EFFECTS OF MINIMUM WAGE INCREASE ON EMPLOYMENT IN SMALL AND MEDIUM-SIZED ENTERPRISES IN KOREA

Hyunah "Julia" Kim*

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Advisor: Professor Frederico Finan

Abstract

In Korea, where SMEs dominantly provide most of the jobs in labor market, how SMEs respond to an increase in minimum wages in terms of employment can be a critical factor of job provision in Korean labor market. This paper mainly examines the effect of minimum wage increase on employment in SMEs in Korea by using a difference-in-differences methodology, and finds that raising minimum wages has on average significantly reduced total employment in all sizes of SMEs relative to large enterprises. Using the same methodology, its effects on hourly wages and total working hours of employees in SMEs are explored as well along with its differential effects on employment in different industries. The finding in this paper suggests that raising minimum wage rate may incur loss of jobs in Korean labor market.

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1. INTRODUCTION

Unlike the United States and many other countries, Korea has a single national statutory minimum wage that changes annually[†] and applies to all the regions in Korea at the time of enforcement. In 2017, President Moon announced an increase in the Korean minimum wage from 6,470 won (Korean currency) per hour to 7,530 won per hour by 16.38%; this increase was found to be the biggest hike in the minimum wage in Korea in nearly the last two decades. Along with this announcement, President Moon has vowed to increase the minimum wage up to 10,000 won by 2020. Whether or not raising the minimum wage will reduce employment has been controversial amongst researchers across nations, but, in the case of Korea, where raising the minimum wage is more of a custom that continues every year, the impact of the minimum wage on employment is considered more critical. If its effect on employment is found to be negative, it is important for Korea to consider whether to continue raising the minimum wage as their annual custom.

Another unfamiliar aspect of the Korean labor market to address is that when many countries have small and medium-sized enterprises (SMEs)[‡] as the largest share of their business sectors[§], SMEs in Korea do not only take up the largest proportion of enterprise sectors but are also the largest job providers in Korean labor market (Figure 1). Figure 1 compares the share of employment by enterprise size in OECD countries. In the case of Korea, the largest firm size (250+) in this figure still includes a share of SMEs since SMEs are up to the size of less than 300 employees in Korea. Yet the share of all other enterprises in the size of up to 249 employees in employment is found to be dominating for Korea; this proportion of employment by enterprise size in Korea is outstanding and contrasting to all other countries except for Greece.

With SMEs as major job providers in Korea, looking into how raising the minimum wage impacts employment in SMEs is important in terms of SME's impact on the Korean labor market and the overall economy. However, though the effect of the minimum wage policy on employment and other factors in Korean labor market has been studied in several much literature, which will be discussed later in the next section, this literature have not particularly and adequately discussed the relationship between the minimum wage and employment in SMEsin

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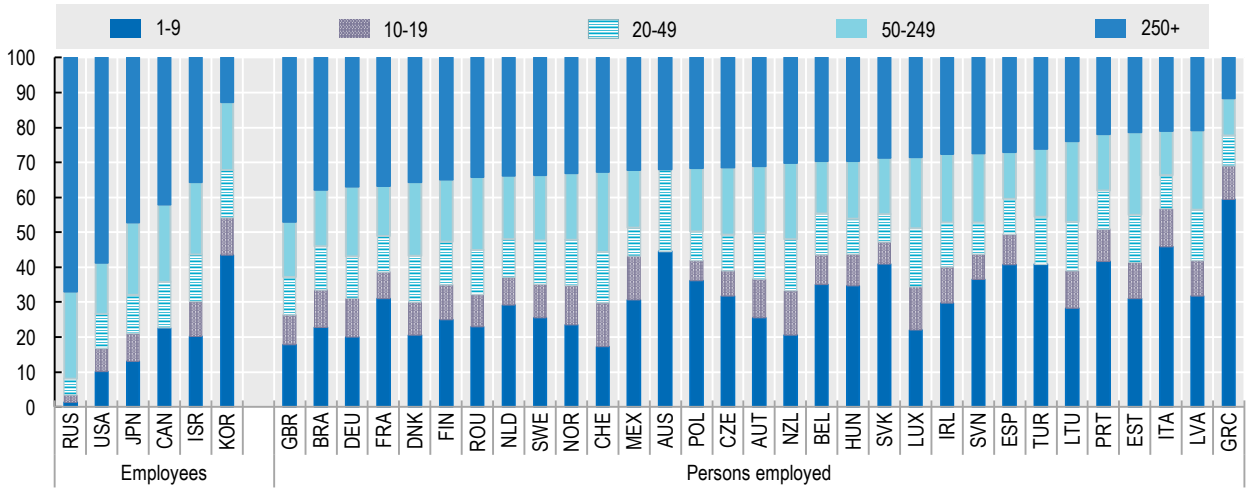
[†] Changes in minimum wage rates from 2009 to 2019 are found in Appendix (A1).

[‡] In Korea, small and medium enterprises (SMEs) are defined to be enterprises with less than 300 employees.

[§] The typical trend in the proportion of enterprises by size in other countries is presented in Appendix (A2).

Korea. So, this paper specifically examines its effect on the employment in SMEs. Apart from this main question, two other questions are also explored in this paper.

Figure 1. Employment by enterprise size, business economy
Percentage of all persons employed, 2014, or latest available year



Source: OECD (2017), "Entrepreneurship at a Glance 2017"

These are the three main questions that I would like to explore throughout the paper:

(1) Does raising the minimum wage reduce employment in SMEs? Does it have differential effects on different types of employment? What about on employees' working hours and wages in SMEs?
(2) Given that we only look at the employment in SMEs, does raising the minimum wage have differential effects on employment in different industries?
(3) How does the non-compliance rate change from 2017 to 2018?

For questions (1) and (2), I will use a difference-in-differences methodology to measure the impact of the minimum wage increase on the aforementioned outcomes of interest. For question (3), I will not include the noncompliance rate in the regression due to lacking observations with only 24 monthly values but I will examine how the non-compliance rate has changed from 2017 to 2018 when exploring the data in Section 4.

The main findings are that raising the minimum wage has on average reduced total employment in all sizes of SMEs. The minimum wage increase has on average increased hourly wages of permanent and temporary employees in the smallest SMEs when negative effects are shown for total working hours of permanent

employees in the smallest SMEs and of temporary employees in SMEs in the size of 5-9 employees. In terms of the effects on employment in different industries, not much differential effect is found in terms of total employment, but the minimum wage increase has on average increased total and permanent employment in SMEs in Accommodation & food service industry. As for the noncompliance rate, it only gets remarkably high in the beginning of 2018 but flattens out eventually, similar to the pattern in 2017.

As noted in Table of Contents, the rest of the paper explores the following: Section 2 discusses a number of literatures that are most relevant to the topic of the minimum wage rate; Section 3 briefly explores employment in Korea; Section 4 presents the type of data and explores descriptive statistics and other figures prior to the regression models; Section 5 is divided into six different parts:

5.1 Effects of raising the minimum wage on employment in SMEs: permanent employment, temporary employment, total employment
5.2 Effects of raising the minimum wage on hourly wages in SMEs: hourly wages for permanent and temporary employees
5.3 Effects of raising the minimum wage on working hours in SMEs: total working hours for permanent and temporary employees
5.4 Effects of raising the minimum wage on employment in SMEs by different industries
5.5 Limitations
5.6 Policy Implications

Sections 5.1 to 5.4 present a method, a regression model, the summary of results and interpretation on the results for each of the topics covered; Section 5.5 discusses the limitations in this paper; Section 5.6 suggests policy implications based on the results; lastly, Section 6 gives the conclusion.

2. LITERATURE REVIEW

With the high incidence of low wages in the Korean labor market compared to the levels seen in OECD countries, several protective policies have been set to help reduce the incidence of low pay and protect the low-pay workers; a minimum wage is one of them. Arguments over the minimum wage effects on employment in the Korean labor market vary a lot: some literatures found the negative effects of the minimum wage increase on employment (Yeongmin Kim 2014, Seongil Nam 2008, Daeil Kim 2012, Dong Ug Kang 2010) when some found positive or no effects on employment (Byeongchan Lee 2008, Sikyun Lee 2007, Yu-seon Kim et al 2004, Yu-seon Kim 2014, Baek and Park 2016).

Another part to note is that Baek and Park (2016) used data from late 1980s

and early 1990s, but the impact of raising the minimum wage on employment in SMEs in 2018 could be different from the early 1990s. This is because Korea has experienced drastic economic transformations in the last few decades[**], and so with these changes, the economic conditions in the late 1980s and early 1990s are considered totally different from the current conditions. Along with economic growth, labor market conditions as well as the trends of employment in Korea have changed as well. So, the minimum wage effect could turn differently in current conditions.

Since the purpose of setting up the minimum wage or increasing the minimum wage is to protect low-pay workers and guarantee the minimum standard of living for these workers, many literatures on the Korean labor market focus on how raising the minimum wage affects low-pay workers in Korea or a group of populations holding the characteristics of "low-pay" workers (Yu-seon Kim 2004, Daeil Kim 2012, Sikyun Lee 2007, Hwang and Lee 2012) to evaluate whether the minimum wage increase has worked for low-pay workers (Byeongchan Lee 2008), but no literature specifically looks into how raising the minimum wage would impact employment in SMEs in Korea when they are the largest job provider across the nation.

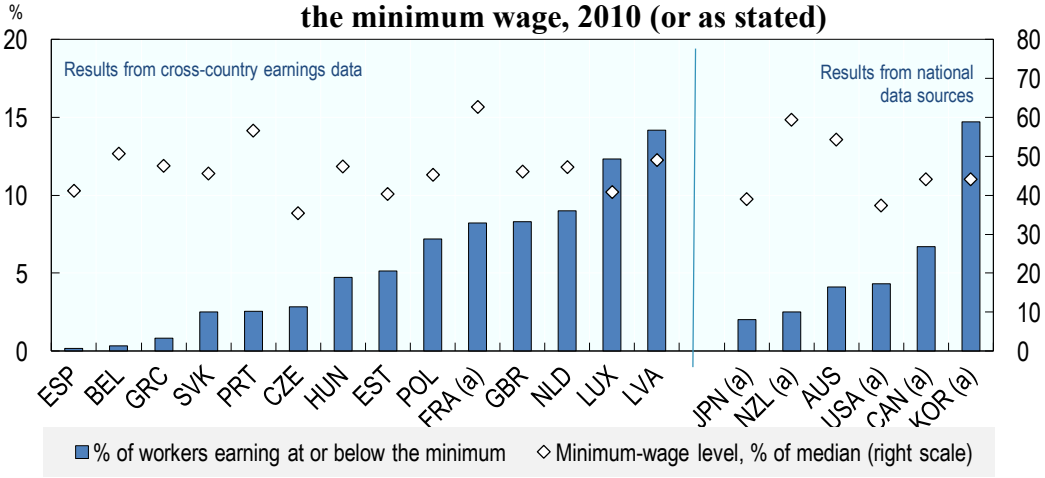
Increasing the minimum wage raises wages of low-pay workers but it also significantly reduces firm's profitability. Draca et al (2011) examines the impact of the minimum wage on firm profitability by looking into the changes induced by the introduction of a UK national minimum wage in 1999. They show that introducing the minimum wage significantly increased the wages and significantly reduced the firm profitability. However, they find no effects on firm employment or productivity. If to solely take into account the result of this paper, the prediction over the impact of raising the minimum wage on employment would be as follows: though firm profitability could significantly decline after implementing the minimum wage, the implementation of the minimum wage would not affect employment in SMEs. However, what I believe could change this predicted result is that, in the case of SMEs – especially the smallest enterprises in the size of 1-5 employees – may face shutdown price more quickly than larger ones with relatively lower profits and may have to exit the market when profitability is largely affected, which will also lead to a reduction in the employment rate. The result in Nam (2017) supports this argument to some extent: Nam (2017) found out that fixed personnel expenses are one of the cost factors that have significant effects on shutdown rate of self-employed businesses[††].

