Uneven Use of Remote Work to Prevent the Spread of COVID-19 in South Korea's Stratified Labor Market

Joonmo Cho[1], Sanghee Lee*[2] and Saejung Park*[3]

Abstract

This research analyzed South Korean companies' adoption of remote work during the COVID-19 pandemic, by focusing on the dual labor market structure comprising of the primary (large corporations) and the secondary sectors (small and medium enterprises (SMEs)). Companies in the dual labor market were classified as per firm size. We used Statistics Korea's August supplementary data from the Economically Active Population Survey, covering 2017–2020. This empirical study analyzed the factors affecting remote work in 2020, after the outbreak of the pandemic. The results showed that the probability of large corporations introducing remote work during the pandemic increased by a significantly larger margin than for small and medium-sized firms. This suggests that the polarization within the dual labor market structure between large corporations and SMEs also spilled over into companies' adoption of remote work, which was initially introduced to prevent the spread of the pandemic. Additionally, the polarization in the use of digital technology is likely to persist even after the pandemic. Hence, based on our analysis of remote work adoption in the dual labor market, this study examined the system and factors of labor-management relations contributing toward such polarization and presented policy directions for the current labor market structure.

Keywords: COVID-19, remote work, dual labor market, polarization, collective bargaining, rule revision unfavorably to workers

[1] Professor of Department of Economics, Sungkyunkwan University, 25-2, Sungkyunkwan-ro, Jongno-gu, Seoul 03063, Korea, trustcho@skku.edu

[2] Corresponding author, Professor of Department of Consilience, Korea Polytechnic University, 237, Sangidaehak-ro, Siheung, Gyeonggi-Do 15073, Korea, lsh2008@kpu.ac.kr, lsh5008@gmail.com

[3] Corresponding author, HRD center researcher, Department of Economics, Sungkyunkwan University, 25-2, Sungkyunkwan-ro, Jongno-gu, Seoul 03063, Korea, sjsj.econ@gmail.com

1. Introduction

After the outbreak of the COVID-19 pandemic, businesses worldwide have increased the use of remote work to continue corporate activities during this period. Although the use of remote work is expected to continue even in the post-pandemic era, the extent of its adoption is likely to vary depending on the countries' labor environment and the characteristics of its economic entities. This difference is likely to lead toward variations in the effects of remote work on the labor market [1].

The pandemic has been present for more than a year now, producing the largest economic suspension the world has ever experienced in modern history. Each nation has had to face various challenges, such as the fear of infection from the virus, suspension of production in plants, interruption of business trips, travel, and accommodation services, as well as obstacles in providing essential services offline. Consequently, various national governments have developed and implemented both short and long-term measures to cope with these issues.

The lockdown, regarded as one of the most stringent measures to combat the spread of the virus, resulted in the halt of production and services. Consequently, remote work has emerged as a new mode of work in response to the suspension of production and services. In Denmark, Netherlands, and Sweden, approximately 30% of the workers relied on remote work before and after the pandemic-induced lockdown [2]. Over half the workers in Netherlands and Denmark, and approximately 40% of the workers in Sweden worked from home [2]. In the United States, employees working from home more than doubled the number compared to the number in 2017 and 2018 [3]. Due to the rapid and global increase in remote work, in July 2020, the International Labor Organization(ILO) prepared and distributed a practical guide addressing the need for special legal protections and caution about various types of remote work, while noting that remote work has blurred the boundaries between paid work and the personal lives of the workers [4].

In South Korea (henceforth, simply Korea), although remote work had already been adopted before the pandemic, only 3% of the companies implemented it in 2016 [5]. A Ministry of Employment and Labor survey in 2019 regarding the intention of firms to introduce remote work showed that only 4% of the respondents intended to adopt remote work, indicating that the reluctance of Korean businesses to implement this policy [6]. However, remote work has emerged as a prominent temporary measure to maintain a certain level of production and services amidst setbacks and as a measure to prevent the spread of COVID-19 [7].

In mid-February, due to the rapid increase in COVID-19 cases in Daegu, the Korean government implemented restrictions on local movement and promoted social distancing between the people in Daegu and its neighborhood. Nevertheless, the sudden adoption of the remote work system was ill-equipped to sustainably tackle the economic crisis at home and abroad. Therefore, many businesses eventually began reverting to the offline mode of work [8]. However, with the resurgence of new cases, the government decided to reinstate remote work and started a social distancing campaign to prevent the spread of the infection [9]. Realizing that the pandemic would not end in the near future, Korean businesses have started building remote work infrastructure [10] for the future, thus relying on offline work when the pandemic slowed down and implementing remote work when the cases surged. Some scholars have argued that polarization, one of the major issues facing the Korean labor market, could be a likely cause affecting the adoption of remote work by firms during the COVID-19. Conversely, the companies' use of remote work to overcome the impact of the pandemic is expected to further deepen the polarization of the labor market. Therefore, the impact of polarized labor market on remote work implemented during the pandemic needs to be analyzed for devising measures to address this issue. To this end, this research analyzed the use of remote work amidst the pandemic with a focus on the dual labor market structure, which is comprised of the primary sector (large corporations) and secondary sector (small and medium enterprises (SMEs)).

Using the 2020 August supplementary report by the Economically Active Population Survey (EAPS), which was conducted after the outbreak of the pandemic, this study analyzed the variation in the rate of remote work adoption by firm size. It empirically examined how the use of remote work—adopted as a means of preventing the spread of the infection—has evolved depending on the size of the business. Based on the empirical analysis, this study identified the significant and urgent measures required to overcome the effects of the pandemic in a dual labor market structure. Moreover, as remote work is likely to continue in the post-pandemic era, this study sought to identify the factors of dual labor market structure that are likely to hinder the spread of remote work while presenting some

suggestions to address these factors.

2. Literature on remote work during COVID-19 and the labor market polarization

2.1 COVID-19 outbreak and deepening of the labor market polarization

COVID-19 has severely and adversely affected countries' economies, industries, and the daily lives of citizens. Although the pandemic's impact on the labor market varied from country to country, it accelerated the polarization that existed even before its outbreak. Numerous recent studies have predicted the possibility that the pandemic may further intensify polarization in the local labor market. The OECD announced that COVID-19 would especially impact low-wage and unstable jobs, and workers from these types of jobs would be more seriously affected by the social distancing rule and lockdown measures in the service sectors such as restaurants and hotels [11]. Furthermore, the OECD maintained that due to the coronavirus, self-employed, temporary workers, and part-time laborers were significantly exposed to risk of unemployment and income loss, and that the lockdown measures taken by the European members of the OECD could adversely affect nearly 40% of the jobs in such vulnerable sectors [12].

The World Bank has also stressed the importance of support in hiring and maintaining the productivity of vulnerable, informal economy workers and small firms to cope with the negative effect of COVID-19 [13]. Additionally, the ILO also highlighted the pandemic's negative impact on SMEs, and small business owners, the self-employed, informal economy workers, temporary workers, and new types of workers working in the gig economy. COVID-19 is expected to further aggravate labor poverty and inequality because its negative effect is more damaging to small business owners and workers who were already vulnerable [14]. An IMF Working Paper also warned that the COVID-19 outbreak could deepen inequity in Asia, especially related to gender-based income inequality and economic imbalance between cities and rural areas [15].

