Labor Market Effects of the Minimum Wage in South Korea

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Abstract

This paper analyzes survey data from businesses regarding individual worker earnings, hours, and characteristics from 1971 to 1998 in order to estimate the labor market effects of the minimum wage in South Korea. Since the minimum wage was only implemented in manufacturing, construction, and mining industries, we are able to compare earnings and hours of workers in these industries with workers in other industries using both a difference-in-differences and a synthetic control approach. Additionally, we test to see if the minimum wage had heterogeneous effects based on an individual worker's gender, level of education, experience, and payment period.

JEL classification: J31, J38, O15

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Section 1. Background

The minimum wage is often a popular policy used by governments in order to increase the wages of unskilled workers and ensure that employers are not able to exploit labor due to unfair bargaining power in the labor market. Policy debates about the minimum wage have sprung up recently in South Korea. The coronavirus pandemic has many in South Korea's business class worried that large increases to the minimum wage during this coronavirus induced recession would be unduly harmful to small businesses. Due to these concerns, the most recent yearly increase to the minimum wage for 2021 was the lowest in South Korea's history at only 1.5%. It is suspected that the business class may wish for the minimum wage to be frozen or even lowered again this upcoming year due to these concerns. Labor groups in South Korea wish to increase the minimum wage in order to protect low-income workers who they claim have incurred the most damage from the pandemic. Additionally, current President Moon Jae-in had promised when he took office in 2017 that the minimum wage would be raised to 10,000 won as had been the original target for 2020 when minimum wage legislation was first enacted back in the 1980s. As such, it is increasingly important to understand empirically how much the minimum wage affects South Korea's. To begin though, it is also important to understand the historical background that led to the minimum wage system in South Korea that we see today.

After a series of unsuccessful attempts to introduce minimum wage legislation in the 1970s, a forum was finally opened within the Democratic Justice Party (DJP) in April 1986 to discuss whether a legal minimum wage should be introduced. By June 1986, the Ministry of Labor had formed a task force in order to create a program to specify the details of this minimum wage. By December 31, 1986, the Minimum Wage Law had been enacted.

The impetus for creating minimum wage legislation arose from increasing political turmoil during the early 1980s in the Chun Doo-hwan regime (Joo 1999). State elites noticed criticisms coming from trade union workers that the government had been neglecting its duty to protect low wage employees. State elites thought that passing minimum wage legislation could increase the public's support for the governing party.

This Minimum Wage Law created a system whereby every year, the minimum wage would be set by a Minimum Wage Council that consists of 27 members, including 9 representatives each from labor, business, and government. Each year, this body would be required to review the minimum wage by March 31st and submit a new minimum wage bill within 90 days of this meeting so that the new minimum wage can be announced to the broader public by August 5th each year. The wage set in this bill would go in effect on January 1st the following year whereby this process would begin again.

The first minimum wage was enacted in January of 1988 and set at 462.50 won, covering roughly 4.2% of the worker population that had been making a smaller wage before the law's implementation. At first, the minimum wage only applied to manufacturing firms with 10 or more workers, but the list of industries requiring a minimum wage quickly expanded the following year to include mining and construction. It was not until 2002 that the minimum wage set by this commission would be enforced across firms in South Korea no matter the industry or firm size.

Given this historical background, this paper will now proceed to examine how the implementation of and subsequent increases to the minimum wage affected the labor market during the late 1980s and 1990s. Section 2 of this paper will provide a brief overview of some of the main literature examining the labor market effects of the minimum wage, including previous

studies done on South Korea's minimum wage. Section 3 describes the data used in this paper. Section 4 describes the difference-in-differences approach used to empirically identify the causal impact of the minimum wage on the previously described labor market outcomes of interest. Section 5 will share the results of this analysis and Section 6 will provide a summary of what was learned from these findings.

Section 2. Literature Review

A partial equilibrium analysis of minimum wage policy would dictate that wages of workers to which the minimum wage applies would increase following the policy's implementation and that the number of labor hours worked should fall. Empirically though, there have often been inconsistent estimates as to how much the minimum wage actually causes these two effects. Manning (2021) explains that the employment effect which many minimum wage studies attempt to measure may be inconsistent due to the difficulty in selecting a sample that consistently has a robust negative effect of the minimum wage on employment. This is particularly due to the fact that employers may not react to the minimum wage the same way across all contexts. Some employers may not react to the minimum wage by reducing the number of workers at the firm but by reducing the number of hours each person works. Employers may also increase the hours of higher-wage, more productive workers in order to reduce the number of jobs available to lower-wage workers who are not seen as productive enough to the employer to justify paying a minimum wage (Zavodny 2000). As such, defining the population of interest can be tricky.

Most papers that determine the labor market effects of the minimum wage examine developed countries, particularly the United States. For example, Card and Krueger (1994) examined how employment levels in fast food restaurants changed near the border of

Pennsylvania and New Jersey after New Jersey increased their minimum wage. That study found no effect of the minimum wage increase on employment. Meanwhile papers such as Jardim et al (2017) found 6-7% decreases in hours worked in low-wage jobs from minimum wage increases in Seattle but raised wages in these jobs by 3%. Meta-analyses on minimum wage research papers across countries have found a small but robust negative effect of minimum wage increases on employment levels (Martinez & Martinez 2021).

