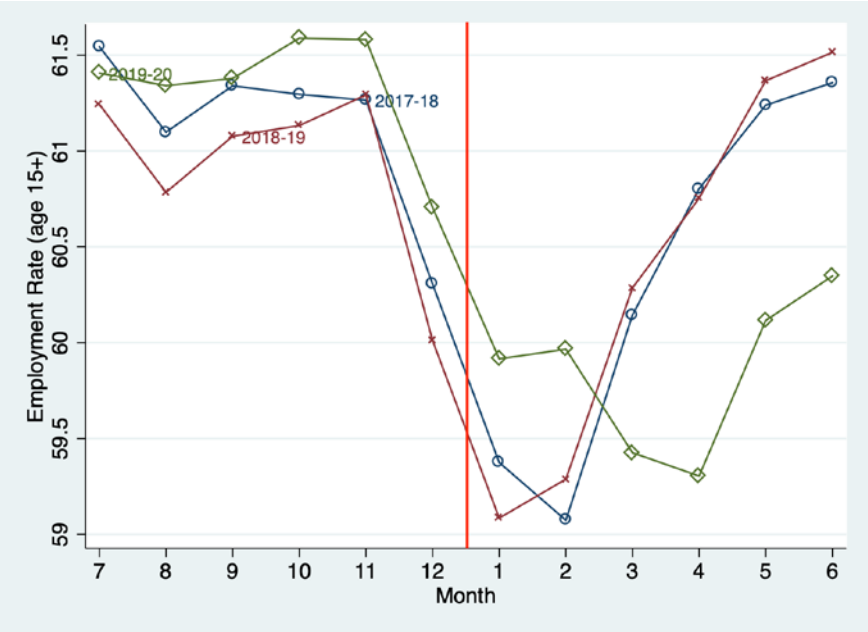
Source: Bank of Korea, "Daily Won Exchange Rate Statistics of Major Currencies," 2018.01–2020.06, Korea International Trade Association, "Trade Statistics by SITC," 2018.01–2020.06

Panel B. Comparison of Periods Before and After the 2008 Financial Crisis

Source: The Bank of Korea, "Daily Won Exchange Rates of Major Currencies," 2007.01–2009.12, Korea International Trade Association, Trade Statistics by SITC," 2007.01–2009.12

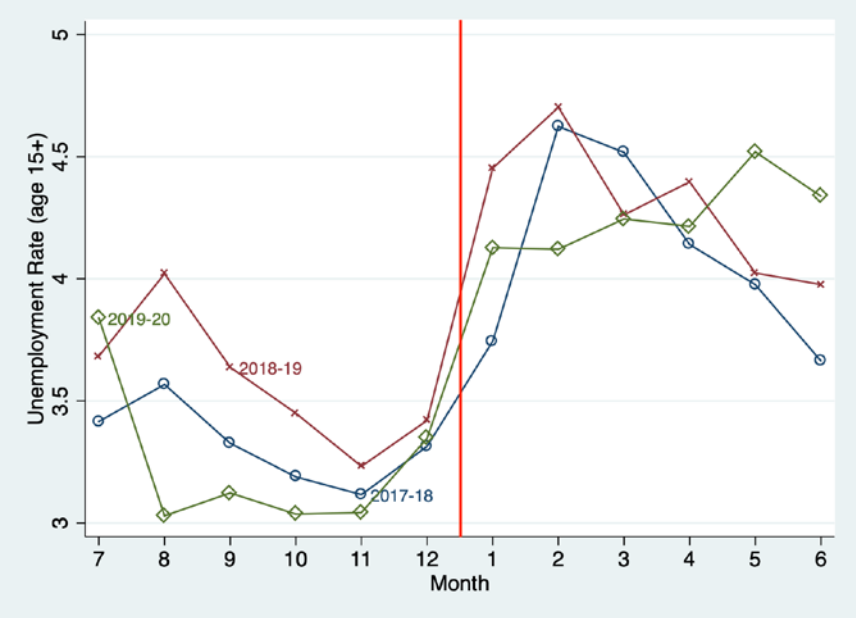
Figure 3: Labor Market Trends Before and After COVID-19 (2017 to 2020)

Panel A. Employment Rate (population aged 15 and over)