Empirical studies reporting about the pandemic-induced polarization in the local labor market also presented similar predictions. A US-based study on the effect of COVID-19 on job markets argued that the reduction in hiring due to the pandemic was the most prominent in low-income communities and areas with a wide income gap. The study also found that a fall in hiring was the most severe in industries with a high unionization rate and in local service sectors such as education, public health, retail, and construction [16].

Some studies reported that the coronavirus pandemic particularly adversely affected the female workers. They found that in the United States, married women was more likely to have experienced reduced work hours or job loss due to COVID-19, suggesting its long-term effect on female employment and the deepening of gender inequality [17]. In addition, other studies found that whereas cyclical economic downturns had a more significant impact on male jobs, social distancing rules amidst COVID-19 had greater impact on the employment of female workers than males [18].

2.2 Working from home amidst COVID-19 pandemic and labor market polarization

Working from home is necessary for reducing economic loss while maintaining economic activity during the pandemic, and can also potentially improve other social and economic indicators such as productivity, employee welfare, and reduce local income inequality [19]. In most countries, work from home has been largely induced by the coronavirus pandemic. Nevertheless, although the OECD has cited the advantages of working from home as a response to the pandemic, in reality, its use has been confined to only a limited number of workers. In fact, in the UK and Europe, prior to COVID-19, remote work was only allowed to high-paying employees such as managers, professionals, public administrators, and other senior business staff [20]. In contrast, after the pandemic, low-income workers are more likely to lose their jobs because they are ill prepared for remote work and are pessimistic about continuing earning income through remote work, whereas people in high-income positions are 50% more likely to work remotely [21]. Furthermore, the COVID-19 crisis is prompting employers to extend remote working opportunities where possible, leading to greater investment in remote work infrastructures, which could bring some long-term benefits. However, these measures would not help frontline workers who cannot work remotely and are more exposed to infection [22].

An International Monetary Fund Working Paper reported that after the COVID-19 outbreak, hiring was most severely hit in sectors where remote work is not possible, such as service sector jobs in hospitality and tourism industries. In addition, workers from industries where remote work is not

affordable are more likely to earn lesser average income than those in other industries. Thus, overall, the pandemic would exacerbate income inequality in sectors where remote work is not possible [23]. Empirical studies have found that the COVID-19 pandemic will further deteriorate the labor market inequality between workers who can work remotely and those who cannot. Studies that analyzed the practice of remote work in the UK, the US, and Germany after the pandemic found that in all three countries, workers who can work from home during the pandemic are far less likely to lose their jobs, whereas workers exposed to the risk of infection are more likely to become unemployed. Moreover, in the United States and the UK, workers who work remotely for fewer hours are more likely to experience a decrease in income [24].

In Germany, a study that assessed employment inequality during the lockdown from the first wave of the pandemic found that while low-income workers seriously suffered from unemployment, employees with superior qualifications could afford to work remotely. Employees who continue to work from home are much less concerned about their job security than those who cannot their change work hours or workplaces. Additionally the infection risk only increased for individuals who began working on-site after being laid-off [25]. In addition, some researchers analyzed the impact of increased remote work opportunities on the labor market in Italy during the pandemic, which has the lowest rate of remote work among the European countries. They found that the rise of remote work benefited males, the elderly, and workers with good education and high income, which could most likely reinforce wage inequality that had existed prior to the pandemic [26].

The probability of safe working environments through measures such as remote work stems from two factors. The first factor is technology intensity. The second factor is the work conditions before the pandemic. For instance, those who earned high income prior to the pandemic and could afford to work even during lockdowns are more likely to work safely at home. Hence, remote work indicates the possibility of an increase in income polarization [27].

Working from home during the pandemic is slated to help maintain economic activities, reduce economic loss, as well as potentially boost or improve social and economic indicators such as productivity and employee welfare, while reducing local inequality. Developing countries that have an inadequate digital infrastructure must focus on introducing or modifying policies, laws, and regulations in many sectors to reap the benefits of remote work, including digitalization and other related practices [28].

3. The impact of Korea's dual labor market structure on remote work during COVID-19

3.1 Trend of COVID-19 spread in Korea

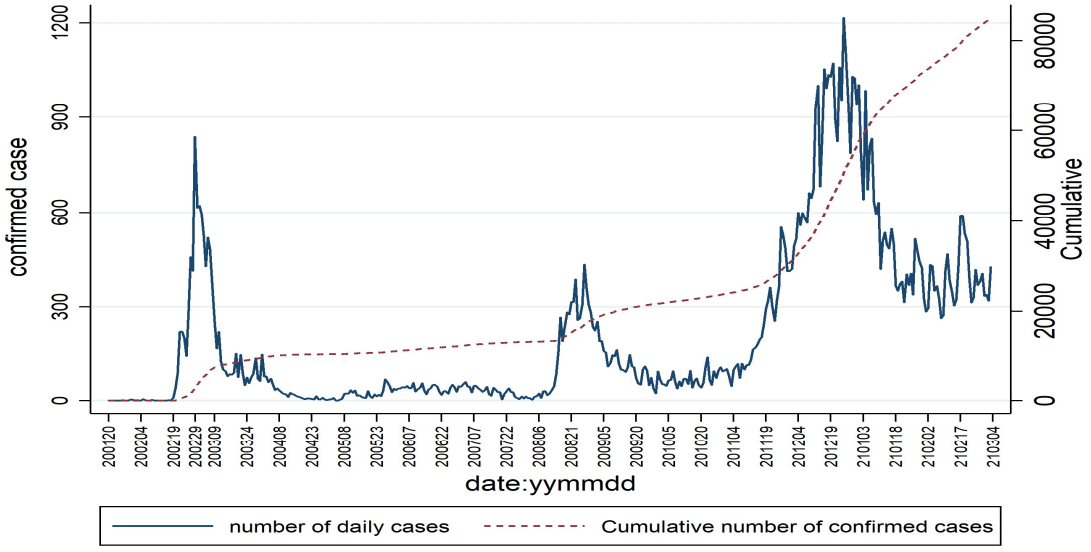
Figure 1 shows the spread of COVID-19 cases in Korea. The X axis represents the timeline from January 20, 2020, when the first COVID-19 case occurred in the country, to February 2020. The Y axis on the left indicates daily cases, while the y axis on the right refers to the cumulative cases. The solid line shows the number of cases per day, and the dashed line indicates the cumulative number of cases. Figure 1 confirms that Korea had three massive outbreaks during this period.

The first wave happened in February and March 2020, which spread due to large-scale religious gatherings in Daegu and Gyeongbuk areas, attended by coronavirus-infected individuals who had earlier visited China. During the first wave, people's fear of coronavirus infection was at its peak; therefore the Korean government took strong measures such as a ban on movement between regions, social distancing, and remote work to nip the rapid spread of the contagion. Owing to these efforts, by April 2020, cases dropped sharply, and Korea's efforts to contain the pandemic received praise from around the world.