There have been some previous papers which have discussed the labor market effects of the minimum wage in South Korea specifically. Both Park and Kang (2018) and Hwang (2017) examine the employment effect of minimum wage increases in South Korea during the 21st century. Park and Kang (2018) finds ambiguous effects of the minimum wage increases on employment. Hwang (2018) finds no adverse effects of the minimum wage on employment.

So far as the author of this paper knows, there is only one study that has examined the labor market effects of the minimum wage in South Korea prior to the 21st century. Baek and Park (2016) studied the employment and wage effects of minimum wage implementation in 1986. This paper determines these effects using a difference-in-differences approach that compares the wages and number of employees of low-wage manufacturing firms that may be more affected by the minimum wage law than higher wage manufacturing firms. That study found that while the total wage paid per worker increased, the implementation of the minimum wage did not seem to affect the number of employees at the low wage plant in comparison to the higher wage firms that were presumably unaffected by the minimum wage. However, this study did not attempt to determine if employers reacted to the minimum wage by reducing hours of those that remained employed rather than decreasing the number of people employed at the firm.

This paper will add to this existing literature by using a novel dataset to determine how the minimum wage may have affected the wages and labor hours of individuals that remain employed. This will help determine whether employers reacted to the minimum wage not by reducing the number of employees but by reducing the amount of time that each employee works. Additionally, this paper also examines how the subsequent increases in the minimum wage may have affected labor hours and the hourly wage that workers receive.

Section 3. Data

This paper uses data regarding the nominal minimum wage in any given year (Minimum Wage Commission). Additionally, in order to convert the nominal wages to real wages, this paper uses each year's April consumer price index of South Korea (Federal Reserve Economic Data). The CPI indexes and minimum wage levels used in this paper are recorded below in Table 1.

Table 1. Nominal and Real Minimum Wage in South Korea by Year

Year	Nominal Minimum Wage (in won)	CPI (=100 in 2015)	Real Min Wage (in 2015 won)	Change in Real Min Wage (from previous year in table)
1971	0	5.491	0	0
1976	0	11.400	0	0
1980	0	21.638	0	0
1983	0	29.736	0	0
1986	0	32.070	0	0
1989	600	37.190	1613.36	1613.36
1992	925	47.113	1963.38	350.05
1994	1085	52.196	2078.70	115.32
1996	1275	57.382	2221.94	143.24
1998	1485	64.580	2299.46	77.52

In order to determine the labor market effects of the minimum wage, this paper primarily uses the South Korean Occupational Wage Survey, OWS (Rodgers). Data from the following years are made available by the Inter-university Consortium for Political and Social Research: 1971, 1976, 1980, 1983, 1986, 1989, 1992, 1994, 1996, 1998. This dataset has been used in

various other labor economics papers examining South Korea. For instance, Fields & Yoo (2000) uses this dataset in order to quantify the importance of various factors that contributed to falling labor inequality in South Korea at the end of the 20th century. Depending upon the year of the survey, this dataset can represent roughly half of South Korea's total nonagricultural labor force.

It should be noted that the OWS data used in this paper is merely a subset of the original survey which was taken every year since 1971 excluding 1975 and 1977 (Fields and Yoo 2000). Even from the years that are included in this paper's data, individual responses were randomly drawn from the original survey. As such, this analysis could be reconducted if the entire OWS data was made available. The benefits that this additional data could bring are discussed later in this paper.

For every year contained in the dataset, this source contains detailed information on tens to hundreds of thousands of individuals regarding their labor markets outcomes such as hours worked, monthly earnings, industry of employment, and years of experience in industry as well as individual characteristics such as age, marital status, educational attainment, and region. This paper is not able to track the labor market outcomes of particular people across time because the dataset is not longitudinal as different people are surveyed each year. It is also impossible to identify the changes that occur to particular firms across time since firms are not given time invariant identification numbers. As such, overall employment effects regarding whether or not the minimum wage decreased the total number of jobs in the economy are impossible to identify using this data.

The OWS was obtained each April by sampling a random selection of firms that have at least 10 employees. From the selected companies, the researchers would survey a certain

percentage of workers includes all workers in companies with 10-99 people, roughly 70% of workers in companies with 100-299 people, roughly 50% of workers in companies with 300-499 employees, and up to 50% of workers in companies with 500+ employees (Fields and Yoo 2000). It should be noted that the exact proportion of those surveyed within each firm changes each year. Since this survey excludes all firms which have fewer than 10 employees, this paper is not able to determine how the minimum wage may have indirectly affected the number of hours worked and hourly wage of people in smaller firms that could occur if workers in large firms were laid off due to the minimum wage and sought work at the smaller firms.

Additionally, it should be noted that workers in agricultural, forestry, hunting, and fishing jobs in 1986 and afterwards are also excluded from the original OWS survey. The exclusion of agricultural, forestry, and hunting sectors did not seem to change the composition of other types of industries included in the dataset (Van der Meulen Rodgers 1998). Since the minimum wage was implemented after 1986, this paper excludes the agricultural industries from all analyses.