[**] Growth in GDP per capita in Korea as an indicator of economic growth, is presented in Appendix (A3).

[††] I found self-employed businesses relevant to SMEs for SMEs in Korea include a big portion of self-employed enterprises with the number of employees starting from 1.

In terms of measuring the effects of the policy implemented, it is not only important to pick the right strategy and data to carry out measuring the effect of the policy but is also important to see whether or not the targeted market complies well with the enacted policy. Relating this market compliance with the minimum wage effect, Hwang and Lee (2012) found a significant role that non-compliance rate plays in measuring the effect of the minimum wage when they examined the minimum wage effect on the incidence of low pay in Korea in their paper. Using a one-way fixed effects panel regression (controlling only for industry) in three different periods (1989-1992, 1993-2001, and 2002-2008), Hwang and Lee use a model that includes the Kaitz index and non-compliance rates by industry. Their results show that though the Kaitz index significantly decreased low-pay incidence in the first and second periods (1989-92, 1993-2001), the rate of non-compliance significantly increased low-pay incidence in the second and third periods (1993-2001, 2003-2008). They conclude that the effect of the minimum wage has not "materialized" due to soaring non-compliance rates and low benefit levels, and suggested this as a possible explanation for why raising the minimum wage failed to make even a moderate impact on low-pay incidence. Consistent with their finding, the following figure (Figure 2) from OECD implies that Korea has the highest non-compliance rate among other countries in 2010. Though the dependent variable that OECD used is different from what is used as a dependent variable in this paper (which is the employment rate in small and medium enterprises (SMEs)), this literature importantly addresses the significance of taking into account an increasing trend of non-compliance rate in the Korean labor market which is a barrier to measure the "true" effect of the minimum wage on the employment in

Figure 2. Proportion of workers earning at or below the minimum wage, 2010 (or as stated)



Source: OECD (2015), "Minimum Wages After the Crisis: Making them Pay"

SMEs; if most of SMEs in Korea do not comply with the minimum wage enactment, it would be a policy failure and a labor market failure as Hwang and Lee mentioned.

Such a high non-compliance rate in Korea supports "imperfect enforcement of the minimum wage (Danziger 2010)" to some extent. Danziger (2010) examines the consequences of introducing a minimum wage rate in a competitive low-pay labor market theoretically and proposes a new model to demonstrate that an imperfectly enforced minimum-wage causes small firms to face an upward-sloping labor supply schedule, leading these small firms to become endogenous monopsonists. He argues that this will then cause the minimum wage rate to have negative impact on employment in small firms as well as what these firms offer their workers: the employment in the small firms will reduce and employed workers in the small firms will become worse off. His paper does not deal with the empirical evidence but the theoretical proposition and proof to demonstrate the negative effect of the minimum wage under monopsony. Briefly bringing the important points related with how raising the minimum wage would impact employment in SMEs in Korea, his model proposes that the firm will pay a subminimum wage rate if the expected labor cost – expectation of getting caught by inspection and paying both the back wages and awards and fines – is less than the minimum wage rate, and the smaller the firm, the lower is the expected labor cost and the more likely it is for them to pay less than the minimum wage rate. This proposition is consistent with what Hwang and Lee (2012) empirically found in their paper (increasing non-compliance rate with the minimum wage) as well as the characteristics of Korean economic structure where SMEs are the largest providers of jobs. Based on the results and arguments of these two papers, raising the minimum wage is predicted to reduce employment in SMEs and could negatively impact the overall employment in Korea with SMEs as the largest job providers.

3. EMPLOYMENT IN KOREA

To briefly introduce employment background in Korea, this section presents the overall structure of employment in terms of employment types, and the share of SMEs in each employment type.

In Korea, the share of permanent employees is dominantly the largest among all the employment types. This is shown in Figure 3 on the next page. It describes how the shares of permanent employees[‡‡], temporary (and daily) employees[§§], and

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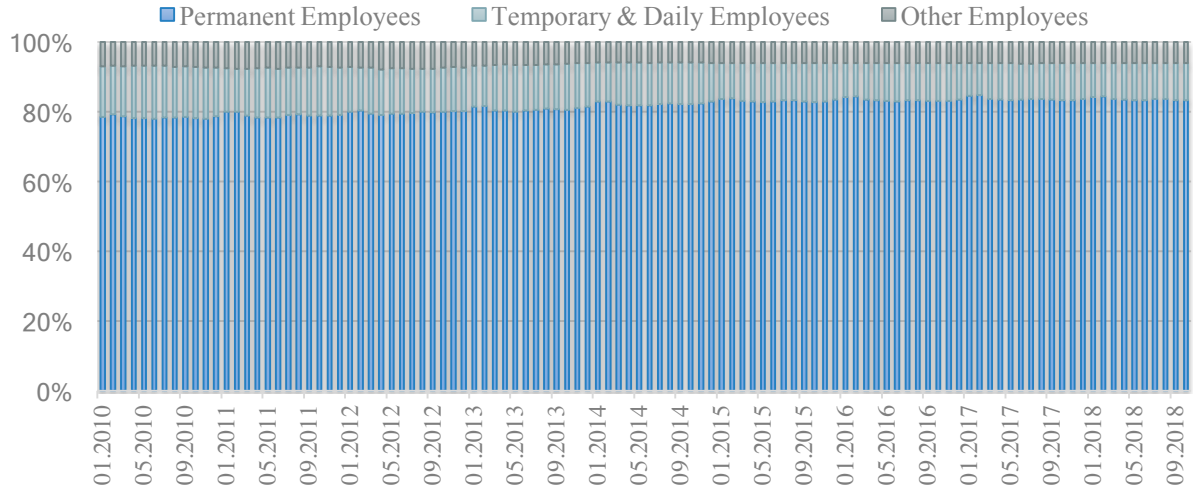
[‡‡] Permanent employees are defined as all employees whose contracts last for one year or more, or employees with no fixed contract periods; they are paid by establishments (Source: South Korea Ministry of Labour, CEIC Global Database).

[§§] Temporary and daily employees are the employees who are hired for less than one year or on a daily-allowance basis. (Source: South Korea Ministry of Labour, CEIC Global Database)

other employees[***] in total employment in Korea have changed in the last eight years. In a consistent manner, the proportion of permanent employees has notably taken up the largest proportion of employment in Korean labor market for the last eight years and its proportion even slightly increased from 2014 onwards. So, among all different employment types, this implies the most significance of minimum wages on permanent employment.

Looking closely into each employment type in terms of firm size, the following figures (Figure 4.1, 4.2, 4.3) uniformly show that SMEs are the major source of providing jobs for all employment types, which adds significance to finding out how employment level in SMEs responds to an increase in minimum wages in the Korean labor market.

Figure 3. Share of Employment in Korea



Source: South Korea Ministry of Labour, CEIC Global Database

[***] Other employees are the employees with no fixed amount of payment but only service charge or commission in proportion to his/her sales records. (Source: South Korea Ministry of Labour, CEIC Global Database) Other employees are not reported in the dataset and so are excluded from employment type in this paper.

Figure 4.1 Permanent Employees
by enterprise size

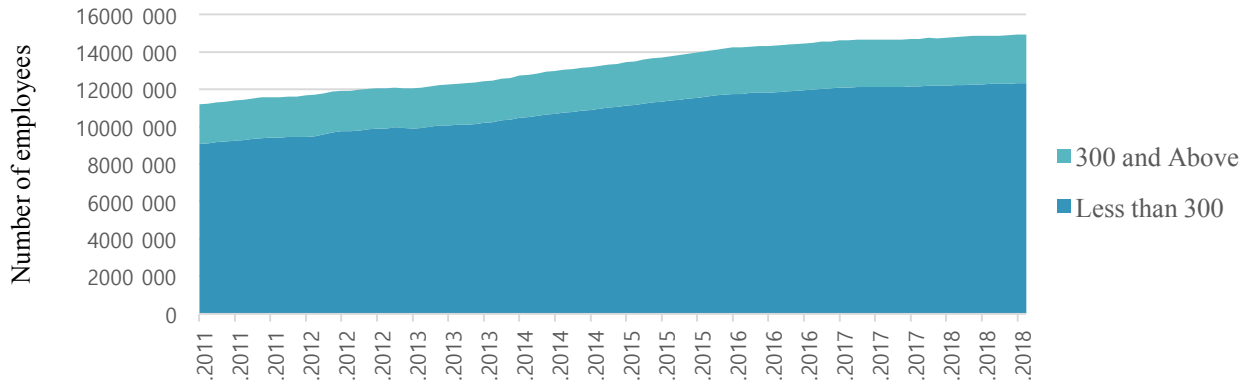


Figure 4.2 Temporary & Daily Employees
by enterprise size

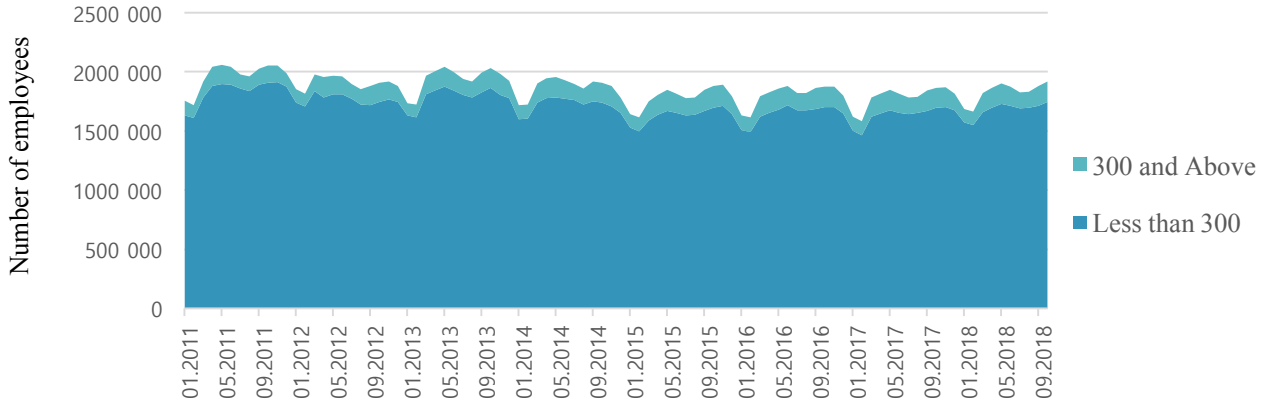
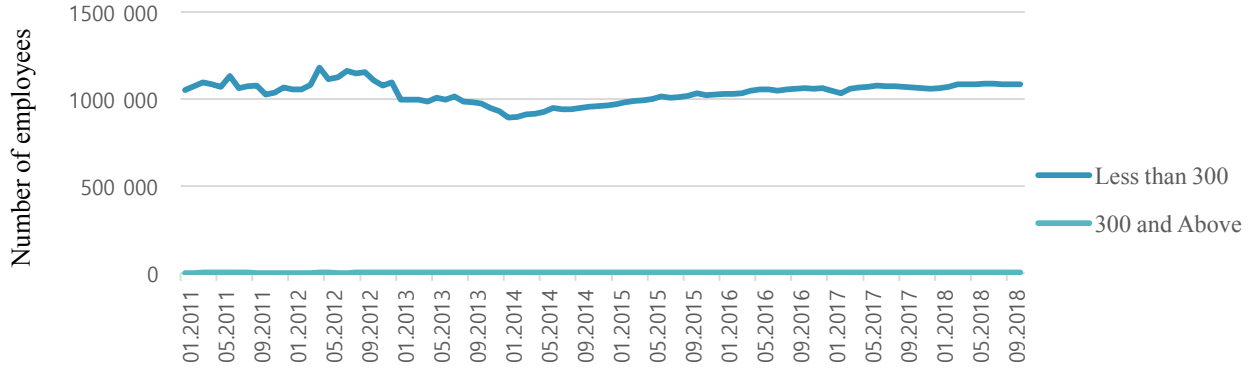