The second wave occurred after a rally in downtown Seoul held around the National Liberation Day on August 15, 2020. Seoul and metropolitan areas surrounding the capital city had the highest spike in cases. Consequently, the government took a stern measure by banning the meeting of five or more persons in the Seoul metropolitan area and reducing the service hours of restaurants and supermarkets.

The third wave of the pandemic began due to the sharp rise in cases in November 2020. The daily cases surpassed the record number of 1,200, and the accelerating infection rate revived the citizens' fear of infection. By February 2021, the cases had dropped to around 400, easing an upward trend; however, because the daily cases have failed to fall further, the country still is likely to experience a fourth wave of COVID-19 cases.

Figure 1. Status of COVID-19 cases in Korea



3.2 Impact of dual labor market structure on labor market polarization in Korea

The Labor market polarization in Korea was already present prior to the coronavirus pandemic. In general, Korea's labor market polarization is synonymous with its dual labor market structure [29], which is comprised of the primary sector, including large corporations and regular employees with labor unions, and the secondary sector representing SMEs and non-regular workers without the union support.

Table 1 shows the number of workers, average monthly wages, and their work years in the primary and secondary sectors of labor market. As of 2018, the primary sector and secondary sector represented 7.2% (1,452,000) and 27.4% (5,489,000) of the total wage earners in Korea, and both sectors had a significant gap in their working conditions. The average monthly income of workers in the primary sector was 2.79 times that of the secondary sector workers. The primary sector workers worked six times the number of years worked by the secondary sector workers. The large wage gap between the two sectors can be attributed to difference in earnings to the pay-out between large corporations and SMEs, and the differences in their wage practices. That is, in Korea, large businesses increase employees' wages in proportion to the number of years worked, following a seniority-based wage system.

Table 1 Dual labor market structure of Korea

Category	Primary labor market (large corporations; unionized workers; regular position)	Secondary labor market (SMEs; non-unionized workers; non-regular positions)
Share of total number of salaried workers (%)	7.2	27.4
Number of workers	1,452,000	5,489,000
Average monthly wage	KRW 4,240,000	KRW 1,520,000
Number of years worked	13.7	2.3

* Source: revised excerpts of data from the Korea Labor Institute (2019; p. 24)
* Original source: Statistics Korea, August supplementary survey of Economically Active Population Survey in August 2020

In Korea, educated male workers are likely to occupy the primary sector [30]. Regular positions mostly involve white-collar jobs employing disproportionate number of male workers with a

Bachelor's degree. Additionally, the primary sector offers a highly automated and digitalized working environment. Hence, the workers in the primary sector can easily adapt to remote work during the pandemic. Moreover, 62.9% of the large companies in the primary sector have labor unions; therefore, workers in the primary sector are free from the risk of losing jobs and hardly experience significant variation in wages and salaries [31].
Meanwhile, the secondary sector comprises of non-regular workers in SMEs, of which only 10% are unionized. That is, companies in the secondary sector have fewer earnings to pay for wages and because their employees are not unionized, they are less likely to protect their employees' jobs or build the infrastructure required to achieve digitalization.

3.3 Polarization in the use of remote work among Korean firms
In Korea, remote work saw a sharp increase as a temporary measure in several companies to maintain business activities that were suspended due to COVID-19. However, the use of remote work in Korea is highly limited by its dual labor market structure, which further intensified during the coronavirus pandemic, showing that dual labor market structure and remote work influence each other reciprocally. Remote work is mostly prevalent among large corporations [32], whereas nearly half the SME employees reported to work on-site amidst the polarization between the two types of companies[33]. In addition, public institutions reported double the rate of remote work use compared to SMEs [34]. Most of the workers in the secondary labor market are least likely to have an option to work remotely. Additionally, companies in the secondary labor market have insufficient financial resources to pay out employees' wages compared to those in the primary sector, and thus cannot afford to continue paying wages to employees working from home. Consequently, due to its inability to offer remote work opportunities, workers in the secondary sector have a higher chance of unemployment during the pandemic than the primary sector.

4. Empirical analysis
4.1 Data
To analyze the characteristics of Korean workers who worked from home before and after the outbreak of the pandemic, we require pre- and post-outbreak remote work data. The August supplementary survey by the Economically Active Population Survey (EAPS) of Korea Statistics (https://mdis.kostat.go.kr/) provides us with such data. The EAPS focuses on the labor supply data collected through household visits each month, which is used as a base data to investigate the monthly employment and unemployment rates. In addition to the monthly EAPS, the August supplementary survey divides workers into salaried and non-salaried workers depending on the respondents' labor type, and collects additional information about labor quality through data on labor contracts, labor hours, and employment insurance by labor type. Thus, since 2001, the EAPS August supplementary survey has been providing detailed information on approximately 35,000 households by economic activity and labor type, as of August. This survey also offers data on the use of flexible work arrangements by salaried workers, including remote work. Thus, it is useful to analyze the trends and characteristics of employees working remotely before and after the outbreak of the pandemic.
This study analyzed the characteristics of the workers who worked remotely before and after the outbreak of the coronavirus pandemic and measured the effect of the dual labor market structure on remote work. This study considered employees who reported receiving flexible work opportunities from their employers a week before the survey, and identified the use of remote work as respondents (samples) answering "work from home" or "remote work" in response to the question "Which type of flexible work do you employ?". The samples did not include salaried workers who are engaged in agriculture, forestry, and fishery; those engaged in domestic activities; and instances of self-consumption and production activities that are not classified into any specific category. In addition, to compare the pre- and post-outbreak data, the analysis period covered every August from 2017 to 2020, where August 2020 belongs to the period after the coronavirus outbreak. Among the samples satisfying these conditions, we eliminated those containing missing values in the explanatory variables and finally included 100,136 samples in our analysis.

4.2 Basic statistical analysis

Figure 2 shows the proportion of salaried workers who worked remotely out of the total number of salaried workers, based on the EAPS August supplementary survey. The share of remote workers steadily surged from 0.30% in 2017 to 0.40% in 2018, and 0.47% in 2019. In 2020, after the outbreak of COVID-19 pandemic, the share of workers attending companies that implemented remote work soared by five times to 2.49% from 2019.