Source: Statistics Korea (KOSTAT), "Labor Force Survey." 2017.07–2020.06

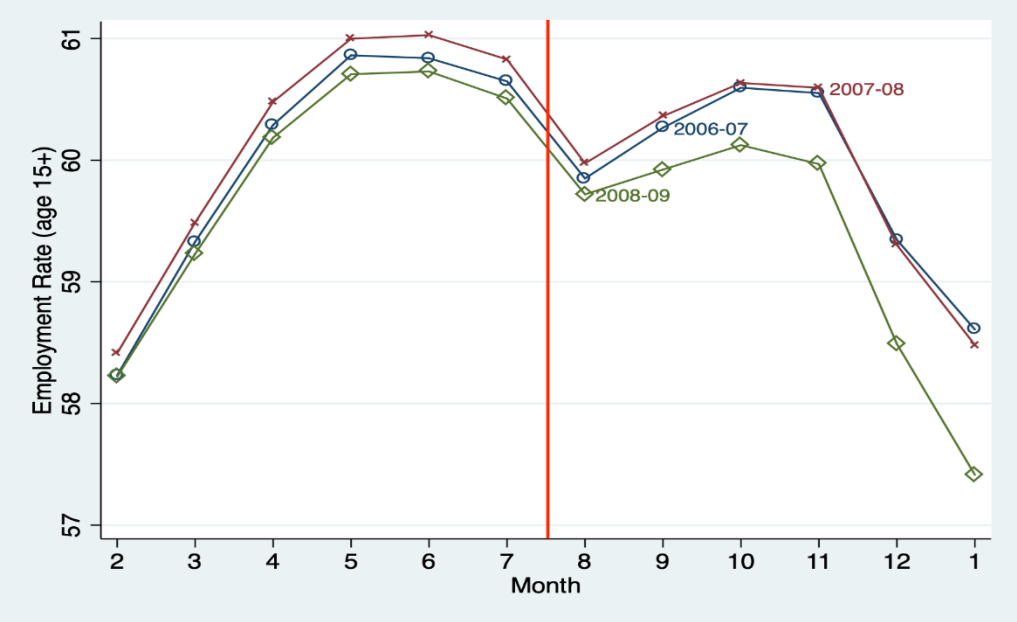
Panel B. Unemployment Rate (population aged 15 and over)



Source: Statistics Korea (KOSTAT), "Labor Force Survey." 2017.07–2020.06

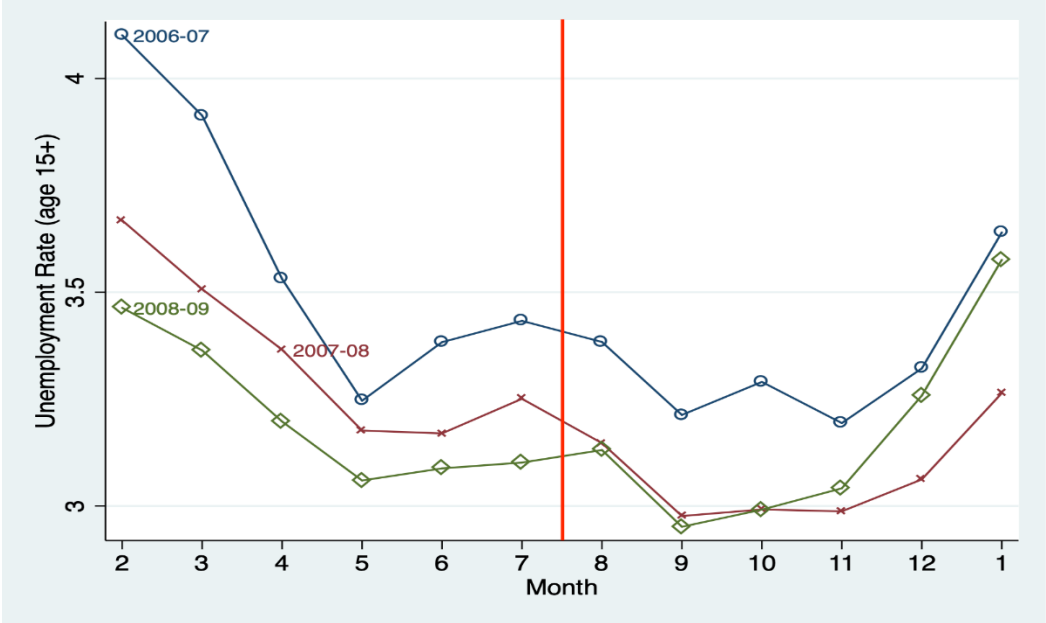
Figure 4: Labor Market Trends Before and After the Financial Crisis (2007 to 2009)

Panel A. Employment Rate (population aged 15 and over)