The primary identification strategy involves comparing individual workers in industries where the minimum wage was implemented, namely manufacturing, mining, and construction, with industries that were not included in the Minimum Wage Act. The OWS dataset used in this paper has a Korean Standard Industrial Classification code (KSIC) to identify the industry in which each individual works. The numbers used to identify each industry occasionally change based on changes to the codebook that occur during this time period. To combat this problem, KSIC revisions 3-7 were obtained from the South Korean Ministry of Labor in order to match the KSIC industrial codes to each industry. The classifications in this paper are available upon request. The number of observations observed for each year manufacturing, mining, construction, and the other industries in which the minimum wage was not implemented are

recorded in Table 2 below. It is important to note that while this paper frequently refer to manufacturing as a single industry, the OWS data actually breaks manufacturing down into many subindustries including but not limited to the Manufacture of Electronic Machinery, Manufacture of Industrial Chemicals, and Manufacture of Footwear. As will be mentioned in the next section on this paper's empirical specification, industry fixed effects and synthetic controls refer to these subindustries.

It should be noted that the number of observations between 1989 and 1996 inclusive contain substantially fewer observations than in the years prior. As will be seen in the empirical results of Section 7, this can affect the standard errors and R^2 of the regressions.

Table 2. Total # of Observations in OWS Data by Industry and Year

Year	Manufacturing Observations	Mining Observations	Construction Observations	Other Industry Observations	Total Observations
1971	128,078	9,717	3,944	51,281	193,020
1976	21,655	1,286	555	6,885	30,381
1980	300,271	10,162	10,442	85,040	405,915
1983	423,983	17,388	17,586	128,195	587,152
1986	403,693	17,909	17,033	142,355	580,990
1989	21,426	683	537	7,810	30,456
1992	26,539	281	1,008	13,154	40,982
1994	22,067	506	2,030	17,698	42,301
1996	21,076	509	1,384	19,518	42,487
1998	180,933	3,993	11,706	187,935	384,567

In order to obtain the total number of hours that each individual works, this paper sums the number of paid hours worked and the number of overtime hours worked. It should be noted that the OWS data prior to 1980 does not separate the number of paid hours working with the number of overtime hours. As will be seen in Table 3, the mean total hours worked in 1976 do not seem particularly different from the mean number afterward 1980, but the mean total hours worked in 1971 does seem much lower than one would initially expect prior to the 1990s. There are two potential explanations for the sudden increase in hours between 1971 and 1976. First,

this could be due to changes in the way the question was asked in the survey in that year that may have caused employers to not include overtime hours. For reference, the mean number of overtime per worker in the OWS data is 36 hours in 1980 and the increase in hours worked between 1971 to 1976 is 29 hours in the OWS data. If the survey had been phrased differently in 1971 compared to future versions of the survey, then regressions using 1971 should be taken lightly. The second explanation is that there simply was simply a large increase in working hours during this time period which would be consistent with the findings of previous researchers analyzing working hour trends in South Korea (Lehberger 2016). If this second explanation is true, then there is less reason to be concerned that the survey method of determining the number of hours worked per individual biases our results.

In order to obtain data on real hourly earnings, this paper sums the monthly earnings from regular salary and overtime earnings and divides this by the total number of hours that the employee works per month. It should be noted that the survey has a cap for the maximum amount of earnings that an individual is reported to have earned with respect to both regular monthly earnings and overtime monthly earnings at 9,999,000 won per month. For reference, the median real earnings in the OWS data for 1998 is approximately 1,713,680 won per month. As such, some workers may earn more money than is reported in the OWS data and could potentially bias the results for the coefficients regarding the effect of the minimum wage on hourly earnings. However, the cap only seems to affect a total of 18 workers who are all in 1998. As such, these individuals are still included in the main analyses and, given the large size of the sample, the bias that results from them is likely small.

Individuals that work zero hours or strictly more than 359 hours per month, which is roughly 12 hours of work every day of the month, are removed from all analyses. Only 15

individuals were removed that worked 0 hours. The upper limit cutoff of 359 hours was chosen both to limit the scope of the analysis and to address potential reporting bias. In particular, it seemed like reporting was biased in two non-minimum wage industries, Business Services and Real Estate. From at least 1986 onwards, a large number of workers were recorded to have worked 360 hours which caused the mean monthly hours per worker in the Real Estate industry to increase by over 60 hours per month between 1989 and 1992. This sudden increase in Real Estate working time could not be found in any prior literature. In total, 15,384 individuals are removed from this upper limit cutoff. Additionally, people who earn zero won per month are also removed from all analyses which removed 1,767 workers from the entire dataset where all but 22 of these individuals are found in the 1971 survey data. Lastly as mentioned earlier, agricultural workers were removed from the analysis. Thus, 20,786 workers out of the 2,338,251 total surveyed workers were not included in the analysis.

Given the alterations above, mean monthly working hours and real hourly wages by year are reported in Table 3 below. For context, 200 hours of work monthly corresponds to roughly 47 hours of work per week. It is interesting to note that the average number of monthly working hours of those employed generally decreases across time while the real hourly earnings tend to increase over time by about 8-9% per year. The notable exception to the real hourly earnings increase is between 1996 and 1998 during which the East Asian Financial Crisis occurred.