Figure 2 Share of salaried workers working in companies that introduced remote work (share)

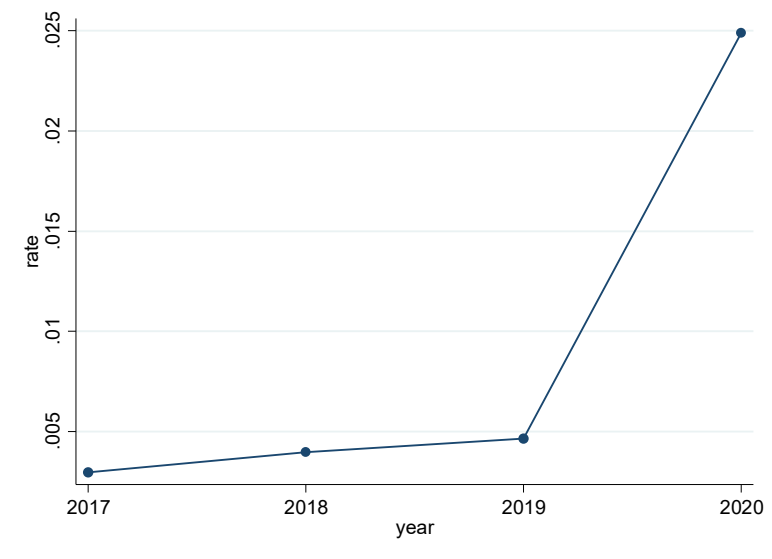


Table 3 presents the annual statistics of salaried workers working for companies that implemented remote work. Specifically, it shows that among the salaried workers employed in companies with the remote work option, the share workers residing in *dong* (urban areas) exceeded that of salaried workers living in *eup/myeon* (regions). In 2020, regardless of the region, the share of salaried workers attending companies with remote work rose sharply; however, the share of 2020 relative to 2019 surged by about six times in *dong* (urban) areas, far outranking the increase in *eup/myeon* areas. There was no significant difference between male and female workers working in companies with the remote work option. Additionally, the higher the education level, the higher the share of workers with companies allowing remote work. In particular, the share of workers with a Master's degree in remote-based roles rose to 6.9% in 2020. Meanwhile, on an average, during the survey period, only 0.5% of the workers who graduated from a technical college or lower were employed by companies that offered a remote work option. However, irrespective of the education levels, the share of workers with remote-based jobs rose by seven times during 2019 to 2020, showing the most prominent increase for all educational levels. In 2017, the share of employees working remotely did not vary significantly with marital status: unmarried persons 0.1%, married persons 0.3%, and the divorced/widowed 0.2%; however, in 2020, the share of both married and unmarried persons rose to 2.2% while that of divorced/widowed workers climbed to 0.5%, representing a substantial change.

Regarding job characteristics, managers constituted the most significant figure (1.7%), followed by clerical workers (1.3%) and sales workers (0.9%). The share of managers who attended companies offering remote work has steadily risen since 2017. The share of clerical workers in 2018 and 2019 showed a change from 0.4% and 0.6%, indicating less steady growth than the managers; however the ratio showed a six-fold increase from 2019 to 2020. In terms of industry type, the share of remote workers was higher in finance, insurance, real estate, public social service, personal service, and others. Sectors such as finance, insurance, real estate, transportation/communication, public social service, personal service, and others showed a sharp increase in the share of workers working remotely from 2019 to 2020. An organization's size was found to be positively related to the share of workers engaged in remote work. The share for companies with 1–4 employees was 0.2%, 5–29 employees

was 0.5%, 30–299 employees was 1.0%, and those with 300 plus employees was 1.9%. Large companies employing more than 300 workers saw the share of workers engaging in remote work soaring by ten times from 0.6% in 2019 to 6% in 2020.

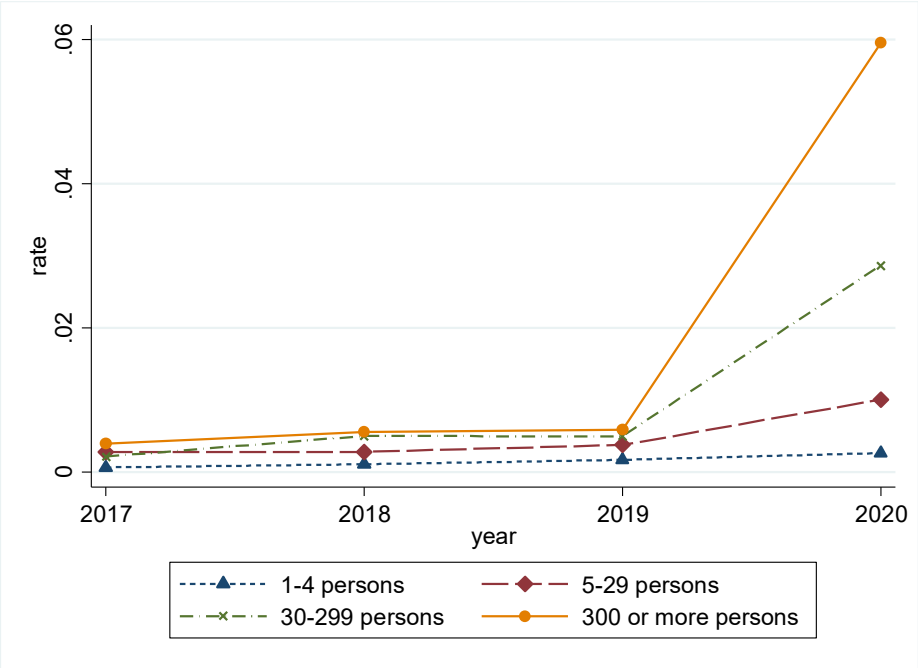
Table 3 Annual statistics on workers employed in companies offering remote work

Main category	Middle category	Variables	2017	2018	2019	2020	Mean
Personal characteristics	Region	*Dong*	0.003	0.004	0.004	0.023	0.008
		Eup/myeon	0.001	0.001	0.002	0.008	0.003
	Gender	Male	0.002	0.003	0.004	0.020	0.007
		Female	0.003	0.005	0.004	0.020	0.008
	Education	High school or lower	0.001	0.001	0.001	0.004	0.002
		Technical college or lower	0.002	0.003	0.002	0.014	0.005
		University or lower	0.004	0.006	0.007	0.036	0.014
		Master's degree or higher	0.006	0.012	0.012	0.069	0.025
	Marital status	Unmarried	0.001	0.002	0.004	0.022	0.007
		Married	0.003	0.004	0.005	0.022	0.009
		Divorced /widowed	0.002	0.002	0.001	0.005	0.002
Job characteristics	Occupation	Manager	0.004	0.007	0.010	0.045	0.017
		Clerical workers	0.004	0.006	0.006	0.038	0.013
		Service workers	0.000	0.001	0.001	0.003	0.001
		Sales workers	0.005	0.005	0.005	0.020	0.009
		Technicians	0.000	0.001	0.000	0.003	0.001
		Workers of simple labor	0.000	0.000	0.000	0.001	0.000
	Industry	Manufacturing	0.001	0.002	0.004	0.012	0.004
		Construction, other manufacturing	0.001	0.002	0.002	0.004	0.002
		Wholesale and retail, food, accommodation	0.002	0.003	0.003	0.011	0.004
		Transport, communication	0.004	0.000	0.000	0.014	0.005
		Finance, insurance, real estate	0.005	0.004	0.004	0.035	0.012
		Public social and personal services	0.001	0.004	0.004	0.033	0.010
		Education, healthcare, social service, arts	0.002	0.004	0.003	0.020	0.008
		Others	0.005	0.007	0.009	0.041	0.015
	Number of employees	1–4	0.001	0.001	0.002	0.003	0.002
		5–29	0.003	0.003	0.004	0.010	0.005
		30–299	0.002	0.005	0.005	0.029	0.010
		300 or more	0.004	0.006	0.006	0.060	0.019
Total			0.002	0.003	0.004	0.020	0.007

Figure 3 shows the trends for the share of salaried workers working in companies implementing remote work by firm size and year, based on data from Table 2. The X axis indicates the year, and the Y axis indicates the share of salaried workers working in companies with remote work opportunity.