Source: Statistics Korea (KOSTAT), "Labor Force Survey." 2006.02–2009.01

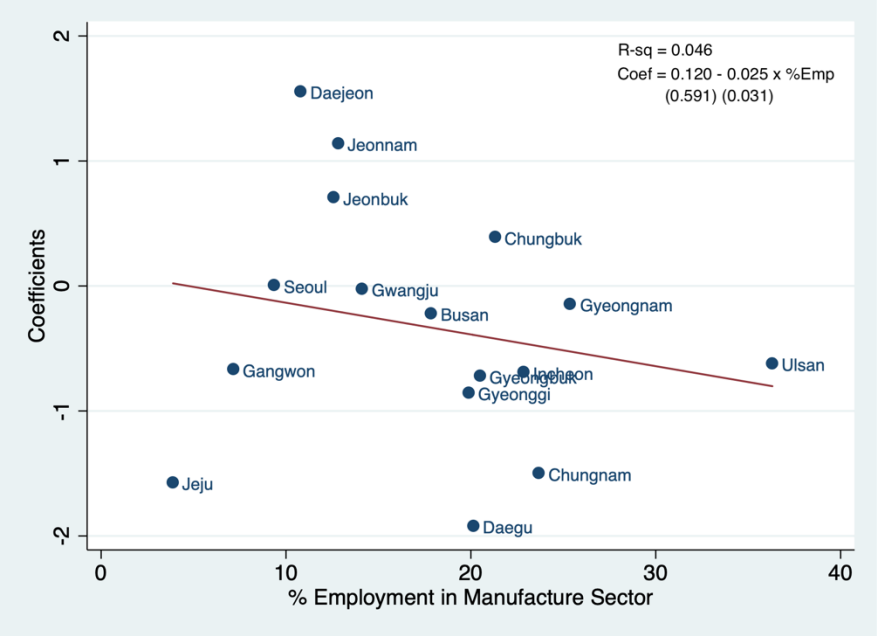
Panel B. Unemployment Rate (population aged 15 and over)



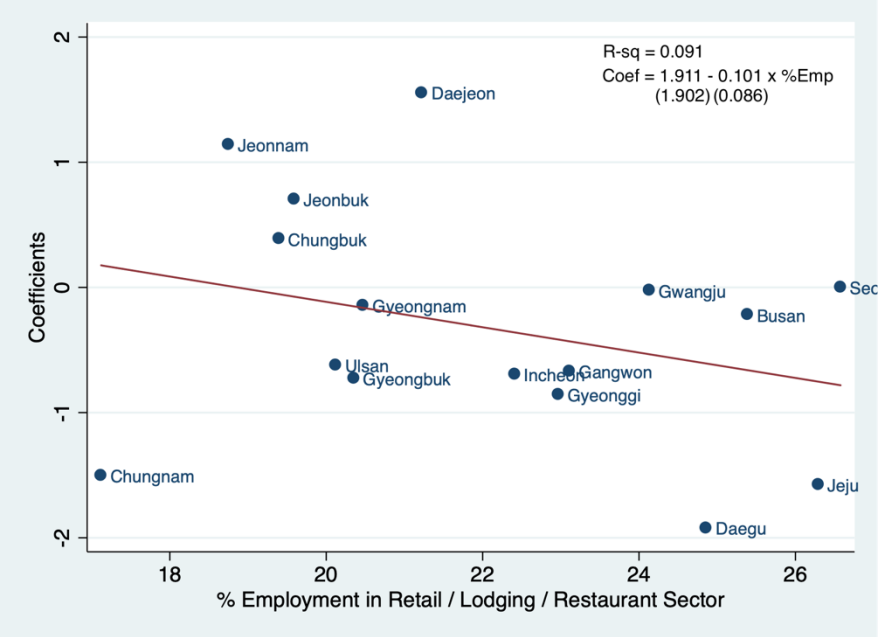
Source: Statistics Korea (KOSTAT), "Labor Force Survey." 2006.02–2009.01

Figure 5: Correlation Between the Impact of COVID-19 by Region and Employment Rates by Industry

Panel A. Correlation with the Employment Share of the Manufacturing Sector



Panel B. Correlation with the Employment Share of the Retail, Lodging, and Restaurant Sector



Source: Statistics Korea, "Labor Force Survey," 2017.07–2020.06.

Notes: Each dot represents the coefficient estimated by the model shown in equation (5) reported in column (1) in Table 8 and the employment share in specific industry in 2016. Sejong Special Self-Governing City is excluded from the sample as data are available from July 2017.