Table 3. Mean Monthly Working Hours and Real Hourly Wage by Year

Year	Mean Monthly Working Hours	Mean Real Hourly Earnings (2015 won)
1971	215.83	2,084.50
1976	238.75	2,830.29
1980	234.69	3,012.13
1983	238.84	3,436.80
1986	229.98	4,252.57
1989	222.43	5,618.50
1992	213.18	7,131.85
1994	214.05	8,270.48
1996	203.76	9,909.52
1998	201.72	9,741.90

Mean monthly working hours and mean hourly wages by year and industry are given in Tables 4 and 5 below. Notably, average working hours in manufacturing is higher than in the other sectors of the economy and has the lowest average hourly wage. This will be important to note since, as stated previously, most of the workers in the OWS data are from manufacturing, and so the effect of the minimum wage on manufacturing workers will tend to dominate the results found when examining all workers directly impacted by the minimum wage.

Table 4. Mean Monthly Working Hours by Industry and Year

Year	Manufacturing Total Monthly Working Hours	Mining Total Monthly Working Hours	Construction Total Monthly Working Hours	Other Industry Total Monthly Working Hours
1971	221.53	186.08	209.46	211.88
1976	253.51	224.99	224.96	224.36
1980	241.32	199.73	226.05	216.22
1983	246.68	202.72	224.67	223.10
1986	238.39	192.69	214.59	214.22
1989	228.87	172.50	208.10	210.26
1992	220.42	189.19	211.44	204.73
1994	223.16	192.24	210.07	206.33
1996	213.70	201.02	196.77	199.39
1998	207.13	186.19	197.44	202.70

Table 5. Mean Real Hourly Wage by Industry and Year

Year	Manufacturing Real Hourly Earnings (2015 won)	Mining Real Hourly Earnings (2015 won)	Construction Real Hourly Earnings (2015 won)	Other Industry Real Hourly Earnings (2015 won)
1971	1,667.92	2,505.41	3,137.22	2,872.73
1976	2,237.93	3,497.83	5,183.76	4,167.05
1980	2,499.44	4,599.63	5,350.65	4,362.94
1983	2,843.20	4,925.36	5,682.54	4,868.46
1986	3,454.64	5,651.32	6,702.36	6,027.70
1989	4,962.88	7,771.36	8,325.91	7,039.90
1992	6,300.91	8,487.86	9,698.51	8,443.62
1994	7,171.33	9,915.86	10,066.45	9,314.10
1996	8,596.95	10,616.22	12,057.54	10,939.04
1998	8,535.23	10,655.49	11,448.22	10,560.68

Since this paper also uses gender, marital status, education, form of payment, location, and experience as control variables, summary statistics for several of these variables in the year 1986 are included in the appendix. These variables were all obtained directly from the OWS data. It should be noted that data in 1971 does not distinguish between workers with a two-year and 4-year college education. As such, regressions between 1971 and 1976 only examine fixed effects of four categories: elementary school education or less, middle school education, high school education, or at least two years college education. All other regressions separate this last educational category into 2-year college education and 4-year college education. Additionally, the location data in the OWS data have numerical codes which this paper aggregates at the city level in accordance with the numbers described in the OWS codebook. Experience in current occupation were placed into five categories: less than one year, between one and three years, between three and five years, between five and ten years, and more than ten years. Lastly, data on marital status was not included in the OWS data in 1971, so regressions involving 1971 do not use marital status and any interaction terms with marital status as control variables.

Section 5. Empirical Specification

This paper employs a difference-in-differences approach to determine the labor market effects of minimum wage implementation and subsequent increases. This is a common approach in the minimum wage literature. It was famously used in Card & Krueger (1994) when comparing employment levels in fast food restaurants in New Jersey and Pennsylvania before and after a minimum wage increase in New Jersey.

In this paper, the difference-in-differences approach works by comparing workers across industries in two time periods before and after a change in the minimum wage. In particular, this paper compares workers in industries directly affected by the minimum wage, including manufacturing, mining, and construction, with workers in other industries. This basic framework is specified in Equation 1 below.

(1)

$$HOURS_{w,t,i} = \beta_0 + \beta_1 * TREATMENT_{w,t,i} + \beta_2 * POST_{w,t,i} + \beta_3 * TREATMENT * POST_{w,t,i} + \varepsilon_{w,t,i}$$

The variable HOURS represents the total number of hours per month that individual w in industry i works during year t. A similar regression is run where the real hourly wage in 2015 won is the dependent variable instead of HOURS. All of the regressions that use Equation 1 restrict the sample to two consecutive years in the OWS data.

TREATMENT is a dummy variable which equals 1 if the worker is in an industry affected by the minimum wage. This includes all subindustries of manufacturing, mining, and construction. Otherwise, the TREATMENT dummy variable will equal 0. POST is a dummy variable which equals 1 if the worker was surveyed in a year after the change to the minimum wage has already taken place. TREATMENT*POST is an interaction term of the previous two dummy variables. $\varepsilon_{w,t,i}$ is an error term for each individual that reflects the difference between

the predicted hours worked for each individual i and the actual number of hours worked by individual i.

The coefficients using the difference-in-differences approach have fairly simple interpretations. β_0 represents the average amount of hours that an employee in an industry not directly impacted by the minimum wage works per month in a year prior to the implementation of the minimum wage. β_1 represents how many more or less hours on average an employee in an industry affected by the minimum wage works compared to a worker across the time periods before and after the changes to the minimum wage. β_2 represents the average increase or decrease in the mean number of monthly hours worked by employees in all industries in the year following the minimum wage change when compared to the mean number of monthly hours worked prior to this change.