The dotted line with a triangle marker indicates the share of salaried workers working in companies with 1–4 employees. The dashed line with a diamond marker represents firms with 5–29 employees, the dash-dotted line with an X marker indicates firms with 30–299 employees, and the solid line with a circle marker shows the share of workers attending large companies with over 300 employees. Regardless of the number of employees, we found that the share of workers working from home steadily rose from 2017 to 2020. Notably the share in 2020 climbed sharply in proportion to the firm size.

Figure 3. Share of salaried workers employed in companies offering remote work



4.3 Analysis methods

This study used the linear probability model (LPM) to analyze the use of remote work among salaried workers. The LPM is used when the dependent variable is not continuous and discrete. Therefore, this paper used LPM to address problems of interaction effect in a non-linear model [35].

The dependent variable, which is the focus of this study, is a binary variable indicating whether a company offers remote work. During the analysis period, salaried workers' use of remote work is indicated as 1, and non-use of remote work is labeled as 0.

$$y_{it} = \begin{cases} 1, if\ z_{it} > 0 \\ 0, if\ z_{it} \le 0 \end{cases}$$

$$where\ z_{it} = \beta_0 + \sum_{k=1}^{K} \beta_k x_{kit} + u_{it} \quad (1)$$

In formula (1), the subscript i is an individual, and t is time. x_{it} indicates the explanatory variables related to the personal characteristics and job characteristics of individuals i during t time. The explanatory variables included age, residence area, gender, education, marital status, position at workplace, occupation, number of employees (firm size), and the year dummy variable.

In formula (1), z_{it} represents the sum of a linear combination of the constant and explanatory variables and the error term. Considering $E(u_{it}) = 0$ to provide an unbiased estimate, $E(y_{it}|X_{it})$, which is a conditional expectation of Y_{it} given X_{it}, is a conditional probability of iX_{it}, $y_{it} = 1$, expressed below as formula (2) [36].

$$E[y_{it}|X_{it}] = \Pr(y_{it}|X_{it}) = \beta_0 + \sum_{k=1}^{K} \beta_k\, x_{kit} \quad (2)$$

Furthermore, to determine the impact of the firm size on the use of remote work after the outbreak of COVID-19, the total number of employees and the year 2020 were added as interaction terms. In formula (3), the expected values were added to both sides of the regression equation to interpret interaction effect.

$$E[y_{it}|X_{it}] = \Pr(y_{it} = 1|X_{it}) = \beta_0 + \sum_j \beta_j \cdot 1\{number\ of\ employees_{it} = j\} + \sum_{k=201}^{2020} \beta_k \cdot 1\{t = k\} + \left(\sum_j \sum_{k=201}^{2020} \delta_{jk} \cdot 1\{number\ of\ employee_{it} = j\} \times 1\{t = k\} \right) + X_{it}'\alpha \quad (3)$$

In formula (3), j is the total number of employees of a firm where an individual *i* works. The total number of employees is a categorical variable with four groups: 1–4 persons (base), 5–29 persons, 30–299 persons, and 300 persons or more. k is a categorical variable that divides the analysis period into four: 2017 (base), 2018, 2019, and 2020. X_{it} is a variable that represents the personal and job characteristics of an individual (*i*), which also represent the explanatory variables used in formula (2).

4.4 Analysis results

Table 4 presents the result of the analysis from considering "companies' adoption of remote work for salaried workers" as the dependent variable. The results were derived by using the Linear Probability Model, which included the variables likely to affect the companies' introduction of remote work. Results of Table 4 are similar to the results of the basic statistics in Table 3. Specifically, regarding the personal characteristics variables, employees with a Master's degree are more likely to work for companies with remote work system by 1.09 percentage points. Meanwhile, regarding the variables related to marital status, divorced/widowed employees are less likely to work remotely than unmarried persons. The positive coefficients for divorced/widowed employees given in Table 4 may be explained by high correlation to age variable.

Regarding job characteristics-related variables, the number of employees within a firm is particularly relevant. Employees in large companies with over 300 employees are 1.28 percentage points more likely to work remotely than employees working in small companies with 1–4 employees. For the year variable, salaried workers are increasingly more likely to work for companies offering remote work opportunities as the year approached 2020, compared with 2017. Additionally, the coefficient of the correlation was prominent in year 2019 and 2020 and the probability of workers engaged in remote work was higher by 1.78 percentage points in 2020 than in 2017.

Table 4 Results of analysis of the dependent variable (whether companies offer remote work)

			Status of introduction of remote work	
			Coef.	Robust Std. Err.
Personal characteristics	Age	Age	-0.0001**	0.000
	Residence area	Base: Cities (*dong*)		
		Regions (*eup/myeon*)	-0.0012**	0.001
	Gender	Base: Male		
		Female	0.0029***	0.001
	Education	Base: High school or lower		
		Technical college	-0.001	0.001
		University	0.0040***	0.001
		Master's degree or higher	0.0109***	0.002
	Marital status	Base: Unmarried		

		Married	0.0033***	0.001
		Divorced/widowed	0.0027***	0.001
Job characteristics	Employment status	Base: Regular positions		
		Temporary, day laborers	-0.0021***	0.001
	Occupation	Base: Service workers		
		Managers and professionals	0.0097***	0.001
		Clerical workers	0.0061***	0.001
		Sales workers	0.0054***	0.001
		Technicians	0	0.001
		Workers engaged in simple labor	-0.0012*	0.001
	Industry	Base: Manufacturing		
		Construction and other manufacturing	0.0012	0.001
		Wholesale and retail trade, food, accommodation	0.0034***	0.001
		Transportation/communication	0.0026**	0.001
		Finance, insurance, real estate	0.0042***	0.002
		Public social service, personal service	0.0040***	0.001
		Education, healthcare, social service, arts	-0.0021**	0.001
		Others	0.0091***	0.001
	Number of employees	Base: 1–4 persons		
		5–29 persons	0.0031***	0.001
		30–299 persons	0.0070***	0.001
		300 or more persons	0.0128***	0.001
	Log (average wage of recent three months)		0.0020***	0.001
	snumber of working hours		-0.0001***	0
Year	Year dummy	Base: 2017		
		2018	0.0008	0
		2019	0.0013**	0.001
		2020	0.0178***	0.001
Constant			-0.0145***	-0.003
Sample Size			100,136	
R-squared			0.019	

Note 1) statistically significant at significance level of *** 1%, ** 5%, * 10%.

Table 5 lists the results of the analysis of whether the companies' adoption of remote work was influenced by firm size after the outbreak of the pandemic. That is, by checking the interaction term between the number of employees in a firm and the COVID-19 period variable, we measured the variation in the probability of companies' introduction of remote work after the COVID-19 depending on its number of employees. As in Table 4, our analysis considered the dependent variable as a dummy variable with value 1 if companies with salaried workers provide remote work opportunities, and value 0 if not. The explanatory variables of employees' personal characteristics and job characteristics remained the same as in Table 4. We then measured the interaction effect of the number of employees in a firm and year variables using the year dummies.