Table 1: Comparison of the Initial Policy Responses to the 2008 Financial Crisis and COVID-19

	2008 Financial Crisis	2020 COVID-19
Monetary policy	-Base interest rate cut by 3.25%p (September 2008–February 2009) -Currency swap with US, China, and Japan -Purchase of Repurchase Agreement (RP) worth 6.5 trillion won (September 2008) -Purchase of Korean treasury bonds worth 1 trillion won (2008 November)	-Base interest rate cut by 0.75%p (March 2020–May 2020) -Approximately $60 billion currency swap with the US (contract signed March 2020) - Purchase of RP worth 3.5 trillion won from securities companies (March 2020) -Purchase of Korean treasury bonds worth 3 trillion won (January 2020–April 2020)
Fiscal policy	-Fiscal spending worth 14 trillion won (November 2008) -Supplementary budget amounting to 10 trillion won (November 2008)	-Fiscal spending worth 277 trillion won (As of July 2020) -Supplementary budgets, amounting to 59 trillion won (1st round:11.7 trillion won, 2nd round: 12.2 trillion won, 3rd round: 35.1 trillion won) -Emergency disaster support (May 2020)
Labor policy	-Transfers for low-income families -Job support for vulnerable groups (18.4 million) and loans to new businesses started by low-income earners -Expansion of youth internship system (increased by 15,000)	-Expansion of employee retention subsidies (April 2020) -Creation of 1.56 million jobs in the public sector (May 2020) -Expansion of emergency employment security support (June 2020)

Table 2: Labor Market Trends Before and After COVID-19 and the 2008 Financial Crisis

Panel A. Individual Characteristics

Variable	Employment Rate				Unemployment Rate			
	2020/1–2020/6 (%) (1)	COVID-19 (%p) (2)	2008/8–2009/1 (%) (3)	Financial Crisis (%p) (4)	2020/1–2020/6 (%) (5)	COVID-19 (%p) (6)	2008/8–2009/1 (%) (7)	Financial Crisis (%p) (8)
Total	59.851	-0.514***	59.268	-0.619***	4.261	0.058*	3.158	-0.040
Gender								
Male	69.609	-0.839***	70.614	-0.814***	4.194	-0.059	3.602	0.030
Female	50.405	-0.222	48.440	-0.479**	4.349	0.214***	2.530	-0.142***
Age								
15–24	25.096	-1.139***	22.427	-3.774***	11.38	-0.043	9.253	0.41***
25–29	67.932	-1.790***	68.545	0.092	8.292	-0.952***	5.955	-0.373***
30–34	76.370	0.804**	70.332	-0.506	4.128	-0.454***	3.716	0.038
35–39	75.072	-0.815*	74.309	-0.937**	2.833	0.177***	2.917	0.464***
40–44	76.285	-0.952**	78.555	-0.233	2.643	-0.046	2.148	-0.107***
45–49	78.081	-1.722***	78.029	0.625*	2.555	0.191***	1.951	0.048*
50–54	76.348	-1.337***	73.972	1.323***	3.055	0.374***	2.096	0.165***
55–59	71.809	-0.677**	65.415	0.662	3.491	0.779***	2.140	0.232***
Over 60	41.416	1.778***	37.032	-0.541**	4.376	0.235***	1.065	-0.197***
Education Level								
Middle school or less	36.535	0.288	41.029	-1.532***	5.033	0.805***	2.136	0.036
High school	59.660	-1.843***	62.148	-0.865***	4.598	0.186***	3.862	-0.024
Junior College	74.383	-1.063***	75.615	-0.388	4.697	0.308***	3.784	-0.342***
College	73.222	-0.276	73.812	-0.684*	3.637	-0.526***	2.768	-0.007
Graduate or more	81.028	-0.803	84.613	-1.756**	1.619	-0.362***	1.355	0.097

Source: Statistics Korea (KOSTAT), "Labor Force Survey"

Notes: The employment rate is weighted by the population aged 15 or older in each cell, and the unemployment rate is weighted by the labor force in each cell. Columns (1) and (5) report the average employment and unemployment rates between January and June 2020. Columns (2) and (6) report the differences between the rates reported in columns (1) and (5) and the average employment and unemployment rates from January–June 2018 and January–June 2019. Columns (3) and (7) report the average employment and unemployment rates between August 2008 and January 2009. Columns (4) and (8) report the differences between the rates reported in columns (3) and (7) and the average employment and unemployment rates from August 2007–January 2008 and August 2006–January 2007. *p < 0.10, **p < 0.05, ***p < 0.01

Table 2. Labor Market Trends Before and After COVID-19 and the 2008 Financial Crisis
Panel B. Regions