β_3 is the main coefficient of interest. For the effect of the minimum wage on the dependent variable labor hours, this coefficient represents the difference between a) the change in mean labor hours per worker in a minimum wage industry before and after the minimum wage treatment has occurred and b) the change in mean labor hours per worker in a non-minimum wage industry before and after the minimum wage treatment has occurred. A similar definition exists for the dependent variable real hourly wage. A positive β_3 when using Equation 1 for 1986 and 1989 would imply that the implementation of the minimum wage in South Korea increased the number of hours worked by the individuals that remained employed. Similarly, a positive β_3 when using Equation 1 for 1992 and 1994 would imply that the increases of the minimum wage in South Korea increased the number of hours worked by the individuals that remained employed.

This simple difference-in-differences regression would be all that is necessary to determine the effect of the minimum wage on labor hours and the real hourly wage if all of the assumptions of a difference-in-differences analysis hold true. However, one assumption that seems to be violated in the analysis in this paper is the assumption that the treatment and control groups have a common trend prior to the reform. This assumption can be tested by running regressions using Equation 1 again but by comparing workers in years prior to 1989 for which the minimum wage had not yet been implemented. If β_3 in these regressions is not statistically significant from zero, then the industries in which the minimum wage was implemented can be inferred to have a common trend with other industries in labor hours and hourly wages. If this is the case, then the original coefficients from the simple difference-in-differences model can be interpreted as the causal effect of the minimum wage on our dependent variables of interest

As will be shown in the empirical results of section 6, the common trends assumption does not seem to hold true. This implies that the real hourly wage and the number of labor hours per employee changes at different rates depending upon the industry in which a worker is employed. Thus, the coefficients found for Equation 1 will be biased. To combat this problem, two different methods are applied.

First, this paper also reports the findings from regressions using Equation 2 below which adds controls that may have caused omitted variable bias.

(2)

$$HOURS_{w,t,i} = \alpha_0 + \alpha_1 * POST_{w,t,i} + \alpha_2 * TREATMENT * POST_{w,t,i} + \lambda \mathbf{X_{w,t,i}} + \delta_w + \nu_{w,t,i}$$

$\mathbf{X}_{w,t,i}$ is a vector of control variables for each individual i at time t in industry w. Control variables used in this paper's analysis include age, age^2, sex, marital status, an interaction term of sex and marital status, education levels, experience levels and location fixed effects as control

variables. δ_w is an industry fixed effect. It should be noted that this paper uses the subindustry codes found in the OWS data as described previously in Section 3. Thus, the industry fixed effect accounts for how the mean labor hours may differ depending upon which subindustry an individual is employed. Lastly, $\nu_{w,t,i}$ is an error term that measures the difference between the predicted number of labor hours for individual i given the measure covariates in the equation above and the actual number of labor hours worked by individual i. A similar equation can be created with the real hourly wage of individual i in industry w at time t as the dependent variable instead.

The astute reader will notice that the TREATMENT dummy variable for workers in a treatment industry has been removed from Equation 2. This dummy variable has been removed in order to add the industry fixed effect. If the TREATMENT dummy variable used in Equation 1 were to be added to these regressions, then there would be perfect collinearity between the dummy variables and the industry fixed effects since knowing the subindustry of individual i also reveals whether that individual is in an industry affected by the minimum wage.

While including the control variables may help reduce the statistical bias on the coefficients of interest, there may be unobserved omitted variables that continue to bias the conclusions. Additionally, since the previous regressions put equal weight on every respondent then the control group population may be including higher-wage industries which are too dissimilar from the minimum wage industries to be used as an effective control. If this were the case, then the common trends assumption would again not hold.

In order to combat the lack of a common trend problem, this paper also employs a synthetic control approach. This approach was pioneered by Abadie & Diamond & Hainmueller (2010) in order to create a control group that is similar enough to the treatment group for

comparison. This method of synthetic controls has been used in previous minimum wage literature, such as Dube and Zipperer (2015).

A more detailed proof of the synthetic control method can be found in Abadie & Diamond & Hainmueller (2010), but a brief explanation is provided here. In the case of the effect of the minimum wage on labor hours, let $Y_{w,t}^N$ be the potential mean number of labor hours per worker for industry w in year t in which the minimum wage is never implemented. Let $Y_{w,t}^I$ be the potential mean number of labor hours per worker for the same industry w in year t in which the minimum wage is implemented. Thus, the effect of the minimum wage on labor hours per worker can be measured by $\phi_{w,t} = Y_{w,t}^I - Y_{w,t}^N$. Note that both of these cannot be observed at the same time in the real-world since an industry cannot both have a minimum wage and not have a minimum wage during the same period of time. Thus, for industry w_1 in which the minimum wage is implemented, $Y_{w1,t}^N$ is not observed. Let $W = (w_2,w_3,\ldots,w_{J+1})$ be a vector of J industries that were unaffected by the implementation of the minimum wage. We can construct a synthetic industry made up of a linear combination of the various industries in W such that $Y_{w*,t} = \sum_{j=2}^{J+1} x_j * Y_{w_j,t}$ where $X = (x_2,x_3,\ldots,x_{J+1})$ is a vector of non-negative weights summing to 1 which describe what percent of each industries outcome variable should be included. This weights for this synthetic control industry are created by examining the mean labor hours of both the control and treatment industries prior to the implementation of the minimum wage and trying to create a linear combination of industries in which the weights are static across time such that the outcomes of the treatment industry match the outcomes of the synthetic control industry, i.e. $Y_{w1,t}^N = Y_{w*,t}$. This implies that ϕ, the effect on the minimum wage on labor hours, can be estimated by $Y_{w,t}^I - Y_{w*,t}$ for all t after which the minimum wage has taken effect.