Our analysis found that, considering firms with 1–4 employees for the year 2017 as the base, in 2020, employees from companies with 5–29 employees were 0.56 percentage points more likely to work from home, and employees from companies with 30–299 employees were 2.51 percentage points more likely to work remotely compared to the base case. For companies with 300 employees, the probability of employees working from home in 2020 rose by 5.40 percentage points from the base case. Similar

to Table 4, Table 5 shows that workers attending companies with a size larger than 1–4 employees after the outbreak of COVID-19 are proportionately more likely to work from home.

Table 5. Interaction term analysis using the number of employees in a firm and year variables

			Status of introduction of remote work	
			Coef.	Robust Std. Err.
Job characteristics	Status of employment	Base: Regulated employees		
		Temporary, day laborers	-0.0016**	0.001
	Number of employees	Base: 1–4		
		5–29	0.0017**	0.001
		30–299	-0.0004	0.001
		300 or more	-0.0016	0.001
Period	Year dummy	Base: 2017		
		2018	0.0001	0.001
		2019	0.0005	0.001
		2020	0.0015*	0.001
Interaction term	Number of employees X Year	Base: 1-4 employees X 2017		
		5–29 employees X 2018	-0.0003	0.001
		5–29 employees X 2019	0.0001	0.001
		5–29 employees X 2020	0.0056***	0.001
		30–299 employees X 2018	0.0021*	0.001
		30–299 employees X 2019	0.0019	0.001
		30–299 employees X 2020	0.0251***	0.002
		300 employees X 2018	0.0013	0.002
		300 employees X 2019	0.0008	0.002
		300 employees X 2020	0.0540***	0.004
Control variables	Personal characteristics		O	
	Occupation		O	
	Industry		O	
	Log (average wage in the past three months)		-0.0016**	-0.001
	Actual hours of employment in a major job		-0.0002***	0
	Sample Size		100,136	
	R-squared		0.026	

주1) statistically significant at significance level of *** 1%, ** 5%, * 10%

5. Implications of increased use of remote work in Korea in the post-pandemic era

5.1 Procedure of labor relation laws governing remote work in Korea

As discussed earlier, the remote work system in Korea was introduced mostly as a temporary measure after the outbreak of the pandemic to stem the spread of the coronavirus, and was adopted without any adjustment process. This conclusion stems from the variation in the level of remote work depending on the fluctuations of COVID-19 caseloads in Korea. The decision to establish a remote work system is not expected to receive any opposition from the employees if it is implemented while keeping intact the current task assessment and remuneration schemes.

However, the first challenge of allowing remote work is to devise methods to measures the remote workers' work attitude and task performance. Because of the difficulties in controlling the employees' work status on a real-time basis while they work from home, companies would need to modify their performance assessment and compensation system. This would hardly be supported by employees because unlike a temporary use of remote work during the pandemic, a long-term system would involve a strict assessment of employees working status and performance, as well as wage reduction.

Introducing a remote work system in Korea involves two legal procedures. The first is to revise the

collective agreement between companies and employees. Whether employees agree to the introduction of remote work proposed by employers would be determined by collective bargaining. Trade unions and employers may decide whether to introduce remote work after an adjustment of the companies' performance assessment and compensation system.

The second procedure for introducing remote work involves an amendment to the employment rules. Employment rules are rules about working conditions unilaterally prescribed by employers to control the employees' working conditions systematically and consistently. According to the current laws, the employment rules cannot breach the provisions of a collective agreement [37]; however, unless a collective agreement specifically bans the use of remote work, the employment rules can be revised to introduce remote work. Meanwhile, in case the amendment of the employment rules is favorable to the employees, obtaining the consent of the trade unions or the majority of the employees is not necessary. However, if the employment rules are amended in a way that disadvantages the interests of the workers, the amendment must obtain the consent of the trade union or the majority of workers [38]. For instance, if while establishing a remote work system the employers wish to impose a strict performance evaluation or wage adjustments that might deteriorate the current working conditions of the workers, the amendment would require the consent of the majority of workers.

Furthermore, recently the Supreme Court of South Korea established a precedent that even after obtaining a majority consent, an amendment to the employment rule that puts workers at a disadvantage would have no effect for a certain worker unless a labor contract with the said individual worker is revised accordingly [39].This implies that even if the introduction of remote work was decided through the difficult process of amending the employment rules, the use of remote work cannot be finalized in case the amendment requires an additional procedure of revising the labor contract with individual workers. This suggests that the current legal environment makes it difficult to introduce remote work at workplaces.

5.2 Rigidity in collective bargaining in the primary sector

In Korea, the primary sector labor market saw an increase in the adoption of remote work after the outbreak of the COVID-19; however, depending on the fluctuation of caseloads, the use of remote work and the return to office-based work occurred without an adjustment in the working conditions. That is, due to the unique circumstances during the pandemic, companies implemented remote work without applying special procedures such as obtaining a majority consent of the workers. However, going forward, in the post-pandemic era, the continued use of remote work in the primary sector may not be easily accommodated by labor organizations if the existing performance assessment and remuneration schemes are modified.

In Korea, a trade union representing two-thirds or more workers of a particular workplace, can sign a union shop clause that would allow the trade union to force an organization to meet its demands [40]. For example, trade unions of large companies who have signed the union shop provision can make all eligible employees to become members of the trade unions. Hence, the high prevalence of trade unions within large primary sector companies in Korea implies that companies cannot implement a remote work policy without a collective agreement that such a policy. Even when a collective agreement does not have a provision that prohibits the introduction of remote work, an amendment to the employment rules for the insertion of a remote work system requires the consent of the trade union or a majority votes of the workers. Therefore, with good cooperation between labor organizations and the management regarding corporate competitiveness and productivity is essential for the insertion of provisions on the use of remote work into collective agreement or employment rules. However, the negotiation culture between labor organizations and the management in Korea has not been cooperative, so much so that the national competitiveness in terms of the labor-management relations is a major source of concern. In fact, among 140 countries, Korea ranked 135th in 2016 and 2017, 124th in 2018, and 130th in 2019 in the World Economic Forum's labor-management relations assessment [41].

Nevertheless, remote work is likely to continue in the post-pandemic era in a way that benefits both employer and employees. Accordingly, companies that anticipate the use of remote work need to establish improved systems and conditions allowing employees to choose a remote work. This is because remote work requires companies to modify their existing business performance and compensation framework, which is currently suitable only for the existing mode of work.

5.3 Rigidity in revising unfavorable employment rules for secondary sector workers

The secondary sector faced considerable obstacles for implementing remote work during the pandemic. SMEs with non-regular workers in the secondary sector reduced workforce instead of offering remote work opportunities due to a lack of financial resources to pay wages to the workers. While the primary sector driven by large corporations, responded to the pandemic by suspending hiring and reducing costs, the secondary sector mostly comprised of SMEs, had to lay off even their skilled workers [42]. However, after the pandemic even the SMEs would need to consider introducing remote work.