Variable	Employment Rate				Unemployment Rate			
	2020/1–2020/6 (%) (1)	COVID-19 (%p) (2)	2008/8–2009/1 (%) (3)	Financial Crisis (%p) (4)	2020/1–2020/6 (%) (5)	COVID-19 (%p) (6)	2008/8–2009/1 (%) (7)	Financial Crisis (%p) (8)
All	59.917	-0.534***	59.365	-0.618***	4.234	0.027***	3.164	-0.043***
Seoul	59.333	-0.209***	59.532	-1.093***	4.900	-0.166***	3.900	-0.333***
Busan	55.351	-0.391***	54.750	-1.183***	4.597	0.013**	3.850	-0.024***
Daegu	55.650	-2.050***	55.983	-1.308***	4.150	-0.446***	3.968	0.424***
Incheon	61.250	-1.300***	58.749	-0.965***	4.734	0.043***	3.764	-0.340***
Gwangju	58.700	-0.350***	55.784	-0.445***	3.968	-0.269***	3.667	-0.256***
Daejeon	60.133	1.392***	56.999	0.263***	5.100	0.424***	3.631	-0.524***
Ulsan	58.017	-0.893***	60.082	1.117***	4.774	0.092***	3.819	1.171***
Sejong	62.190	0.511***	-	-	3.204	0.711***	-	-
Gyeonggi	60.599	-1.168***	60.081	-0.450***	4.117	0.109***	3.047	-0.035***
Gangwon	60.369	0.283***	57.512	-0.484***	4.439	0.527***	1.796	0.199***
Chungbuk	62.968	0.499***	58.796	0.725***	3.412	0.323***	2.260	0.064***
Chungnam	61.483	-1.258***	60.942	-2.628***	3.938	0.710***	2.739	0.456***
Jeonbuk	58.933	0.659***	57.981	-0.277***	2.818	-0.213***	2.117	-0.179***
Jeonnam	63.449	1.308***	63.833	-0.160***	2.816	-0.492***	1.930	0.206***
Gyeongbuk	60.534	-0.366***	63.182	0.525***	4.542	0.005	2.074	-0.105***
Gyeongnam	60.534	-0.401***	60.931	0.106***	4.152	0.306***	2.463	0.265***
Jeju	66.734	-1.498***	67.467	-1.416***	2.982	0.787***	1.582	-0.281***

Source: Statistics Korea (KOSTAT), "Population Survey."
Notes: See notes in Panel A of Table 2.

Table 2. Labor Market Trends Before and After COVID-19 and the 2008 Financial Crisis
Panel C. Industries

Variable	Number of Employees (thousand)				% of Industry in the Cell			
	2020/1–2020/6 (%) (1)	COVID-19 (%p) (2)	2008/8–2009/1 (%) (3)	Financial Crisis (%p) (4)	2020/1–2020/6 (%) (5)	COVID-19 (%p) (6)	2008/8–2009/1 (%) (7)	Financial Crisis (%p) (8)
All	22,448	170	19,974	196	6.411	-0.028*	6.345	0.022
Manufacturing	51,202	-1,037	49,928	-396	16.46	-0.331***	16.81	-0.564***
Wholesale and Retail	41,544	-1,807	43,619	-331	13.274	-0.656***	15.47	-0.372***
Business service	30,312	2,040	21,695	1,961*	9.269	0.171***	7.514	0.571***
Accommodation & restaurant	26,852	-629	26,688	-408	8.219	-0.345***	8.712	-0.110
Health	28,394	2,983	10,928	1,806**	8.575	0.790***	3.819	0.653***
Construction	25,807	-825	25,329	-876	7.460	-0.183***	7.750	-0.279***
Education	23,422	-368	21,856	401	6.795	-0.181**	7.588	0.115
Electronics, water, & other individual service	17,321	179	16,870	-283	5.319	-0.088***	6.151	0.045*
Transportation, warehousing	20,595	457	18,925	218	5.721	0.250***	5.456	-0.018
Agriculture	19,828	1,752	24,780	758	5.615	0.530***	7.729	0.098
Public service	13,862	-130	11,686	1,317*	3.978	-0.105***	3.577	0.123***
ICT	11,876	-173	10,143	50	3.292	-0.018	2.994	-0.071**
Finance and insurance	11,328	-50	11,529	105	2.998	-0.139***	3.770	0.215***
Real estate	8,575	28	7,500	359	2.115	-0.032*	2.167	0.012
Leisure	6,610	634*	5,911	631*	1.899	0.161***	1.905	0.251***
Household production	5,323	1,762**	5,113	-1,940**	1.158	0.477***	1.378	-0.326***
Mining	829	-29	984	96	0.149	-0.013***	0.192	0.021***
Int'l. & foreign organization	1,247	238***	1,193	65	0.235	0.024***	0.252	0.031***

Source: Statistics Korea (KOSTAT), "Population Survey."
Notes: See notes in Panel A of Table 2.

Table 3. Impact of COVID-19 on Labor Market based on Individual-level Data

Sample	**Aged 15+**	**Labor Force**	**Employed**	
Dep. Variables	Employment	Unemployment	% of Temporary workers	% of Self-employed workers
	(1)	(2)	(3)	(4)
Recession	-0.820***	0.290**	-0.717***	-0.030
	(0.216)	(0.136)	(0.159)	(0.128)
R-sq	0.993	0.789	0.944	0.987
Mean Dep.	60.66	3.799	14.03	12.69
No Obs.	3,168	3,167	3,168	3,168

Source: Statistics Korea (KOSTAT), "Labor Force Survey."