Figure 4.3 Other Employees
by enterprise size

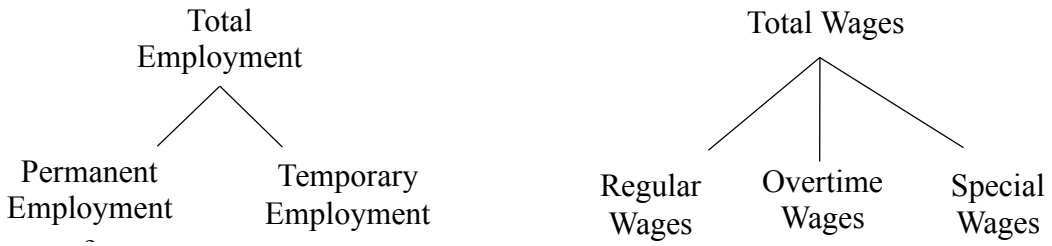


Sources: South Korea Ministry of Labour, CEIC Global Database

4. DATA

Upon the approval of data provision from Ministry of Labour in South Korea, multiple cross-sectional data were drawn from monthly labor surveys of approximately 11,000 enterprises from January 2017 to December 2018. The units of observation are enterprises that responded to this labor survey, and the sample size of 281,236 enterprises was in total collected for 24 months. Employment data is fractionalized into permanent employees and temporary (and daily) employees. Wages reported are categorized into regular wages, overtime wages, special wages and total wages as the sum of these aforementioned wages. For temporary employees, only total wages are reported in the survey because of the nature that temporary employment entails. The classifications of employment and wages in the survey are visually presented in Figure 5:

Figure 5. Classifications of employment and wages



This firm-level dataset provides two types of information:

(1) **Information about each enterprise surveyed**:
an industry that an enterprise belongs to, and the firm size[†††]

(2) **Information about employees that each enterprise hired**:
the number of employees hired for each employment type and total number of employees, regular wages & overtime wages & special wages for permanent employees, and total wages for both permanent and temporary employees, working hours and days of employees for each type of employees.

[†††] Firm size is defined by the number of permanent employees hired in each enterprise. More details are presented later in Section 5.

To check whether an increase in the minimum wage has worked in 2018, hourly wage distributions[‡‡‡] [§§§] for permanent employees[****] at four different points of time (January 2017 & 2018, December 2017 & 2018) are created for comparison (Figure 6.1). In Figure 6.1, wage distributions in January 2017 and January 2018 show that the number of enterprises paying right above the minimum wage boundary has slightly increased when the number of enterprises paying below the minimum wage has also increased. But, in contrast to this comparison, wage distributions in December 2017 and December 2018 show that when both the number of enterprises paying right above the minimum wage and the number of enterprises paying below the minimum wage have decreased from December 2017 to December 2018, the number of firms paying much higher than the minimum wage has increased.

In Figure 6.1, the firms paying less than the minimum wage rate in 2018 are the firms that contribute to the noncompliance rate of the minimum wage. As seen in the literature review, the noncompliance rate in Korea is high, relative to other OECD countries. To see whether this rate has changed dramatically due to a hike in the minimum wage in 2018 and answer the third main question, the noncompliance rate is derived by computing the proportion of firms paying less than minimum wage for each month from Jan 2017 to Dec 2018. Figure 6.2 shows the monthly noncompliance rate from January 2017 to December 2018. The computed noncompliance rates range from 2.2% to 6%; overall the rate is relatively lower than what is reported in Figure 3 (15%). The noncompliance rate drastically increases in January 2018, which seems remarkable in comparison to January 2017,

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[‡‡‡] Hourly regular wages for permanent employees are used for the distribution; hourly regular wages are derived by dividing monthly regular wages by monthly regular working hours. Some portions of regular wages (i.e. extra benefits, pensions) are not within the coverage of minimum wage and so hourly regular wages for permanent employees are considered a little higher than the minimum wage rate.

[§§§] Regular wages are total amount paid for regular hours worked as predetermine basic pay, regular allowance, and other allowance including unused annual leave compensation pursuant to employment contract, collective agreement and/or employment regulations; it excludes special payments and overtime payments. (Defined in the following source: South Korea Ministry of Labour, CEIC Global Database)

[****] Due to large differences in wages between permanent employees and temporary employees, hourly wage distributions are separately created. With permanent employees as the major type of employment, hourly wage distributions for permanent employees are presented here, but the same result holds for temporary employees and is shown in Appendix (A4).

but later it flattens out eventually. So, despite a hike in minimum wage in 2018, the noncompliance rate does not seem to vary a lot in 2018.

Figure 6.1 Hourly wage distribution for permanent employees

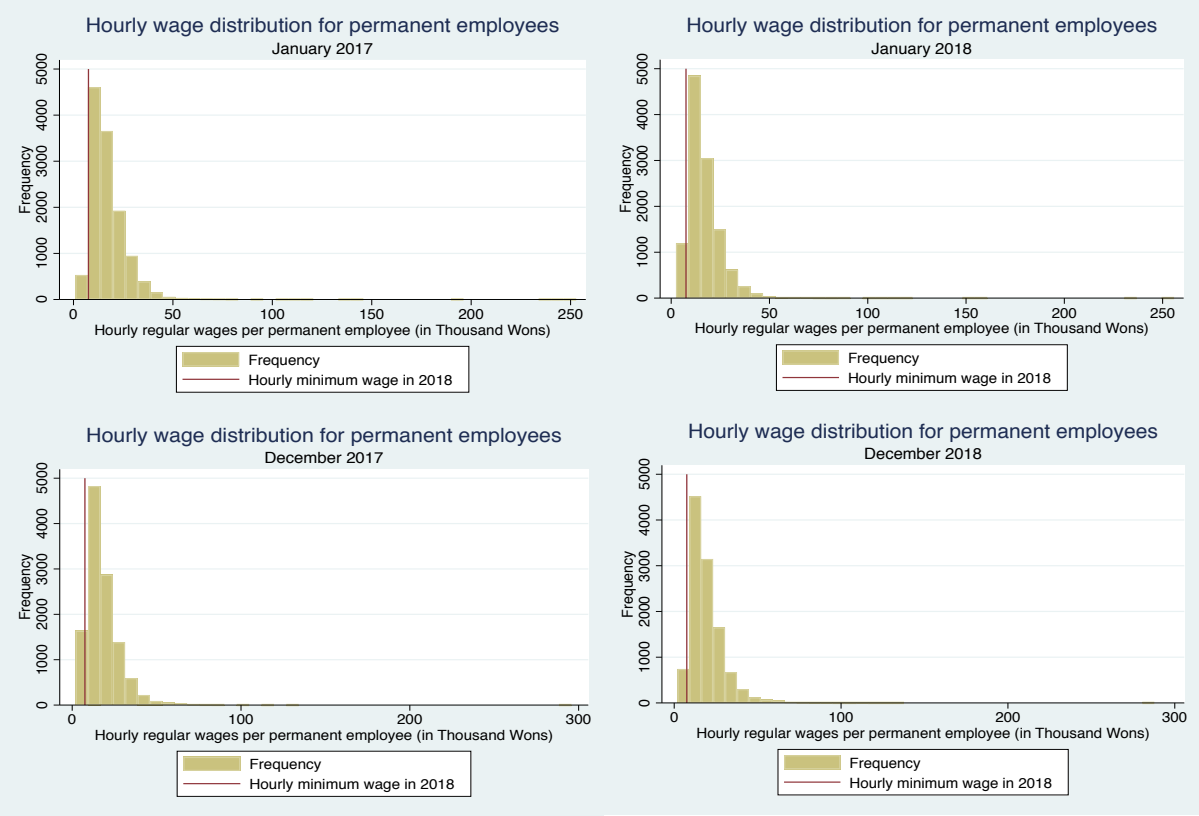
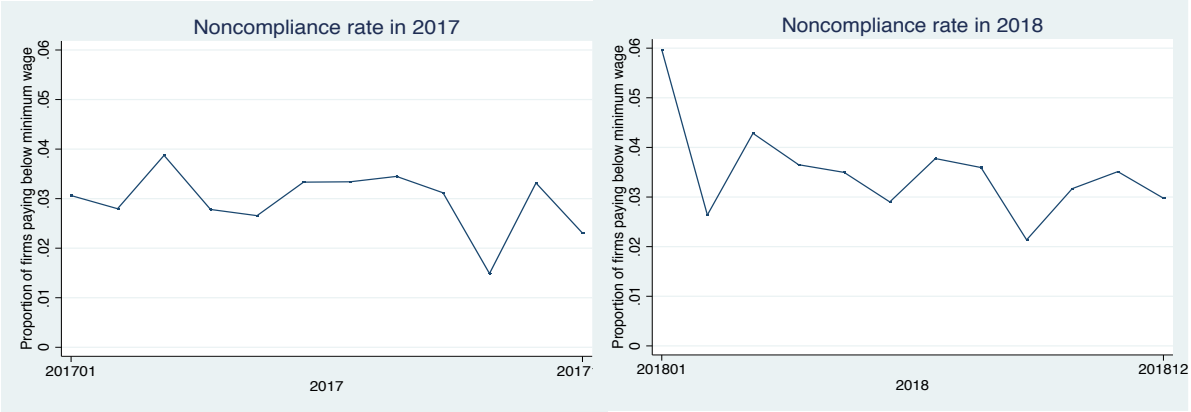
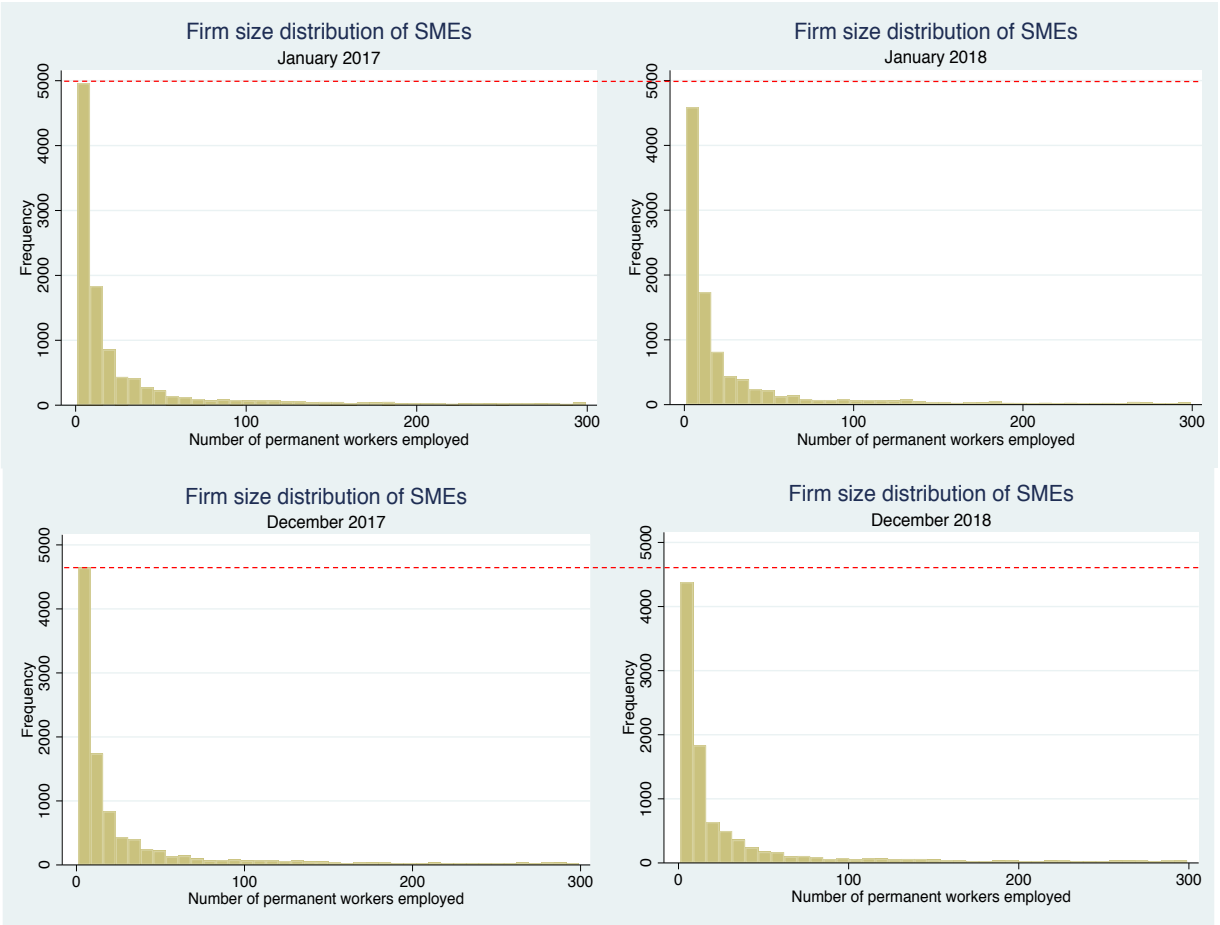