In case the secondary sector intends introduce remote work, similar to the primary sector, the workers are unlikely to accept the policy easily if it involves modifications to the existing task performance evaluation and compensation methods. As the secondary sector pays workers a smaller compensation amount, it cannot afford to adjust performance assessment and remuneration schemes implementing remote work. Nevertheless, the use of remote work in the primary sector is likely to influence its adoption in the secondary sector.

In Korea's secondary labor market, only 12.3% of middle market enterprises with 122– 299 employees and 2.7% of medium-sized companies with 30–99 employees have trade unions (National Economic Advisory Council, 2020). Moreover, most of the trade unions in the secondary sector are so small that they are poorly equipped to use their collective bargaining power to have their demand accepted through labor strikes and other means. Therefore, the secondary sector companies are more likely to consider introducing remote work through revision of the employment rules instead of collective bargaining. Even so, the introduction of remote work by amending the employment rules requires the consent of the majority of employees, which could pose a challenge. As mentioned earlier, even with the consent of the majority of the employees, if a concerned employee requires a revision of a labor contract, companies must make such a revision. Therefore, overall, the introduction of remote work in the secondary labor market in Korea is not easy under the current legal system.

6. Conclusion

This research conducted an empirical analysis of the changes in the companies' use of remote work by firm size after the outbreak of COVID-19 using the August supplementary survey of the EAPS released by Statistics Korea. Focusing on determining whether the gap in the use of remote work by firm size narrowed in an effort to combat the coronavirus, we found that the probability of large corporations implementing remote work after the pandemic's outbreak in 2020 surged more rapidly than small companies, thus widening the gap in the labor market.

Given Korea's dual labor market structure, companies require customized support to establish a remote work system after the pandemic. The secondary sector, which faces greater difficulties in implementing remote work requires rapid, targeted, and intensive support. Without the appropriate support, SMEs in the secondary sector cannot overcome the obstacle of insufficient financial resources, which can hinder their survival and lead to massive unemployment, resulting in a sharp increase in the cost of unemployment benefits. In a country like Korea, where there is a clear distinction between the primary and secondary sectors of labor market, a timely support needs to be provided to the eligible targets, without which the disparity in the dual labor market structure will further intensify.

The Korean government's recent efforts to support [43] the establishment of remote work infrastructure in SMEs may be considered as a policy reflecting the country's dual labor market structure. Additionally, during the pandemic, the Korean government designated the workers engaged in coronavirus prevention efforts; services employees working on-site, including parcel delivery; frontline workers protecting the safety of ordinary citizens and the socially vulnerable sections; and care-based workers as "essential workers," and implemented policies ensuring safety and social protection for these people [44]. Such policy is similar to the protective measures for essential workers in the UK [45], and the Essential workers' protection and the HEROES Act in the United States [46, 47].

Meanwhile, the country seriously requires a long-term policy to address the labor market polarization [48]. In Korea's dual labor market structure, primary sector companies introducing remote work face challenges such as negotiating with non-cooperative trade unions, whereas the secondary sector faces challenges from making employment rule changes under the current laws that are unfavorable to the employees. The root cause of difficulties in introducing remote work in Korea is the seniority system,

which considers the length of service to calculate wages, among other elements of dual labor market and outdated work hour system, which is applied to factory workers. As a member of a global economy, the promotion of remote work is essential to Korea; therefore the country must be willing to modify its inflexible work hour system and wage system that emphasizes on seniority, which also obstructs innovative modes of work [49, 50]. Flexible work hours are essential to ensure sufficient rest for workers, similar to the work hour policy implemented by Germany. Additionally, the outdated seniority-based wage system should be improved to reflect employees' performance and the type of tasks. In particular, current laws that make amending employment laws difficult must instead focus on resolving the issue of unfavorable amendments to the employment rules in a way that maximizes workplace efficiency while allowing workers to cope with the changing environment provided that unilateral deterioration of working conditions by employers can be avoided.

Author Contributions: Conceptualization, S.L. and J.C.; Methodology, J.C. and S.P.; Formal Analysis, S.P.; Data Curation, S.P.; Writing – Original Draft Preparation, S.L. and S.P.; Writing – Review & Editing, S.L. and J.C.; Visualization, S.P.; Supervision, J.C.; Project Administration, S.L. and J.C.; Funding Acquisition, J.C., All authors have read and agreed to the published version of the manuscript.

Funding: This paper was supported by SKKU Excellence in Research Award Research Fund, Sungkyunkwan University 2020.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the institutional data policy.

Conflicts of Interest: The authors have no conflicts of interest to declare.

Reference

1. Steelcase, "Changing Expectations and the Future of Work - Insights from the pandemic to create a better work experience -, Steelcase Global Report, 2021)" accessed 31 March 2021, https://www.steelcase.com/research/articles/topics/work-better/changing-expectations-future-work/
2. International Labour Organization, (ILO) "Teleworking during the COVID-19 pandemic and beyond-A Practical Guide," July 2020, https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---travail/documents/instructionalmaterial/wcms_751232.pdf.
3. Katherine Guyot and Isabel V. Sawhill, Monday, "Telecommuting will likely continue long after the pandemic," *BROOKINGS*, 6 April 2020, https://www.brookings.edu/blog/up-front/2020/04/06/telecommuting-will-likely-continue-long-after-the-pandemic/.
4. ILO, "Teleworking during the COVID-19 pandemic and beyond-A Practical Guide."
5. The Korea Chamber Of Commerce & Industry, "Investigation on the status of the company's introduction of the flexible work system." Accessed 15 March 2021. http://www.korcham.net/nCham/Service/Economy/appl/KcciReportDetail.asp?SEQ_NO_C010=20120930850&CHAM_CD=B001.
6. Korean Women's Development Institute (KWDI), Work-family balance survey as of 2017, Sejong: Ministry of Employment and Labor, 2019.
7. Park, D.G., "February "Corona 19" Pandemic Buildings of large corporations are "closed" one after another… Spreading'work from home'," *KBS*, 25 February 2020, http://news.kbs.co.kr/news/view.do?ncd=4388513&ref=D.
8. Park, K.I., Kang, J.H., and Kim, S.H., ""Shutdown" scarier than Corona… Telecommuting companies return one after another," *Kookmin-Ilbo,* 25 March 2020, http://news.kmib.co.kr/article/view.asp?arcid=0924129101&code=11151400&cp=du.

9. Seo, M.S., "August Industry corona recurrence back to home," *Yeonhapnews,* 19 August 2020, https://www.yna.co.kr/view/AKR20200819148700003?input=1179m.

10. Kang, G.M., "Telecommuting and video conference become everyday life… The 'how to work' has changed," *HankookGyungje,* 31 August 2020, https://www.hankyung.com/economy/article/2020083136081

11. Organisation for Economic Cooperation and Development (OECD), "Covid-19: Protecting people and societies," 2020, https://read.oecd-ilibrary.org/view/?ref=126_126985-nv145m3l96&title=COVID-19-Protecting-people-and-societies.

12. Organisation for Economic Cooperation and Development (OECD), "OECD Employment Outlook 2020. Worker Security and the COVID-19 Crisis : 1.2.1. The initial labour market impact: More vulnerable workers are bearing the immediate brunt of this crisis," 2020, https://static.poder360.com.br/2020/07/OCDE-desemprego-em-10.pdf.