Notes: Columns (1), (3)–(4) are weighted by the population aged 15 or older in each cell, and column (2) is weighted by the labor force in each cell. Month, fiscal year and cell (gender x age x education) fixed effects are controlled. Standard errors reported in parentheses, are clustered at cell. *p < 0.10, **p < 0.05, ***p < 0.01

Table 4. Comparison of Labor Market Impacts of the 2008 Financial Crisis and COVID-19 based on Individual-level Data

Sample	**Aged 15+**	**Labor Force**	**Employed**	
Dep. Variables	Employment	Unemployment	% of Temporary workers	% of Self-Employed workers
	(1)	(2)	(3)	(4)
Recession	-0.338**	0.216*	-0.137	-0.099
	(0.169)	(0.121)	(0.162)	(0.136)
Additional COVID-19	-0.483*	0.075	-0.582**	0.068
	(0.244)	(0.173)	(0.250)	(0.202)
R-sq	0.984	0.785	0.889	0.964
Mean Dep.	60.29	3.561	16.21	13.96
No Obs.	6,253	6,151	6,253	6,253

Source: Statistics Korea (KOSTAT), "Labor Force Survey."

Notes: Columns (1), (3) – (4) are weighted by the population aged 15 or older in each cell, and column (2) is weighted by the labor force in each cell. Month, fiscal year and cell (gender x age x education) fixed effects are controlled. Standard errors reported in parentheses, are clustered at cell. *p < 0.10, **p < 0.05, ***p < 0.01

Table 5. Heterogenous Impact of COVID-19

Sample	**Aged 15+**	**Labor Force**	**Employed**	
Dep. Variables	Employment	Unemployment	% of Temporary workers	% of Self-Employed workers
No Obs.	3,168	3,167	3,168	3,168
	(1)	(2)	(3)	(4)
Panel A. by Gender				
Recession	-1.209***	0.082	-0.713**	-0.341
	(0.352)	(0.185)	(0.312)	(0.216)
X Female	0.764	0.488	-0.008	0.613*
	(0.573)	(0.304)	(0.452)	(0.340)
R-sq	0.993	0.790	0.944	0.987
Mean Dep.	60.66	3.799	14.03	12.69
Panel B. by Age				
Recession	0.635	0.987***	0.154	0.457*
	(0.485)	(0.277)	(0.250)	(0.261)
X aged 15–24	-3.147***	-0.039	-1.207**	-0.030
	(0.881)	(0.446)	(0.581)	(0.266)
X aged 25–29	-2.490***	-1.488**	-0.660	0.748***
	(0.698)	(0.696)	(0.600)	(0.269)
X aged 30–34	0.049	-1.350**	0.091	0.0221
	(0.740)	(0.622)	(0.523)	(0.456)
X aged 35–39	-1.389*	-0.966**	-0.803	0.571
	(0.704)	(0.374)	(0.528)	(0.482)
X aged 40–44	-1.740**	-1.076**	-1.241*	-1.283***
	(0.817)	(0.439)	(0.708)	(0.458)
X aged 45–49	-2.697***	-0.819**	-1.949***	-1.771**
	(0.765)	(0.355)	(0.576)	(0.719)
X aged 50–54	-2.140**	-0.627	-1.797**	-1.457**
	(0.871)	(0.477)	(0.698)	(0.567)
X aged 55–59	-1.474	-0.268	-1.459**	-1.783***
	(0.962)	(0.432)	(0.681)	(0.638)
R-sq	0.993	0.793	0.946	0.988
Mean Dep.	60.66	3.799	14.03	12.69
Panel C. by Education Level				
Recession	-1.414***	0.316	-1.596***	-0.002
	(0.449)	(0.229)	(0.355)	(0.190)
X Middle School	0.749	1.222***	1.605***	0.130
	(0.935)	(0.257)	(0.475)	(0.426)
X Junior College	0.133	0.0208	0.712	-0.0164
	(0.731)	(0.359)	(0.614)	(0.547)
X College	1.416**	-0.568**	1.545***	-0.218
	(0.662)	(0.278)	(0.420)	(0.515)
X Graduate or more	1.748**	-0.808***	1.478***	-0.0678
	(0.786)	(0.306)	(0.561)	(0.801)
R-sq	0.993	0.794	0.946	0.987
Mean Dep.	60.66	3.799	14.03	12.69

Source: Statistics Korea (KOSTAT), "Labor Force Survey."