Figure 6.2 Noncompliance rate in 2017 and 2018



Apart from checking whether the minimum wage implementation has changed the wage distribution in 2018, we can also look at the firm size distribution to check whether there is any change in this distribution in 2018 since a change in firm size distribution could be the possible sign of the minimum wage effect in 2018. The distributions are from January 2017 & 2018 and December 2017 & 2018 and are presented on Figure 6.3. The result from comparison in firm size distributions between January 2017 and 2018 is consistent with the one from comparison in the distributions between December 2017 and 2018: the number of firms hiring 10 or less employees has decreased from 2017 to 2018 when the number of firms hiring more than 10 employees seems to stay the same in 2018. Though it is not panel data that tracks the same firms from 2017 to 2018 but is a set of multiple cross-sectional data that has collected different samples of enterprises at each point of time, the reduction in the number of firms hiring 10 or below employees may imply that the firms that hired 10 or less employees in 2017 but disappeared in 2018 either moved

Figure 6.3 Firm size distributions of SMEs



into the higher category where they hire more than 10 employees or they shut down. In any manner, this change in distribution would be due to the minimum wage effects in 2018. So, this relationship will be checked more thoroughly in the next sections.

Summary statistics are presented in Table 1 on the next page. Consistent with the findings on the proportion of permanent employees in total employment in the previous section, Table 1 shows that most employees in SMEs and large enterprises are permanent employees; the number of permanent employees is on average much higher than the number of temporary employees in all of small, medium and large enterprises. Column (1) of Panel D shows that SMEs are 86.1% of the entire sample when those with less than 10 employees take up almost half the proportions of the entire sample (43.5%). This high contribution of SMEs again emphasizes their importance in job provision in the labor market. In the whole sample, monthly total wages for permanent employees are, on average, much higher than the ones for temporary employees; wage differentials between permanent employees and temporary employees get bigger as moving from small to medium and medium to large enterprises. This finding implies that temporary employees are more susceptible to regulatory shocks in the minimum wage than permanent employees. In term of employees' working hours, average total working hours of permanent employees increase as the size of enterprises increases. In contrast, average total working hours of temporary employees are larger in medium and large enterprises than in small enterprises but there is not much difference in these hours between medium and large enterprises.

Table 1. Descriptive statistics
Jan 2017

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Whole sample		Small Enterprises (1-99 employees)		Medium Enterprises (100-299 employees)		Large Enterprises (300 or above employees)	
VARIABLES	mean	sd	mean	sd	mean	sd	mean	sd
Panel A: Total Employees (Permanent employees + Temporary employees)								
Total number of employees	169.6	739.7	18.29	29.08	193.5	108.3	1,007	1,766
Total working days of total employees	3,322	14,029	357.4	519.7	3,878	2,315	19,669	33,218
Total working hours of total employees	28,015	115,647	2,972	4,317	32,855	20,679	165,992	271,830
Total wages of total employees (in Thousand Wons)	1.091e+06	1.218e+07	62,554	110,520	845,259	777,017	7.026e+06	3.213e+07
Panel B: Permanent employees								
Number of permanent workers employed	162.3	728.0	20.76	22.70	178.7	66.92	963.3	1,735
Total working days of permanent employees	3,203	13,822	321.5	390.5	3,601	1,244	19,179	32,856
Total working hours per permanent employee (monthly)	169.8	25.00	169.6	24.53	169.9	27.33	170.8	26.12
Total working hours per permanent employee (daily)	8.318	1.153	8.254	1.107	8.462	1.174	8.586	1.324
Regular working hours per permanent employee (monthly)	162.1	20.55	163.8	20.70	155.2	19.00	156.2	18.50
Overtime working hours per permanent employee (monthly)	7.734	16.14	5.776	14.25	14.68	19.86	14.55	20.16
Monthly total wages per permanent worker (in Thousand Wons)	3,599	2,666	3,172	1,956	4,464	3,278	5,479	4,287
Hourly total wages per permanent employee (in Thousand Wons)	21.72	17.64	19.07	12.86	27.56	25.30	33.09	27.23
Monthly regular wages per permanent employee (in Thousand Wons)	2,713	1,315	2,554	1,212	3,072	1,421	3,389	1,535
Hourly regular wages per permanent employee (in Thousand Wons)	17.16	9.821	15.92	8.699	20.53	14.16	22.11	10.52
Monthly overtime working wages per permanent employee (in Thousand Wons)	146.0	288.6	97.89	232.4	292.6	380.7	328.2	389.6
Monthly special wages per permanent employee (in Thousand Wons)	740.1	1,872	519.5	1,133	1,099	2,533	1,762	3,585
Panel C: Temporary employees								
Number of temporary workers employed	7.309	50.20	2.504	20.38	14.31	87.55	30.14	102.9
Working days per temporary employee (monthly)	15.51	6.444	14.82	6.671	16.84	6.009	16.59	5.811
Working hours per temporary employee (monthly)	115.2	56.54	107.0	56.49	131.1	54.98	127.9	53.46
Working hours of temporary employees per day	7.396	1.784	7.257	1.835	7.681	1.618	7.603	1.695
Monthly total wages per temporary employee (in Thousand Wons)	1,438	1,043	1,256	863.5	1,671	1,138	1,771	1,269
Hourly wages per temporary employee (in Thousand Wons)	13.24	12.46	12.79	13.84	13.04	9.210	14.42	9.912
Panel D: Proportions of firms by firm size								
Weighted	108.3	172.8	72.79	89.37	8.708	7.067	1.233	0.419
Masking	0.00994	0.0992	0.000153	0.0124	0	0	0.0638	0.244
1-4 employees	0.216	0.411	0.278	0.448	0	0	0	0
5-9 employees	0.219	0.413	0.281	0.450	0	0	0	0
10-29 employees	0.215	0.411	0.276	0.447	0	0	0	0
30-99 employees	0.128	0.334	0.165	0.371	0	0	0	0
100-299 employees	0.0837	0.277	0	0	1	0	0	0
300 or more employees	0.139	0.346	0	0	0	0	1	0

5. METHODS AND RESULTS

5.1 ESTIMATING THE IMPACT OF THE MINIMUM WAGE INCREASE ON EMPLOYMENT IN SMES

Method

Section 5.1 explores the effects of raising the minimum wage on employment in SMEs. To test my hypothesis that raising the minimum wage reduces employment in SMEs, a difference-in-differences methodology is used as follows:

$$log\ (emp_{zit}) = B_0 + B_1 Post_t + B_2 SME1_{it} + B_3 SME2_{it} + B_4 SME3_{it} + B_5 SME4_{it} + B_6 SME5_{it} + B_7 (SME1_{it} * Post_t) + B_8 (SME2_{it} * Post_{it}) + B_9 (SME3_{it} * Post_{it}) + B_{10} (SME4_{it} * Post_{it}) + B_{11} (SME5_{it} * Post_{it}) + month_t + \varepsilon_{it} \quad (1)$$

where

$SMEj$ = 1, where j = 1 if 1-4 employees

= 2 if 5-9 employees

= 3 if 10-29 employees

= 4 if 30-99 employees

= 5 if 100 -299 employees

= 0 otherwise (300 or above employees);

$Post$ = 1 2018, a year during which the minimum wage increase for 2018 was implemented

= 0 2017, a year during which the minimum wage increase for 2018 was not yet implemented

i indexes each enterprise where i = 1,…, I; t indexes a given point of time where t = 1,...,T to indicate different monthly points from 2017 to 2018; z indexes each employment type where z = 1 if permanent employment, 2 if temporary employment, 3 if total employment; emp denotes the number of employees hired for each employment type z, in each enterprise i, at time t; $month$ denotes a set of month dummies to control for time variations; ε denotes an error term.

As noted in the explanation for SME variables, SMEs are divided into five different groups by firm sizes to examine the differential impact of the minimum wage increase on employment in each different size of SMEs. The results on the effects of the minimum wage increase on employment in SMEs are reported in the following ways: (1) its effects on permanent employment (2) its effects on temporary employment (3) its effects on total employment.

Results

Table 2.1: Effect of raising minimum wage on the number of permanent employees

logworker	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
post	0.033	0.009	3.58	0.000	0.015	0.051	***
1-4 employees	-5.755	0.006	-975.53	0.000	-5.766	-5.743	***
5-9 employees	-4.624	0.005	-887.52	0.000	-4.634	-4.613	***
10-29 employees	-3.770	0.005	-698.81	0.000	-3.780	-3.759	***
30-99 employees	-2.606	0.006	-459.13	0.000	-2.617	-2.594	***
100-299 employees	-1.380	0.006	-234.47	0.000	-1.391	-1.368	***
Post * 1-4 Employees	-0.018	0.008	-2.16	0.031	-0.035	-0.002	**
Post * 5-9 Employees	-0.027	0.007	-3.56	0.000	-0.041	-0.012	***
Post * 10-29 Emplo~s	-0.022	0.008	-2.87	0.004	-0.037	-0.007	***
Post * 30-99 Emplo~s	-0.024	0.008	-2.98	0.003	-0.040	-0.008	***
Post * 100-299 Emp~s	-0.012	0.008	-1.44	0.150	-0.029	0.004	
Constant	6.517	0.006	1023.00	0.000	6.504	6.529	***

Mean dependent var	3.022	SD dependent var	1.939
R-squared	0.950	Number of obs	281737.000
F-test	138761.235	Prob > F	0.000
Akaike crit. (AIC)	329444.446	Bayesian crit. (BIC)	329803.102

**** p<0.01, ** p<0.05, * p<0.1*

Table 2.1 presents the effect of raising the minimum wage on the number of permanent employees. The effect of the minimum wage increase on employment in all categories of SMEs is overall negative relative to large enterprises when its effect on large enterprises is positive. An increase in the minimum wage in 2018 has on average increased the number of permanent employees in large enterprises by 3.3%. In this case of permanent employees, employment in enterprises with 5-9 employees is most affected: for SMEs with 5-9 employees, the minimum wage increase in 2018 has on average reduced its employment by 2.7% in 2018. All the coefficients on the effects of the minimum wage increase are statistically significant at 5% level except for the enterprises with 100-299 employees.