13. World Bank, "Saving Lives, Scaling-up Impact and Getting Back on Track, World Bank Group COVID-19 Crisis Response Approach Paper," June 2020, http://documents1.worldbank.org/curated/en/136631594937150795/pdf/World-Bank-Group-COVID-19-Crisis-Response-Approach-Paper-Saving-Lives-Scaling-up-Impact-and-Getting-Back-on-Track.pdf.

14. International Labour Organization, (ILO) "ILO brief: A policy framework for tackling the economic and social impact of the COVID-19 crisis," May 2020, https://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/documents/briefingnote/wcms_745337.pdf.

15. Emilia M. Jurzyk et al., "COVID-19 and Inequality in Asia: Breaking the Vicious Cycle," *IMF Working Paper(WP/20/217),* October 2020, https://www.imf.org/en/Publications/WP/Issues/2020/10/16/COVID-19-and-Inequality-in-Asia-Breaking-the-Vicious-Cycle-49807.

16. Murillo Campello, Gaurav Kankanhalli and Pradeep Muthukrishnan, "Corporate Hiring under COVID-19: Labor Market Concentration, Downskilling, and Income Inequality," *Nber working paper*, no. 27208, (May 2020), https://www.nber.org/system/files/working_papers/w27208/w27208.pdf.

17. Liana Christin Landivar et al., "Early Signs Indicate That COVID-19 Is Exacerbating Gender Inequality in the Labor Force," *Socius: Sociological Research for a Dynamic World, (August 2020),* 6: 1-3, https://doi.org/10.1177/2378023120947997.

18. Titan Alon et al., The impact of Covid-19 on gender equality, *Nber working paper,* no. 26947, (April 2020), https://www.nber.org/papers/w26947.

19. Ammar Abulibdeh, "Can COVID-19 mitigation measures promote telework practices?" *Journal of Labor and Society* 23.4 (2020): 551-576.

20. OECD, "Covid-19: Protecting people and societies."

21. OECD, "Employment Outlook 2020. Worker Security and the COVID-19 Crisis - 1.2.1. The initial labour market impact: More vulnerable workers are bearing the immediate brunt of this crisis."

22. OECD, "COVID-19: PROTECTING PEOPLE AND SOCIETIES."

23. Jurzyk et al., "COVID-19 and Inequality in Asia: Breaking the Vicious Cycle."

24. Abi Adams-Prassl et al., "Inequality in the impact of the coronavirus shock: Evidence from real time surveys," *Journal of Public Economics* 189, (2020): 104245

25. Katja Möhring et al., "Inequality in employment trajectories and their socio-economic consequences during the early phase of the COVID-19 pandemic in Germany, SocArXiv, 19 January 2021 https://osf.io/preprints/socarxiv/m95df/

26. Luca Bonacini, Giovanni Gallo and Sergio Scicchitano, "Working from home and income inequality: risks of a 'new normal'with COVID-19," *Journal of Population Economics,* 34.1 (2021): 303-360.

27. World bank blog, Francisco Ferreira and Marta Schoch, "Covid-19 in Latin America: A pandemic meets extreme inequality," accessed 10 June 2020, https://blogs.worldbank.org/developmenttalk/covid-19-latin-america-pandemic-meets-extreme-inequality.

28. Abulibdeh, "Can COVID-19 mitigation measures," 551.

29. Korea Labor Institute(KLI), "Wage Trends in 2018 and Wage Forecasts in 2019," 2019.

30. Joonmo Cho and Jaeseong Lee, "Persistence of the Gender Gap and Low Employment of Female Workers in a Stratified Labor Market: Evidence from South Korea" Sustainability *Sustainability* 7.9 (2015): 12425-12451.

31. Lim, S.H., "Reform Tasks for Resolving the Dual Structure of the Labor Market," 2020, National Economic Advisory Council.

32. Lee, S.J., "Talking about large corporations working from home?.. the government helps," *KBS,*23 October 2020, https://news.v.daum.net/v/20201023000007934?f=o

33. Choi, Y.K., "Telecommuting is also polarized... 53% of Chinese workers said, "I left the company." *Seoul news*, 25 January 2021. https://www.seoul.co.kr/news/newsView.php?id=20210126010004&wlog_tag3=daum

34. Yoon, E.S., "'God's Workplace' public company has twice the experience of telecommuting from Corona compared to 'China'," *Kookmin ilbo,* 25 January 2021. http://www.kukinews.com/newsView/kuk202101250225

35. Ai, C., & Norton, E. C. (2003). Interaction terms in logit and probit models. Economics letters, 80(1), 123-129.

36. Gujarati, D. N., Porter, D. C., & Gunasekar, S. (2012). Basic econometrics. Tata McGraw-Hill Education.

37. Trade Union And Labor Relations Adjustment Act. Article 33. 1. https://elaw.klri.re.kr/eng_service/lawView.do?lang=ENG&hseq=22056

38. Labor Standards ActLABOR STANDARDS ACT. Article 94. 1. https://elaw.klri.re.kr/eng_service/lawView.do?hseq=50315&lang=ENG

39. Supreme Court, November 14, 2019, Sentence 2018 da 200709

40. Trade Union And Labor Relations Adjustment Act. Article 81. 1. https://elaw.klri.re.kr/eng_service/lawView.do?lang=ENG&hseq=22056

41. WEF, The Global Competitiveness Report, *WEF Report 2016~2019* http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf

42. Kim, J.M., "Large corporations lose fat, SMEs lose weight... Manpower restructuring is also "polarized"" Edaily, 10 February 2021 https://www.edaily.co.kr/news/read?newsId=01289046625994912&mediaCodeNo=257

43. Ministry of Employment and Labor, 2020.6.23. Minister of Employment and Labor, listening to opinions of workplaces to expand telecommuting of SMEs, http://www.moel.go.kr/news/enews/report/enewsView.do?news_seq=11091

44. Ministry of Employment and Labor, 2020.10.6. Held the launching meeting of the government-wide "T/F of relevant ministries for the protection of essential workers" http://www.moel.go.kr/news/enews/report/enewsView.do?news_seq=11494

45. Gov.uk, Essential workers and those prioritised for testing(gov.uk, 2020) https://www.gov.uk/guidance/coronavirus-covid-19-getting-tested#essential-workers

46. NCSL, VCOVID-19: Essential Workers in the States(NCSL 2020)https://www.ncsl.org/research/labor-and-employment/covid-19-essential-workers-in-the-states.aspx

47. House.gov, House Passes Updated Heroes Act, 2020(house.gov 2020)(https://appropriations.house.gov/news/press-releases/house-passes-updated-heroes-act

48. Bonacini, L., Gallo, G., & Scicchitano, S. (2021). Working from home and income inequality: risks of

a ‘new normal’with COVID-19. Journal of population economics, 34(1), 303-360.

49. Joonmo Cho, “Labor system vocational training and social insurance reform for economic innovation in the post-corona era,” *KDI*, 2020

50. Jung, H., & Cho, J. (2020). High Corporate Social Responsibility but Low Corporate Maternity Responsibility: Korean Evidence. The Singapore Economic Review, 1-21.