Notes: Columns (1), (3)–(4) are weighted by the population aged 15 or older in each cell, and column (2) is weighted by the labor force in each cell. In panels A, B, and C, males, age over 60, and high school graduates are the omitted groups, respectively. Month, fiscal year, and cell (gender x age x education) fixed effects are controlled. Standard errors reported in parentheses, are clustered at cell. *p < 0.10, **p < 0.05, ***p < 0.01

Table 6. Impact of COVID-19 on Labor Market by Industry

Dep. Variables	Log No of Employees			Share by Industry in the Cell		
Sample	Workers	Temp. workers	Self-employed workers	Workers	Temp. workers	Self-employed workers
	(1)	(2)	(3)	(4)	(5)	(6)
Recession	-0.063*	-0.040	-0.128**	0.086	0.295	-0.550
	(0.034)	(0.063)	(0.057)	(0.213)	(0.306)	(0.340)
X Wholesale/Retail	0.034	-0.078	0.107	-0.604**	-1.659***	-0.276
	(0.055)	(0.080)	(0.073)	(0.283)	(0.409)	(0.560)
X Business Service	0.053	0.048	0.107	0.040	-0.307	0.907**
	(0.052)	(0.091)	(0.098)	(0.280)	(0.412)	(0.447)
X Accommodation.	-0.028	-0.086	0.099	-0.196	-0.986**	0.813
	(0.060)	(0.080)	(0.085)	(0.261)	(0.471)	(0.544)
X Health	0.102**	0.084	0.181	0.565*	0.941	0.644*
	(0.047)	(0.086)	(0.116)	(0.306)	(0.694)	(0.374)
X Construction	0.030	0.094	0.106	-0.163	0.122	0.059
	(0.051)	(0.079)	(0.097)	(0.253)	(0.402)	(0.495)
X Education Service	-0.018	-0.019	0.096	-0.408	-0.253	0.237
	(0.055)	(0.088)	(0.095)	(0.259)	(0.427)	(0.411)
X Electronics etc.	0.007	-0.177*	0.187**	-0.067	-0.984**	1.084**
	(0.052)	(0.100)	(0.092)	(0.262)	(0.471)	(0.470)
X Transportation.	0.138**	0.025	0.130	0.188	-0.014	1.340***
	(0.068)	(0.091)	(0.090)	(0.253)	(0.382)	(0.484)
X Agriculture	0.114*	0.111	0.174**	-0.030	-0.399	0.980**
	(0.066)	(0.108)	(0.085)	(0.236)	(0.345)	(0.438)
X Public service	-0.127**	0.184**	-	-0.297	-0.011	0.552
	(0.060)	(0.090)	-	(0.250)	(0.332)	(0.350)
X ICT	0.047	0.044	0.147	0.007	-0.326	0.666*
	(0.064)	(0.117)	(0.124)	(0.246)	(0.332)	(0.387)
X Finance	-0.063	-0.007	-0.341***	-0.224	-0.162	0.222
	(0.057)	(0.088)	(0.128)	(0.239)	(0.395)	(0.359)
X Real estate	-0.000	-0.205**	0.081	-0.221	-0.896**	0.264
	(0.066)	(0.095)	(0.101)	(0.233)	(0.371)	(0.392)
X Leisure	0.121**	0.174*	0.221**	0.072	0.028	0.812**
	(0.058)	(0.092)	(0.098)	(0.230)	(0.371)	(0.401)
X Household prod.	0.253	0.309	-0.153	0.246	1.068**	0.357
	(0.187)	(0.196)	(0.179)	(0.250)	(0.533)	(0.380)
X Mining	-0.116	0.294***	0.237***	-0.114	-0.290	0.557
	(0.090)	(0.068)	(0.056)	(0.221)	(0.307)	(0.350)
X Int'l. & foreign	0.204*	0.173**	-	-0.052	-0.279	0.552
	(0.104)	(0.069)	-	(0.220)	(0.305)	(0.346)
R-sq	0.942	0.856	0.895	0.976	0.947	0.964
Mean Dep.	7.390	10.07	11.99	6.425	6.419	6.233
No Obs.	43,260	31,427	25,186	43,189	36,563	34,671

Source: Statistics Korea (KOSTAT), "Labor Force Survey."