However, its effects turn out differently with the number of temporary employees (Table 2.2). The minimum wage effect on the number of temporary employees is negative for large enterprises: for large enterprises with more than 300

employees, the minimum wage increase in 2018 has on average reduced the number of temporary employees by 16.0% in 2018. Its effects are positive in SMEs with 1-4 employees, 10-29 employees, and 100-299 employees when its effects stay the same as negative in SMEs with 5-9 employees and 30-99 employees. But, this impact is only statistically significant for SMEs with 30-99 employees (10% significance level) and large enterprises (1% significance level). For SMEs with 30-99 employees, the minimum wage increase in 2018 has on average reduced the temporary employment by 6.6% relative to large enterprises.

Table 2.2: Effect of raising minimum wage on the number of temporary employees

logtworker	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
post	-0.160	0.046	-3.47	0.001	-0.251	-0.070	***
1-4 employees	-2.475	0.022	-111.48	0.000	-2.519	-2.432	***
5-9 employees	-1.918	0.026	-73.70	0.000	-1.969	-1.867	***
10-29 employees	-1.748	0.025	-69.69	0.000	-1.797	-1.699	***
30-99 employees	-1.381	0.026	-52.92	0.000	-1.432	-1.329	***
100-299 employees	-0.894	0.032	-28.28	0.000	-0.955	-0.832	***
Post * 1-4 Employees	0.047	0.033	1.44	0.150	-0.017	0.111	
Post * 5-9 Employees	-0.022	0.038	-0.59	0.554	-0.096	0.051	
Post * 10-29 Emplo~s	0.029	0.036	0.79	0.429	-0.042	0.100	
Post * 30-99 Emplo~s	-0.066	0.038	-1.74	0.082	-0.139	0.008	*
Post * 100-299 Emp~s	0.017	0.045	0.38	0.702	-0.070	0.104	
Constant	3.312	0.033	101.45	0.000	3.248	3.376	***

Mean dependent var	2.045	SD dependent var	1.676
R-squared	0.259	Number of obs	63982.000
F-test	770.413	Prob > F	0.000
Akaike crit. (AIC)	228602.293	Bayesian crit. (BIC)	228910.549

**** p<0.01, ** p<0.05, * p<0.1*

Table 2.3 on the next page presents the effect of raising the minimum wage on the number of total employees. With the number of permanent employees as the major component in total employment, the result for total employment is consistent with the result for permanent employees: overall, it shows that raising the minimum wage has negatively affected the employment in SMEs but positively affected the employment in large enterprises. For large enterprises, raising the minimum wage has on average increased its total employment by 3.3%. SMEs are ordered in a decreasing magnitude in the minimum wage effects on total employment as follows: (1) 30-99 employees (-3.3%); (2) 5-9 employees (-3.1%) (3) 1-4 employees (-2.6%) (4) 10-29 employees (-2.5%) (5) 100-299 employees (-1.5%). Surprisingly, unlike relatively large negative effects of the minimum wage increase on the number of temporary employees in large enterprises, its effect on total employment in large enterprises stays exactly the same as its effect on permanent employment. Summary

statistics suggest that this could be because temporary employment takes up less than 10% of the total employment in large enterprises.

The result from the minimum wage impact on total employment in SMEs supports my hypothesis that raising the minimum wage reduces employment in SMEs in Korea. Its negative effects are consistent with the model of the minimum wage implementation in a perfectly competitive market where imposing a minimum wage incurs unemployment.

Table 2.3: Effect of raising minimum wage on the number of total employees

logaworker	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
post	0.033	0.010	3.35	0.001	0.014	0.052	***
1-4 employees	-5.692	0.006	-920.67	0.000	-5.704	-5.680	***
5-9 employees	-4.578	0.006	-818.83	0.000	-4.588	-4.567	***
10-29 employees	-3.722	0.006	-649.98	0.000	-3.733	-3.711	***
30-99 employees	-2.580	0.006	-434.19	0.000	-2.592	-2.568	***
100-299 employees	-1.370	0.006	-221.69	0.000	-1.382	-1.358	***
Post * 1-4 Employees	-0.026	0.009	-2.93	0.003	-0.043	-0.009	***
Post * 5-9 Employees	-0.031	0.008	-3.86	0.000	-0.047	-0.015	***
Post * 10-29 Emplo~s	-0.025	0.008	-3.06	0.002	-0.041	-0.009	***
Post * 30-99 Emplo~s	-0.033	0.008	-3.87	0.000	-0.050	-0.016	***
Post * 100-299 Emp~s	-0.015	0.009	-1.73	0.084	-0.032	0.002	*
Constant	6.564	0.007	954.79	0.000	6.550	6.577	***

Mean dependent var	3.104	SD dependent var	1.938
R-squared	0.931	Number of obs	281236.000
F-test	95220.857	Prob > F	0.000
Akaike crit. (AIC)	420366.733	Bayesian crit. (BIC)	420725.330

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

5.2 ESTIMATING THE IMPACT OF THE MINIMUM WAGE INCREASE ON HOURLY WAGES IN SMES

Method

This section explores the effects of raising the minimum wage on hourly wages in SMEs. The following equation is used to estimate the effects of the minimum wage increase on hourly wages for permanent employees and temporary employees in SMEs:

$$log\ (wages_{zit}) = B_0 + B_1 Post_t + B_2 SME1_{it} + B_3 SME2_{it} + B_4 SME3_{it} + B_5 SME4_{it} + B_6 SME5_{it} + B_7 (SME1_{it} * Post_t) + B_8 (SME2_{it} * Post_{it}) + B_9 (SME3_{it} * Post_{it}) + B_{10} (SME4_{it} * Post_{it}) + B_{11} (SME5_{it} * Post_{it}) + month_t + \varepsilon_{it} \quad (2)$$

where $wages$[14] denotes monthly total wages for each employment type z, in each enterprise i, at time t, and definitions for other variables and subscripts are the same as in equation (1).

Results

Table 3.1: Effect of raising minimum wage on hourly wages per permanent employee

logmonrwage2	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
post	-0.039	0.007	-5.57	0.000	-0.052	-0.025	***
1-4 employees	-0.549	0.004	-132.84	0.000	-0.557	-0.541	***
5-9 employees	-0.298	0.004	-74.57	0.000	-0.306	-0.290	***
10-29 employees	-0.176	0.004	-44.06	0.000	-0.184	-0.168	***
30-99 employees	-0.131	0.004	-29.48	0.000	-0.140	-0.123	***
100-299 employees	-0.076	0.005	-14.62	0.000	-0.087	-0.066	***
Post * 1-4 Employees	0.025	0.006	4.43	0.000	0.014	0.037	***
Post * 5-9 Employees	-0.005	0.006	-0.94	0.345	-0.016	0.006	
Post * 10-29 Emplo~s	-0.006	0.006	-1.18	0.240	-0.017	0.004	
Post * 30-99 Emplo~s	-0.014	0.006	-2.35	0.019	-0.027	-0.002	**
Post * 100-299 Emp~s	-0.022	0.007	-3.02	0.003	-0.036	-0.008	***
Constant	3.014	0.005	584.30	0.000	3.004	3.024	***

Mean dependent var	2.757	SD dependent var	0.453
R-squared	0.183	Number of obs	281233.000
F-test	1745.514	Prob > F	0.000
Akaike crit. (AIC)	296381.200	Bayesian crit. (BIC)	296739.796

**** p<0.01, ** p<0.05, * p<0.1*

Table 3.1 presents the effects of the minimum wage increase on hourly wages for permanent employees. Positive effect on hourly wages is only shown for the smallest SMEs (1-4 employees) when negative effects are found in large enterprises and SMEs in the sizes of 30-99 employees and 100-299 employees; with no statistical power, the impact of the minimum wage increase on hourly wages of permanent employees is almost zero for SMEs in the sizes of 5-9 employees and 10-29 employees. Raising the minimum wage has on average increased hourly wages of permanent employees in the smallest SMEs by 2.5% relative to large enterprises when it has on average reduced hourly wages of permanent employees in large enterprises by 3.9%. The coefficient estimates are statistically significant

[14] Hourly wages are computed differently for permanent and temporary employees: for permanent employees, regular wages are used instead of total wages since total wages include overtime wages and other benefits which could overestimate hourly wages paid to permanent employees Still, using regular wages for computing hourly wages could overestimate the amount. (Please refer back to footnote 12 for further information); for temporary employees, only data on total wages is available and so total wages are used.

at 1% level except for SMEs in the sizes of 5-9 employees and 10-29 employees. Possible explanation for positive effects on hourly wages in the smallest SMEs is that with high wage differentials between small and large enterprises, these smallest enterprises likely offered lowest wages at the rate closer to minimum wage, and so raising the minimum wage in 2018 has forced these enterprises to raise hourly wages, resulting in higher hourly wages for permanent employees.

As for temporary employees, the impact on hourly wages stays the same for all SMEs but turns out differently for large enterprises (Table 3.2). Unlike the statistically significant, negative effects on hourly wages of permanent employees, the impact on hourly wages of temporary employees is close to zero in large enterprises. In the smallest SMEs, the positive impact of the minimum wage increase on hourly wages of temporary employees stays statistically significant at 1% level and is even larger by 9 percentage points than of permanent employees. Based on summary statistics, this difference could be due to high wage differentials between temporary and permanent employees: temporary employees in the smallest SMEs (in the size of 1-4 employees) are likely to be paid even lower than permanent employees in these enterprises, and so these enterprises have been forced to raise hourly wage rates for temporary employees even higher when the minimum wage was raised in 2018.

Table 3.2: Effect of raising minimum wage on hourly wages per temporary employee

logmontemwage2	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
post	0.008	0.014	0.56	0.579	-0.020	0.036	
1-4 employees	-0.263	0.009	-30.29	0.000	-0.280	-0.246	***
5-9 employees	-0.079	0.009	-8.95	0.000	-0.096	-0.062	***
10-29 employees	-0.104	0.008	-13.14	0.000	-0.120	-0.089	***
30-99 employees	-0.135	0.008	-16.48	0.000	-0.151	-0.119	***
100-299 employees	-0.101	0.009	-11.05	0.000	-0.118	-0.083	***
Post * 1-4 Employees	0.034	0.012	2.72	0.007	0.009	0.058	***
Post * 5-9 Employees	-0.018	0.012	-1.48	0.139	-0.043	0.006	
Post * 10-29 Emplo~s	-0.004	0.011	-0.38	0.708	-0.026	0.018	
Post * 30-99 Emplo~s	-0.020	0.011	-1.79	0.074	-0.043	0.002	*
Post * 100-299 Emp~s	-0.038	0.013	-2.95	0.003	-0.063	-0.013	***
Constant	2.617	0.011	244.78	0.000	2.596	2.638	***

Mean dependent var	2.518	SD dependent var	0.465
R-squared	0.044	Number of obs	63980.000
F-test	84.778	Prob > F	0.000
Akaike crit. (AIC)	80759.623	Bayesian crit. (BIC)	81067.878

**** p<0.01, ** p<0.05, * p<0.1*

5.3 ESTIMATING THE IMPACT OF THE MINIMUM WAGE INCREASE ON TOTAL WORKING HOURS IN SMES

Method

So far, we have seen that when the minimum wage was raised in 2018, all the sizes of SMEs have on average cut off total employment and the smallest enterprises in the size of 1-4 employees have on average raised hourly wages both for permanent and temporary employees in 2018. In reaction to this regulatory shock of the minimum wage, SMEs could have also lowered or restricted the working hours of employees to keep the cost of labor lower. To estimate the effects of the minimum wage increase on monthly total working hours of permanent employees and temporary employees, the following equation is used:

$$log\ (hours_{zit}) = B_0 + B_1 Post_t + B_2 SME1_{it} + B_3 SME2_{it} + B_4 SME3_{it} + B_5 SME4_{it} + B_6 SME5_{it} + B_7 (SME1_{it} * Post_t) + B_8 (SME2_{it} * Post_{it}) + B_9 (SME3_{it} * Post_{it}) + B_{10} (SME4_{it} * Post_{it}) + B_{11} (SME5_{it} * Post_{it}) + month_t + \varepsilon_{it} \quad (3)$$

where $hours$ denotes monthly total working hours for each employment type z, in each enterprise i, at time t, and definitions for other variables and subscripts are the same as in equation (1).