For this paper, we create synthetic controls for 4 subindustries where a minimum wage was implemented: Manufacture of Electronic Machinery, Manufacture of Other Chemical Products, Coal Mining, and General Construction. These subindustries have been chosen due to having larger amounts of individuals surveyed. Multiple subindustries are examined in order to determine how the accuracy of a synthetic control affects the conclusions as well as to ensure that our findings are not spurious. Additionally, the communications industry is not included as a potential control industry in this analysis due to a lack of data prior to 1986.

Section 6. Empirical Results

Part A. Effects on Labor Hours

First, this paper attempts to find how the implementation of and subsequent increases to the minimum wage may have affected the number of hours that individuals that remain employed work. We do so using the difference-in-difference regression implied by Equation 1 in the previous section. The results for these regressions are displayed below in Table 5. The main coefficient of interest is on TREATMENT*POST which will help in determining the effect of the minimum wage on labor hours per worker.

We would expect the effect to be largest in the time frame when the minimum wage was first implemented between 1986 and 1989 as well as for any large increases in the minimum wage, such as between 1989 and 1992. The results for these regressions are displayed below in Table 6.

Table 6. Basic DiD Effect of Minimum Wage on Hours Worked

	(1)	(2)	(3)	(4)	(5)
	1986-1989	1989-1992	1992-1994	1994-1996	1996-1998
TREATMENT	22.143*** (0.117)	16.606*** (0.450)	19.186*** (0.320)	16.900*** (0.348)	17.439*** (0.346)
POST	-3.168*** (0.396)	-10.029*** (0.453)	4.128*** (0.342)	-9.960*** (0.334)	3.434*** (0.239)
TREATMENT*POST	-5.537*** (0.465)	2.580*** (0.552)	-2.286*** (0.473)	0.539 (0.491)	-9.576*** (0.363)
Constant	213.243	210.074	200.045	204.173	194.213
Absolute Change in Real Min Wage	1613.36	350.05	115.32	143.24	77.52
Percent Increase in the Real Min Wage	N/A	21.70%	5.87%	6.89%	3.49%
Observations	609,871	70,957	82,512	83,784	419,774
R^2	0.055	0.072	0.058	0.071	0.018

** = Significant at the 10% level, ** = Significant at the 5% level, *** = Significant at the 1% level (Standard errors are in parentheses)*

According column 1 in Table 6, we can determine that in 1986, a worker in an industry which would not be affected by the incoming minimum wage worked an average of roughly 213.2 hours per month while a worker in an industry affected by the minimum wage worked roughly 22.1 hours more per month than those in the non-minimum wage industries for an average of 235.4 hours per month. By 1989, workers in the non-minimum wage industries were working roughly 3.2 hours less than they were in 1986, thus averaging 210 hours of work per month. Meanwhile, workers in the minimum wage industries were working 8.7 hours less than they were in 1986 for a new average of 226.7 hours per month. This 8.7 hour number was calculate by adding the coefficient on POST with the coefficient on TREATMENT*POST. As such, assuming our model is correct, we can say that the original implementation of the minimum wage between 1986 and 1989 seemed to cause a 5.5-hour decrease in the total number of labor hours per worker, or roughly a 2.3% decrease. All other columns can be interpreted using a similar approach.

Meanwhile, subsequent increases in the minimum wage had significant effects on hours per worker in columns 2 and 3, but seemingly no effect in column 4 between 1994 and 1996. Additionally, the minimum wage seems to increase hours per worker in column 2 between 1989 and 1992.

Noticeably, the effect of a small increase in the minimum wage between 1996 and 1998 seemed to be larger than the initial implementation, reducing hours per worker by roughly 9.5 hours, or roughly 4.5%. Assuming the model is specified correctly, this could potentially be due to looser labor market conditions during the East Asian Financial Crisis that cause any increase in the minimum wage to have a larger effect on hours per worker.

These finding has several explanations. Firstly, the common trends assumption from beforehand may not hold which causes bias on all of these coefficients as discussed in the previous section. Secondly, the population affected by the minimum wage may not be correctly specified. Since the OWS data used in these regressions contains both people who are earning close to the minimum wage and people who earning significantly more than the minimum wage, the regressions may be including workers that would not be affected by the implementation of or increases to the minimum wage. Theoretically, including the high wage workers in the regression should bias the coefficient towards zero. However, if there are other exogenous changes in the labor market that occur between the time periods in the regression, then that could bias the coefficient away from zero as found in Table 6.

As a robustness check to first test whether the common trends assumption holds, we examine the years prior to the implementation of the minimum wage using Equation 1 again. In each regression involving years prior to 1989, we make a false assumption that a minimum wage was implemented within the specified time period in order to see if the coefficient of interest,

TREATMENT*POST, is statistically indistinguishable from zero. If so, then it is more likely that the common trends assumption holds, and we can better interpret the regressions from Table 6 as causal. Table 7 below shows the coefficient of interest regarding the effect of the false minimum wage implementation on labor hours.