Notes: Month, fiscal year, and cell (gender x age x education) fixed effects are controlled. Manufacturing sector is the omitted group. Standard errors reported in parentheses, are clustered at cell. *p < 0.10, **p < 0.05, ***p < 0.01

Table 7. Impact of COVID-19 on Labor Market using Aggregated data by Region

Dep. Variables	**Employment Rate**		**Unemployment Rate**	
	(1)	(2)	(3)	(4)
COVID-19	-0.824***	-	0.269**	-
	(0.112)	-	(0.095)	-
Recession	-	-0.429**	-	0.230***
	-	(0.160)	-	(0.076)
Additional COVID-19	-	-0.396**	-	0.040
	-	(0.146)	-	(0.128)
R-sq	0.864	0.796	0.702	0.757
Mean Dep.	60.74	60.37	3.805	3.565
No Obs.	612	1,188	612	1,188

Source: Statistics Korea (KOSTAT), "Employment/Unemployment rate by Metropolitan Areas & Provinces."
Notes: Columns (1)–(2) are weighted by the population aged 15 or older, while columns (3)–(4) are weighted by the labor force in each region. Month, fiscal year, and regional fixed effects are controlled. Standard errors reported in parentheses, are clustered at regional level. *p < 0.10, **p < 0.05, ***p < 0.01

Table 8. Impact of COVID-19 on Labor Market by Province

Dep. Variables	**Employment Rate**	**Unemployment rate**
	(1)	(2)
Recession	-0.423**	0.090
	(0.173)	(0.136)
X Busan	-0.220***	0.192***
	(0.000)	(0.000)
X Daegu	-1.920***	-0.172***
	(0.001)	(0.001)
X Incheon	-0.692***	0.103***
	(0.001)	(0.001)
X Gwangju	-0.026***	0.054***
	(0.000)	(0.000)
X Daejeon	1.556***	0.753***
	(0.000)	(0.001)
X Ulsan	-0.622***	0.242***
	(0.000)	(0.001)
X Sejong	0.766***	0.339***
	(0.006)	(0.006)
X Gyeonggi	-0.856***	0.014***
	(0.001)	(0.001)
X Gangwon	-0.671***	1.006***
	(0.000)	(0.002)
X Chungbuk	0.386***	0.477***
	(0.001)	(0.001)
X Chungnam	-1.501***	0.665***
	(0.001)	(0.002)
X Jeonbuk	0.706***	-0.089***
	(0.000)	(0.001)
X Jeonnam	1.139***	-0.191***
	(0.000)	(0.000)
X Gyeongbuk	-0.725***	0.527***
	(0.000)	(0.000)
X Gyeongnam	-0.145***	0.537***
	(0.001)	(0.001)
X Jeju	-1.574***	0.586***
	(0.002)	(0.001)
R-sq	0.877	0.716
Mean Dep.	60.74	3.805
No Obs.	612	612

Source: Statistics Korea (KOSTAT), "Employment/Unemployment rate by Metropolitan Areas & Provinces."
Notes: Column (1) is weighted by the population aged 15 or older, while column (2) is weighted by the labor force in each region. Seoul is the omitted group. Month, fiscal year, and regional fixed effects are controlled. Standard errors reported in parentheses, are clustered at regional level. *p < 0.10, **p < 0.05, ***p < 0.01

Table 9. Impact of COVID-19 on Labor Market by the Intensity of COVID-19

Sample	Cumulative confirmed cases (per 10,000) (1)	Monthly new confirmed cases (per 10,000) (2)	Log (cumulative confirmed cases) (per 10,000) (3)	Log (new confirmed cases) (per 10,000) (4)
Panel A. Employment Rate				
Treat x COVID-19 Intensity	-0.115***	-0.184***	-0.253***	-0.271***
	(0.017)	(0.034)	(0.023)	(0.029)
R-sq	0.865	0.860	0.878	0.873
Mean Dep.	60.74	60.74	60.74	60.74
No. Obs.	612	612	612	612
Panel B. Unemployment Rate				
Treat x COVID-19 Intensity	0.006	-0.031*	0.046**	0.022
	(0.009)	(0.015)	(0.020)	(0.027)
R-sq	0.698	0.698	0.702	0.698
Mean Dep.	3.805	3.805	3.805	3.805
No. Obs.	612	612	612	612

Source: Statistics Korea (KOSTAT), "Employment/Unemployment rate by Metropolitan Areas & Provinces;" Korea Disease Control and Prevention Agency (KDCA), "Coronavirus Disease-19 Cases in Korea by Metropolitan Areas/Provinces."

Notes: The dependent variable of Panel A is the employment rate, weighted by the population aged 15 or older in each cell. The dependent variable of Panel B is the unemployment rate, weighted by the labor force of each region. Columns (1) and (2) use the number of confirmed cases and monthly new confirmed cases as of the end of each month. Columns (3) and (4) use the measure by taking the natural logarithm of the estimated values in columns (1) and (2), respectively. Month, fiscal year, and regional fixed effects are controlled. Standard errors reported in parentheses, are clustered at cell. *p < 0.10, **p < 0.05, ***p < 0.01