Results

Table 4.1 reports the results of the minimum wage impact on total working hours for permanent employees. The result shows that the minimum wage increase in 2018 has on average reduced total working hours of permanent employees in SMEs with 1-4 employees, 30-99 employees and large enterprises when it has no effect on the working hours of permanent employees in SMEs in sizes of 5-9, 10-29 and 30-99 employees. When its effect is nearly zero for SMEs with 30-99 employees, an increase in the minimum wage has on average reduced total working hours of permanent employees in SMEs with 1-4 employees by 1% relative to large enterprises and also reduced the working hours of permanent employees in large enterprises by 1.4%; the coefficient estimates for these two enterprises are statistically significant at 1% level. This result supports the idea that the smallest enterprises that had to increase hourly wages for permanent employees could have cut their working hours to keep labor cost lower.

Table 4.1: Effect of raising minimum wage on total working hours per permanent employee

logmontwh	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
post	-0.014	0.002	-6.00	0.000	-0.018	-0.009	***
1-4 employees	-0.012	0.001	-8.37	0.000	-0.015	-0.009	***
5-9 employees	-0.003	0.001	-2.21	0.027	-0.005	0.000	**
10-29 employees	0.007	0.001	5.14	0.000	0.004	0.009	***
30-99 employees	0.015	0.002	9.67	0.000	0.012	0.018	***
100-299 employees	-0.001	0.002	-0.65	0.517	-0.005	0.002	
Post * 1-4 Employees	-0.010	0.002	-4.70	0.000	-0.014	-0.006	***
Post * 5-9 Employees	0.000	0.002	0.01	0.996	-0.003	0.004	
Post * 10-29 Emplo~s	0.000	0.002	-0.15	0.878	-0.004	0.003	
Post * 30-99 Emplo~s	-0.002	0.002	-0.67	0.502	-0.006	0.003	
Post * 100-299 Emp~s	0.001	0.003	0.45	0.654	-0.004	0.006	
Constant	5.205	0.002	3302.46	0.000	5.202	5.208	***

Mean dependent var	5.132	SD dependent var	0.169
R-squared	0.140	Number of obs	281737.000
F-test	1209.231	Prob > F	0.000
Akaike crit. (AIC)	-243145.143	Bayesian crit. (BIC)	-242786.486

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4.2: Effect of raising minimum wage on total working hours per temporary employee

logtemwh	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
post	0.058	0.023	2.55	0.011	0.013	0.102	**
1-4 employees	-0.148	0.014	-10.81	0.000	-0.175	-0.121	***
5-9 employees	-0.189	0.014	-13.94	0.000	-0.215	-0.162	***
10-29 employees	-0.175	0.013	-13.90	0.000	-0.200	-0.150	***
30-99 employees	-0.028	0.013	-2.15	0.032	-0.053	-0.002	**
100-299 employees	0.070	0.014	4.96	0.000	0.042	0.097	***
Post * 1-4 Employees	-0.029	0.020	-1.43	0.153	-0.068	0.011	
Post * 5-9 Employees	-0.065	0.020	-3.29	0.001	-0.103	-0.026	***
Post * 10-29 Emplo~s	-0.027	0.018	-1.50	0.133	-0.063	0.008	
Post * 30-99 Emplo~s	-0.016	0.019	-0.85	0.395	-0.053	0.021	
Post * 100-299 Emp~s	-0.039	0.020	-1.91	0.057	-0.079	0.001	*
Constant	4.558	0.016	281.03	0.000	4.527	4.590	***

Mean dependent var	4.486	SD dependent var	0.760
R-squared	0.022	Number of obs	63980.000
F-test	45.397	Prob > F	0.000
Akaike crit. (AIC)	145097.354	Bayesian crit. (BIC)	145405.610

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The impact of minimum wage increase on total working hours of temporary employees is relatively larger than its impact on total working hours of permanent employees. The result from Table 4.2 shows that the minimum wage increase has on average reduced the working hours of temporary employees in all categories of

SMEs relative to large enterprises when it has on average increased the working hours of temporary employees in large enterprises. With statistical significance at least at 10% level, large enterprises and SMEs in the size of 5-9 employees are affected the most in terms of working hours of temporary employees: the minimum wage increase in 2018 has on average reduced the total working hours of temporary employees in SMEs in the size of 5-9 employees by 6.5% when for large enterprises, it has on average increased total working hours of these employees by 5.8%. In reaction to the minimum wage increase in 2018, large enterprises, which on average reduced the number of temporary employees by 16%, may have decided to increase the working hours of remaining temporary employees to replenish the ongoing workloads.

5.4 ESTIMATING THE IMPACT OF THE MINIMUM WAGE INCREASE ON EMPLOYMENT IN SMES BY DIFFERENT INDUSTRIES

Method

This section explores the second part of the main questions: "given that we only look at the employment in SMEs, does raising the minimum wage have differential effects on employment in different industries?" Descriptive statistics on 17 different industries is reported in Appendix for reference[15]. The following equation is used to estimate its effects on employment in different industries given that enterprises are SMEs:

$$log(emp_{it}) = B_0 + B_1 Post_t + \alpha_1 ind1_{it} + \cdots + \alpha_{16} ind16_{it} + \gamma_1 (ind1_{it} * Post_t) + \ldots + \gamma_{16} (ind16_{it} * Post_t) + month_t + \varepsilon_{it} \quad (4)$$

where $ind1, \ldots, ind16$ are industry dummies that equal to 1 when each enterprise *i* is in one of the following industries: (1) Mining and quarrying; (2) Manufacturing; (3) Electricity, gas & water supply; (4) Sewerage, material recovery & remediation; (5) Construction; (6) Wholesale & retail trade; (7) Transportation; (8) Accommodation & food service; (9) Info & communication; (10) Finance & insurance; (11) Real estate, renting & leasing; (12) Professional, scientific & technical; (13) Business facilities & support services; (14) Education; (15) Health & social works; (16) Arts, sports & recreational; (17) Membership org, repair &

[15] Includes information about the number of employees and hourly wages for each employment type in different industries (A5. Summary Statistics by Industry).

personal services[16] [17]. Definitions for other variables and subscripts are the same as in equation (1).

Results

Given that SMEs are only included in this regression, the differential impact of the minimum wage increase on the number of permanent employees based on industries is Table 5.1. The coefficient estimates on its impact in Mining and quarrying, Manufacturing, Finance & insurance, Health & social works industries are nearly zero and are not statistically significant at 10% level. Positive effects are found in Electricity, gas & water, Sewerage, material recovery & remediation, Wholesale & retail trade, Transportation, Accommodation & food service, Info & communications, Business facilities & support services, Education, Membership org, repair & personal services, Arts, sports & recreational, Professional, scientific & technical industries, but the coefficient estimate is only statistically significant for Accommodation & food service industry at 10% level. Negative effects are found in Construction, and Real estate, renting & leasing industries, but statistical significance only holds for Construction industry at 5% level. For SMEs in Accommodation & food service industry, the minimum wage increase in 2018 has on average increased the number of permanent employees by 6.8% relative to Membership org, repair & personal services industry when for SMEs in Construction industry, it has on average reduced the number of permanent employees by 6.5% relative to Membership org, repair & personal services industry. Only 2 out of 17 industries are found to be affected by the minimum wage increase in terms of the number of permanent employees.

Table 5.2 presents the results for its effects on the number of temporary employees in each industry. In terms of its impact on the number of temporary employees in SMEs, more industries are found to be affected by the minimum wage increase: significant, positive effects hold for Manufacturing (8.8% at 10% level), Wholesale & retail trade (14.1% at 5% level), Finance & insurance (10.9% at 5% level), and Business facilities & support service (17.3% at 10% level) industries when negative effect is found to be statistically significant for Membership org, repair & personal services industry (-12.3% at 5% level). The effects of the minimum wage increase on the number of temporary employees are not statistically

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[16] A dummy for membership org, repair & personal services industry is excluded in the regression to avoid perfect multicollinearity. Thus, the constant term in equation (4) reflects average number of employees in membership org, repair & personal services industry for each employment type, and the "post" term reflects the differential effect of minimum wage increase on membership org, repair & personal services industry.

[17] Public administration & defense industry is not included in this dataset for the targeted population of this survey is private enterprises.

significant for Accommodations & food service and Construction industries where the number of permanent employees was significantly affected by the minimum wage increase in 2018.

Table 5.1: Effect of raising minimum wage on the number of permanent employees in different industries

logworker	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
post	0.031	0.029	1.05	0.295	-0.027	0.088	
Mining and quarrying	0.499	0.039	12.95	0.000	0.424	0.575	***
Manufacturing	0.594	0.017	33.99	0.000	0.560	0.628	***
Electricity, gas &~y	0.969	0.033	29.08	0.000	0.903	1.034	***
Sewerage, material~e	0.517	0.028	18.40	0.000	0.462	0.572	***
Construction	0.332	0.019	17.29	0.000	0.295	0.370	***
Wholesale & retail~e	0.117	0.021	5.61	0.000	0.076	0.157	***
Transportation	0.876	0.021	40.93	0.000	0.834	0.918	***
Accommodation & fo~e	-0.225	0.026	-8.52	0.000	-0.276	-0.173	***
Info & communication	0.610	0.022	28.09	0.000	0.568	0.653	***
Finance & insurance	0.431	0.024	18.15	0.000	0.385	0.478	***
Real estate, renin~g	0.307	0.023	13.55	0.000	0.263	0.351	***
Professional, scie~n	0.342	0.021	16.55	0.000	0.302	0.383	***
Business facilitie~e	1.143	0.028	40.58	0.000	1.088	1.198	***
Education	0.524	0.033	15.67	0.000	0.459	0.590	***
Health & social wo~s	0.243	0.026	9.43	0.000	0.193	0.294	***
Arts, sports & rec~l	0.554	0.028	19.54	0.000	0.498	0.609	***
Post * Mining and ~g	-0.004	0.055	-0.08	0.936	-0.112	0.103	
Post * Manufacturing	-0.003	0.025	-0.13	0.899	-0.053	0.046	
Post * Electricity~	0.051	0.047	1.09	0.275	-0.041	0.144	
Post * Sewerage, m~e	0.013	0.040	0.31	0.756	-0.067	0.092	
Post * Construction	-0.065	0.028	-2.36	0.018	-0.119	-0.011	**
Post * Wholesale &~e	0.039	0.030	1.31	0.189	-0.019	0.098	
Post * Transportat~n	0.011	0.031	0.35	0.724	-0.049	0.071	
Post * Accommodati~v	0.068	0.039	1.78	0.076	-0.007	0.144	*
Post * Info & comm~n	0.014	0.031	0.45	0.650	-0.047	0.076	
Post * Finance & i~e	-0.001	0.034	-0.02	0.984	-0.067	0.066	
Post * Real estate~a	-0.033	0.032	-1.02	0.306	-0.097	0.030	
Post * Professiona~	0.007	0.030	0.23	0.815	-0.051	0.065	
Post * Business fa~p	0.048	0.040	1.19	0.235	-0.031	0.127	
Post * Education	0.038	0.049	0.78	0.437	-0.058	0.133	
Post * Health & so~s	0.002	0.037	0.06	0.951	-0.070	0.075	
Post * Arts, sport~n	0.017	0.041	0.42	0.671	-0.062	0.097	
Constant	1.998	0.020	98.17	0.000	1.958	2.038	***