Table 7. Basic DiD Effect of Fake Minimum Wage on Hours Worked

	1971-1976	1976-1980	1980-1983	1983-1986
	(1)	(2)	(3)	(4)
TREATMENT*POST	16.230*** (0.608)	-0.493 (0.597)	0.059 (0.200)	-1.175*** (0.174)
Observations	217,946	433,681	987,362	1,162,086
R^2	0.054	0.048	0.050	0.061

** = Significant at the 10% level, ** = Significant at the 5% level, *** = Significant at the 1% level (Standard errors are in parentheses)*

While the common trend between labor hours in minimum wage and non-minimum wage industries seems to hold between 1976 and 1980 as well as 1980 and 1983 from columns 2 and 3 of Table 7, the common trends assumption appears to be violated in columns 1 and 4. Between 1971 and 1976, minimum wage industries increased work time by 16.2 hours more than the increase in non-minimum wage industries. One could potentially interpret the 1.2 hour decrease in hours between 1983 and 1986 as an anticipation effect in which firms try to get adjusted to the minimum wage prior to its enactment. This seems less likely considering the minimum wage law was not considered openly in the legislature until the month of the OWS 1986 survey, was not passed until the end of 1986, and was not officially implemented until the beginning of 1988.

Thus, it still seems as though our common trends assumption could be false. In order to combat this problem, this paper attempts to two distinct methods: control variables and synthetic controls.

For the first approach, we add control variables and fixed effects to our regression as described in the empirical specification of Section 4 for this paper. This method is shown in

Tables 8 and 9 below. Table 8 shows the effect of the initial minimum wage implementation on labor hours per worker in column 1 and the effects of the subsequent increases in columns 2-5. Table 9 again assumes a fake minimum wage in time period prior to the real-world implementation of the minimum wage to retest the common trends assumption given the controls and fixed effects added in Table 8. Since the coefficients on the control variables are not the primary research interest of this paper, their values are included this first regression as a sanity test but will not be visually included in other regressions. The regressions in Table 8 do seem to pass this sanity check. People with higher levels of education and experience work less across all 5 columns of the regression which would be expected as they are likely to receive a higher wage and not need to work as many hours. A similar argument can be made for experience since it decreases with more years within an occupation. The negative coefficient on hours worked for women seems curious at first since most literature suggests that women in South Korea work longer hours than the men. However, this finding has been found to be due to men having more education than women during this time period (Lehberger 2016). Since we are already controlling for education, the negative coefficient for labor hours by women is not unexpected. The effect of age on labor hours seems to stay consistent throughout each of the regressions.

Given Table 8, there appears to be a statistically significant negative effect of increases to the minimum wage on labor hours per employed worker except between 1992 and 1994 as well as 1994 and 1996 in which there is a small positive effect.

Table 8. DiD Effect of Minimum Wage w/ Controls and Fixed Effects on Hours Worked

	1986-1989	1989-1992	1992-1994	1994-1996	1996-1998
	(1)	(2)	(3)	(4)	(5)
POST	-2.523***	-4.370**	2.869*	-9.565***	4.032***

	(0.345)	(0.394)	(0.316)	(0.300)	(0.210)
TREATMENT*POST	-5.593*** (0.410)	-2.311*** (0.492)	-0.146 (0.437)	0.986** (0.443)	-9.717*** (0.328)
Age	0.665*** (0.042)	0.706*** (0.101)	0.990*** (0.095)	0.816*** (0.098)	0.477*** (0.042)
Age^2	-0.009*** (0.001)	-0.009*** (0.001)	-0.012*** (0.001)	-0.011*** (0.001)	-0.007*** (0.0004)
Female	-5.772*** (0.161)	-6.732*** (0.416)	-7.967*** (0.409)	-9.554*** (0.417)	-7.525*** (0.183)
Married	0.043 (0.166)	-0.626 (0.411)	-1.157*** (0.381)	-1.678*** (0.382)	-0.079 (0.163)
Female*Married	4.228*** (0.261)	3.109*** (0.588)	-0.112 (0.557)	2.776*** (0.561)	2.258*** (0.238)
Education FE					
Middle School	-0.810*** (0.198)	-0.593 (0.604)	1.061* (0.628)	0.818 (0.683)	-0.090 (0.337)
High School	-8.874*** (0.201)	-6.203*** (0.608)	-5.960*** (0.19)	-7.760*** (0.658)	-6.455*** (0.319)
2-Year College	-21.380*** (0.278)	-14.179*** (0.711)	-14.510*** (0.698)	-17.653*** (0.732)	-13.664*** (0.342)
4-Year College	-27.997*** (0.220)	-24.610*** (0.626)	-25.795*** (0.629)	-27.791*** (0.670)	-21.535*** (0.320)
Experience FE					
1-3 Years	0.768*** (0.168)	0.152 (0.427)	0.556 (0.421)	-0.014 (0.438)	-0.792*** (0.226)
3-5 Years	-0.160** (0.177)	0.058 (0.456)	0.211 (0.452)	-0.365 (0.474)	-2.058*** (0.233)
5-10 Years	-1.520*** (0.189)	-0.822* (0.474)	-1.096** (0.464)	-1.926*** (0.479)	-3.047*** (0.235)
10+ Years	-3.691*** (0.226)	-1.997*** (0.546)	-3.789*** (0.529)	-4.755*** (0.543)	-5.236*** (0.255)
Location FE	X	X	X	X	X
Industry FE	X	X	X	X	X
Absolute Change in Real Min Wage	1613.36	350.05	115.32	143.24	77.52
Percent Increase in Min Wage	N/A	21.70%	5.87%	6.89%	3.49%
Observations	609,871	71,438	82,512	83,784	419,766
R^2	0.258	0.236	0.226	0.253	0.189