Mean dependent var	2.461	SD dependent var	1.412
R-squared	0.045	Number of obs	242839.000
F-test	189.235	Prob > F	0.000
Akaike crit. (AIC)	845847.603	Bayesian crit. (BIC)	846430.012

**** p<0.01, ** p<0.05, * p<0.1*

Table 5.2: Effect of raising minimum wage on the number of temporary employees in different industries

logtworker	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
post	-0.123	0.061	-2.01	0.044	-0.243	-0.003	**
Mining and quarrying	-0.372	0.080	-4.63	0.000	-0.529	-0.214	***
Manufacturing	-0.307	0.036	-8.53	0.000	-0.377	-0.236	***
Electricity, gas &~y	-0.509	0.051	-10.04	0.000	-0.608	-0.410	***
Sewerage, material~e	-0.126	0.061	-2.05	0.041	-0.246	-0.005	**
Construction	1.248	0.044	28.65	0.000	1.163	1.333	***
Wholesale & retail~e	-0.052	0.043	-1.22	0.223	-0.136	0.032	
Transportation	0.147	0.049	2.97	0.003	0.050	0.244	***
Accommodation & fo~e	0.153	0.043	3.54	0.000	0.068	0.238	***
Info & communication	0.451	0.049	9.14	0.000	0.354	0.548	***
Finance & insurance	-0.464	0.045	-10.28	0.000	-0.553	-0.376	***
Real estate, renin~g	0.054	0.063	0.85	0.396	-0.070	0.178	
Professional, scie~n	-0.231	0.049	-4.70	0.000	-0.327	-0.135	***
Business facilitie~e	0.869	0.057	15.38	0.000	0.758	0.980	***
Education	0.500	0.057	8.76	0.000	0.388	0.612	***
Health & social wo~s	-0.536	0.047	-11.52	0.000	-0.627	-0.445	***
Arts, sports & rec~l	0.446	0.049	9.11	0.000	0.350	0.542	***
Post * Mining and ~g	0.051	0.114	0.45	0.654	-0.172	0.275	
Post * Manufacturing	0.088	0.051	1.71	0.087	-0.013	0.188	*
Post * Electricity~	-0.007	0.072	-0.10	0.923	-0.148	0.134	
Post * Sewerage, m~e	-0.020	0.083	-0.24	0.806	-0.183	0.142	
Post * Construction	0.026	0.061	0.42	0.672	-0.094	0.146	
Post * Wholesale &~e	0.141	0.062	2.27	0.023	0.019	0.262	**
Post * Transportat~n	-0.016	0.072	-0.22	0.828	-0.156	0.125	
Post * Accommodati~v	0.082	0.063	1.30	0.192	-0.041	0.206	
Post * Info & comm~n	0.009	0.071	0.12	0.903	-0.130	0.147	
Post * Finance & i~e	0.109	0.066	1.66	0.098	-0.020	0.238	*
Post * Real estate~a	-0.116	0.085	-1.37	0.172	-0.284	0.051	
Post * Professiona~	0.064	0.070	0.91	0.362	-0.074	0.201	
Post * Business fa~p	0.173	0.080	2.17	0.030	0.017	0.329	**
Post * Education	0.024	0.084	0.29	0.774	-0.141	0.189	
Post * Health & so~s	-0.005	0.066	-0.07	0.942	-0.134	0.124	
Post * Arts, sport~n	-0.064	0.068	-0.94	0.348	-0.197	0.069	
Constant	1.425	0.043	33.02	0.000	1.341	1.510	***

Mean dependent var	1.597	SD dependent var	1.429
R-squared	0.147	Number of obs	46890.000
F-test	134.771	Prob > F	0.000
Akaike crit. (AIC)	159199.726	Bayesian crit. (BIC)	159690.038

**** p<0.01, ** p<0.05, * p<0.1*

However, not many industries stand out for the effects of the minimum wage increase on their total employment (Table 5.3): in the case of total employment, statistical significance holds only for Accommodation & food service industry and the coefficients on all other interaction terms are not statistically significant at 10%

level. With dominance in the number of permanent employees in total employment, relatively large, positive effects on the number of permanent employees seem to have affected total employment in the Accommodation & food service industry since its effect on the number of permanent employees is 6.8%.

Overall, the results turn out differently for permanent and temporary employment in terms of its differential effects on industries, but the positive impact of the minimum wage increase on employment in the Accommodation & food industry is found to be consistent for permanent and total employment and so raising the minimum wage does have a differential effect on employment in SMEs in the Accommodation & food industry.

Table 5.3: Effect of raising minimum wage on the number of total employees in different industries

logaworker	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
post	0.020	0.030	0.66	0.508	-0.039	0.078	
Mining and quarrying	0.453	0.039	11.71	0.000	0.377	0.529	***
Manufacturing	0.539	0.018	30.52	0.000	0.505	0.574	***
Electricity, gas &~y	0.891	0.033	26.63	0.000	0.826	0.957	***
Sewerage, material~e	0.461	0.028	16.28	0.000	0.405	0.516	***
Construction	0.546	0.021	26.31	0.000	0.506	0.587	***
Wholesale & retail~e	0.078	0.021	3.71	0.000	0.037	0.119	***
Transportation	0.811	0.022	37.57	0.000	0.769	0.853	***
Accommodation & fo~e	-0.011	0.026	-0.41	0.678	-0.063	0.041	
Info & communication	0.618	0.022	28.03	0.000	0.575	0.662	***
Finance & insurance	0.356	0.024	14.83	0.000	0.309	0.403	***
Real estate, renin~g	0.246	0.023	10.76	0.000	0.201	0.291	***
Professional, scie~n	0.279	0.021	13.32	0.000	0.238	0.320	***
Business facilitie~e	1.163	0.028	40.93	0.000	1.107	1.218	***
Education	0.561	0.035	16.20	0.000	0.493	0.629	***
Health & social wo~s	0.184	0.026	7.08	0.000	0.133	0.235	***
Arts, sports & rec~l	0.624	0.029	21.19	0.000	0.566	0.682	***
Post * Mining and ~g	-0.001	0.055	-0.01	0.989	-0.108	0.107	
Post * Manufacturing	0.002	0.025	0.09	0.933	-0.048	0.052	
Post * Electricity~	0.062	0.047	1.30	0.192	-0.031	0.154	
Post * Sewerage, m~e	0.016	0.041	0.39	0.698	-0.064	0.096	
Post * Construction	-0.048	0.030	-1.62	0.106	-0.106	0.010	
Post * Wholesale &~e	0.040	0.030	1.33	0.183	-0.019	0.100	
Post * Transportat~n	0.014	0.031	0.46	0.643	-0.046	0.075	
Post * Accommodati~v	0.064	0.038	1.65	0.099	-0.012	0.139	*
Post * Info & comm~n	0.014	0.032	0.45	0.650	-0.048	0.077	
Post * Finance & i~e	0.009	0.034	0.28	0.783	-0.058	0.077	
Post * Real estate~a	-0.027	0.033	-0.84	0.401	-0.091	0.037	
Post * Professiona~	0.014	0.030	0.46	0.646	-0.045	0.073	
Post * Business fa~p	0.061	0.041	1.49	0.135	-0.019	0.140	
Post * Education	0.042	0.050	0.83	0.406	-0.057	0.141	
Post * Health & so~s	0.015	0.037	0.39	0.695	-0.058	0.087	
Post * Arts, sport~n	0.004	0.042	0.09	0.928	-0.078	0.086	
Constant	2.099	0.021	101.48	0.000	2.058	2.139	***

Mean dependent var	2.547	SD dependent var	1.428
R-squared	0.040	Number of obs	242839.000
F-test	164.488	Prob > F	0.000
Akaike crit. (AIC)	852344.391	Bayesian crit. (BIC)	852926.800

*** p<0.01, ** p<0.05, * p<0.1

5.5 LIMITATIONS

Using a difference-in-differences methodology requires parallel trends of treatment and control groups as a counterfactual assumption. So, in my case of using SMEs and large enterprises as treatment and control groups respectively, I have assumed that the trend of employment in SMEs is the same as the trend of employment in large enterprises. Though there is no way to test the parallel trends assumption, I was not able to compellingly argue for its validity by visually showing that employment in SMEs has grown at the same rate as the one in large enterprises.

Another limitation is that the coefficient estimates on the impact of the minimum wage increase in 2018 are likely to suffer from omitted variable bias. In Korea, where SMEs are dominant in product and labor markets, various policies have been created to encourage further development of SMEs, and other labor market policies could have also emerged for different purposes. Thus, the impact of all other policies that have emerged in 2018 is likely captured in the "Post" variable and all other interaction terms and creates bias if these policy effects affect employment in SMEs but are not included in the regression. Moreover, other important omitted factors that should be accounted for in the regression would be enterprise-specific characteristics (i.e. profits, productivity, whether or not a labor union exists in an enterprise) which are the determinants of employment and could be correlated with firm sizes. Unfortunately, this set of enterprise-specific information was not included in the survey, and so I was not able to include them as controls to account for variations across enterprises.

5.6 POLICY IMPLICATIONS

With SMEs as the major job providers in the labor market of Korea, how raising the minimum wages impacts employment in SMEs is important in a sense that the finding of this relationship could change the future direction of labor market policies. The purpose of setting up a minimum wage is to protect low-pay workers and make sure they get paid enough to keep a minimum standard of living. However, based on the results found in this paper, small enterprises may act to cut off employment or reduce the working hours of employees to adjust for higher labor cost that incurs due to the minimum wage increase. It is important to protect low-

pay workers but the government intervention may not work in a way that we want, especially in the market. The results from this paper do not only show the negative effects of the minimum wage increase on employment in all categories of SMEs but it also suggests that raising the minimum wage drastically could have caused more difficulties for low-pay workers. Overall, findings suggest that raising the minimum wage would lead to reduction in employment in SMEs and, in turn, could largely impact the overall employment in Korea due to SME's contribution to labor market.

6. CONCLUSION

In Korea, where small and medium-sized enterprises (SMEs) constitute the major segment of the business sector and dominantly provide most of the jobs in the labor market, how SMEs respond to the minimum wage increase in terms of employment is a critical factor of job provision in the Korean labor market. This paper mainly examines the effect of raising the minimum wage on employment in SMEs in Korea by using a difference-in-differences methodology, and finds that raising the minimum wage has on average reduced total employment in all sizes of SMEs. Using the same methodology, the effects of the minimum wage increase on hourly wages and working hours of employees in SMEs as well as its effect on employment in SMEs by different industries are also explored: the minimum wage increase has on average increased hourly wages of permanent and temporary employees in the smallest SMEs when total working hours of permanent employees in the smallest SMEs and of temporary employees in SMEs in the size of 5-9 employees are affected negatively. In terms of the effects on employment in different industries, not much differential effect is found in terms of total employment; a positive effect is found only for SMEs in Accommodation & food service industry in terms of permanent and total employment. As for the change in the noncompliance rate in 2018, it only gets remarkably high in the beginning of 2018 but flattens out eventually, similar to the pattern in 2017. Overall, the main finding in this paper suggests that raising the minimum wage rate may incur significant loss of jobs in the Korean labor market.

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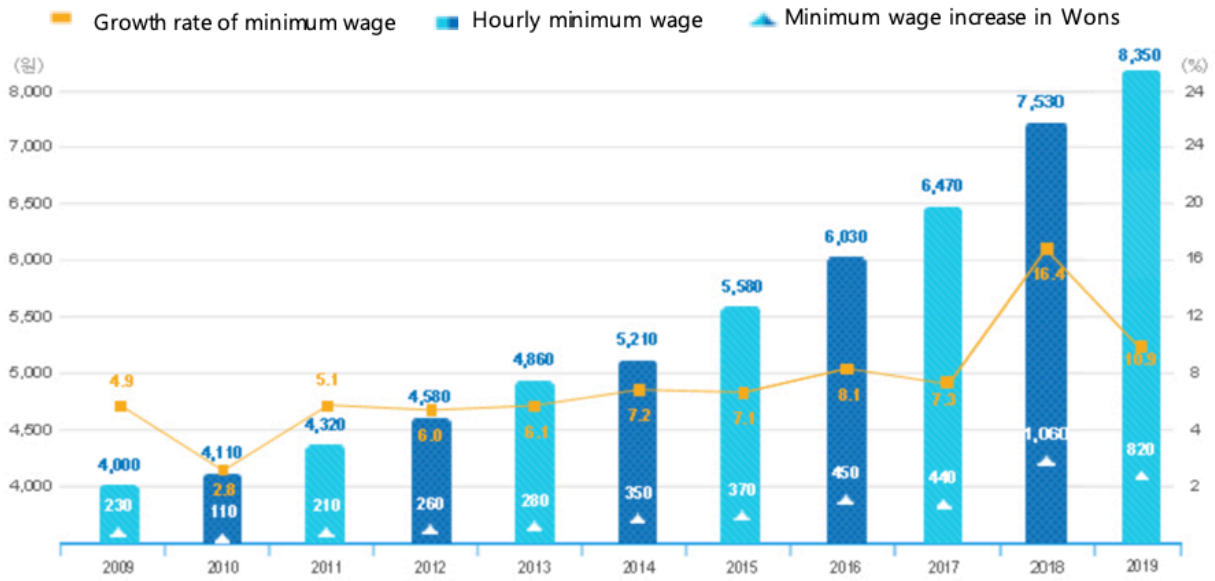
APPENDIX

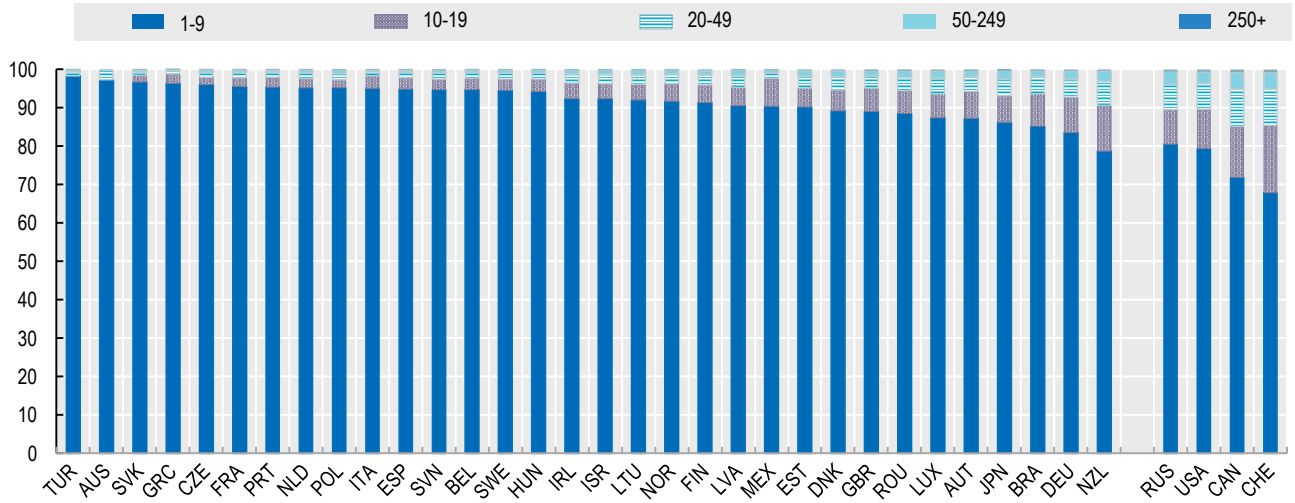
A1. Hourly minimum wage in Korea (2009 – 2019)



Source: Minimum Wage Commission, South Korea

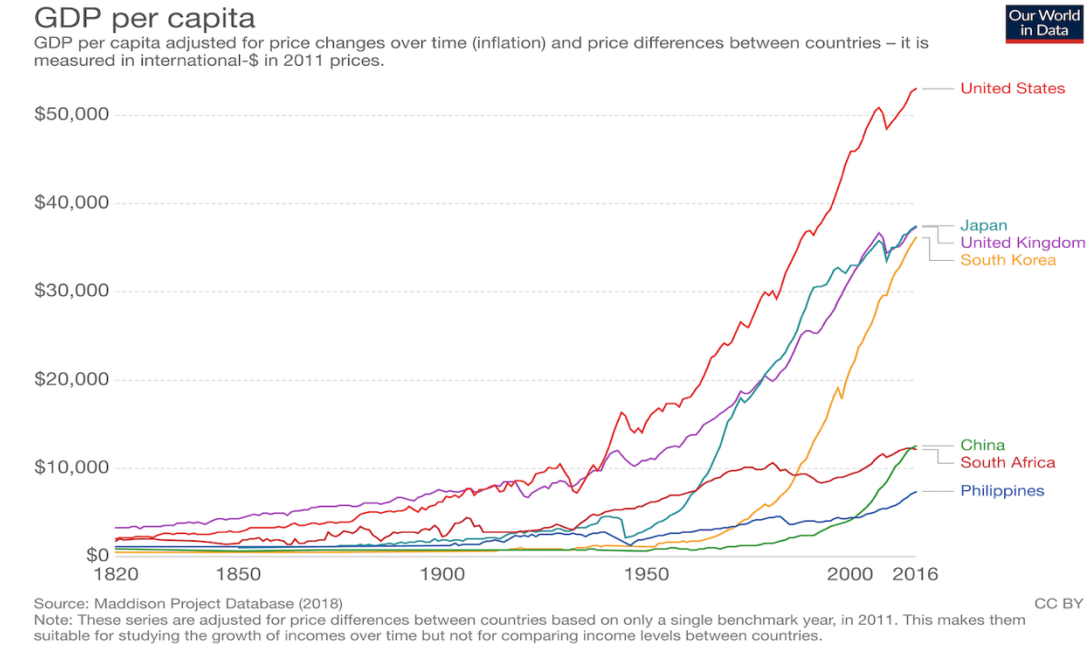
A2. Enterprises by size, business economy

Percentage of all enterprises, 2014, or latest available year

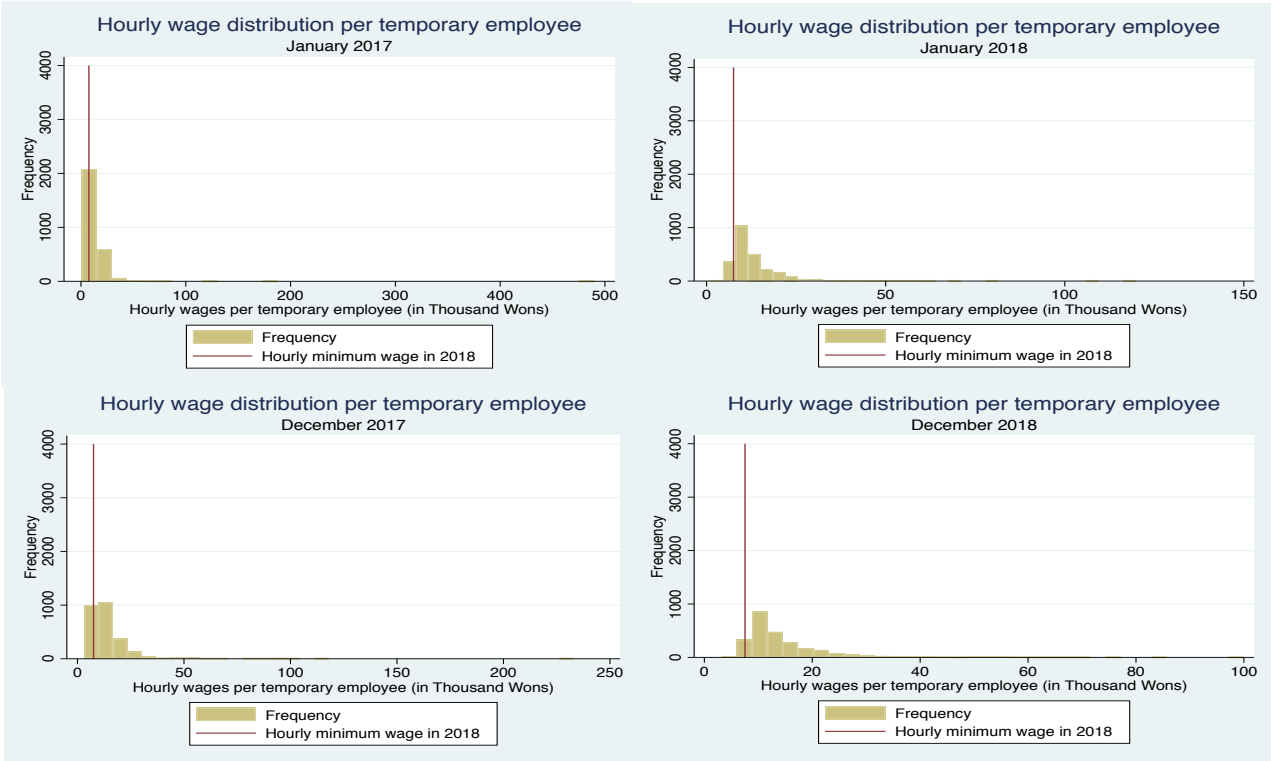


Source: OECD (2017), "Enterprises by size, business economy: Percentage of all enterprises, 2014, or latest available year"

A3. Economic growth in Korea (1820 – 2016)



A4. Hourly wage distribution per temporary employee



A5. Summary Statistics by Industry
January 2017

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean
Number of permanent workers employed	22.62	35.46	38.90	22.67	23.98	26.23	42.43	19.23	34.70	28.33	25.68	27.29	65.16	41.02	28.27	27.77	20.55
Number of temporary workers employed	0.76	0.96	0.54	1.02	21.02	1.87	1.53	8.16	3.73	0.54	1.20	1.48	5.65	3.09	0.87	5.73	2.67
Hourly regular wages per permanent employee (in Thousand Wons)	21.10	15.51	24.84	16.24	15.73	15.87	16.66	10.46	19.42	26.44	13.70	19.12	13.62	22.55	12.55	15.62	12.67
Hourly wages per permanent employee (in Thousand Wons)	24.16	19.22	34.43	19.71	18.08	20.15	20.45	11.74	23.39	37.35	15.63	21.95	16.11	27.11	13.87	17.60	14.59
Houlry wages per temporary employee (in Thousand Wons)	20.34	11.77	13.33	12.65	18.81	10.45	11.39	8.89	11.66	12.05	11.12	13.26	12.19	20.26	13.37	11.41	11.03
Observations	87	2674	164	219	853	971	733	394	728	441	510	805	421	262	365	286	743

Note that each column number corresponds to each of the following industries: (1) Mining and quarrying; (2) Manufacturing; (3) Electricity, gas & water supply; (4) Sewerage, material recovery & remediation; (5) Construction; (6) Wholesale & retail trade; (7) Transportation; (8) Accommodation & food service; (9) Info & communication; (10) Finance & insurance; (11) Real estate, renting & leasing; (12) Professional, scientific & technical; (13) Business facilities & support services; (14) Education; (15) Health & social works; (16) Arts, sports & recreational; (17) Membership org, repair & personal