** = Significant at the 10% level, ** = Significant at the 5% level, *** = Significant at the 1% level (Standard errors are in parentheses)*

Table 9. DiD Effect of Fake Minimum Wage w/ Controls and Fixed Effects on Hours Worked

	1971-1976	1976-1980	1980-1983	1983-1986

	(1)	(2)	(3)	(4)
TREATMENT*POST	13.445***	0.660	1.653***	-1.969***
	(0.598)	(0.554)	(0.180)	(0.153)
Observations	217,946	433,224	986,905	1,162,086
R^2	0.171	0.216	0.223	0.243

** = Significant at the 10% level, ** = Significant at the 5% level, *** = Significant at the 1% level (Standard errors are in parentheses)*

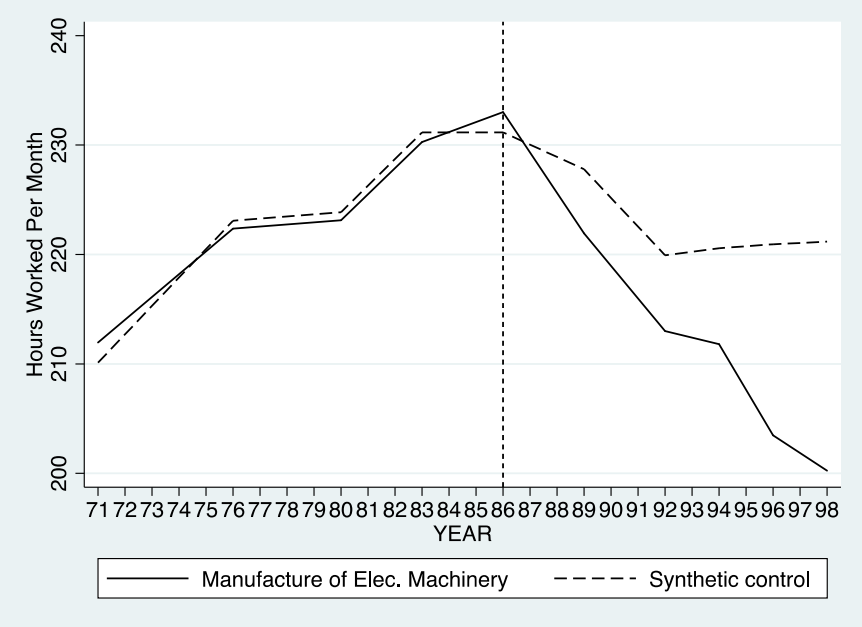
Controls: Age, Age^2, Female, Married and Female*Married (except for 1971-1976 which does not include Married or Female*Married since there is no marital status data for 1971), Education Fixed Effects (where 2-year and 4-year college are placed in the same category for 1971-1976 due to lack of data), Experience Fixed Effects, Location Effects, Industry Fixed Effects

However, similar to the prior baseline regressions in Tables 6 and 7, the common trends assumption seems further violated in the new model. As seen in Table 9 since a minimum wage that was never actually implemented seems to be statistically significant in column 3 when prior to adding the controls, our coefficient of interest was not statistically significant from zero.

The second approach to combatting the common trends problem is through the synthetic controls approach as described in the empirical specification in Section 4. In this method, we compare the average hours worked in industries in which the minimum wage was implemented with a linear combination of the average hours worked in industries in other unaffected industries that is similar to the affected industry prior to the implementation of the minimum wage.

One such synthetic control results is shown in Figure 1 where we compare the Manufacture of Electric Machinery industry with a synthetic control described below. This industry has been chosen as the main example for this paper for two primary reasons. One because it is one of the largest industries found in the OWS data and thus the average hours per year is likely to be more accurate. Additionally, since it one of the lowest paying industries in South Korea in 1986 according to the OWS data, people in this industry are more likely to be affected by the minimum wage.

Figure 1. Synthetic Control Approach: Effect of Minimum Wage on Hours Worked in the Manufacture of Electric Machinery Industry



Manufacture of Elec Machinery = 34.7% Electricity, Gas, Steam, and Water Works; 3.6% Restaurants and Hotels; 43.2% Land Transport; 1.3% Financial Institutions; 17.2% Sanitary and Similar Services

As can be seen in Figure 1, the implementation of the minimum wage in 1988 appears to have a negative effect on monthly hours of work per employee. From 1986 to 1989, hours worked per employee in the Manufacture of Electric Machinery decreases by roughly 8 hours more, or roughly 3% more, than the synthetic control. In 1998, nine years after the initial implementation of the minimum wage, workers in the Manufacture of Electric Machinery industry work roughly 20 hours less per month, or roughly 9% less per month, than the synthetic control.

However, it should be noted that other industries in which a minimum wage was implemented do not have nearly as clear of a trend nor interpretation. These industries are included in the Appendix in Figure B1, B2, B3, and B4. Figure B4 is probably most interesting in this regard since hours worked per month initially increases relative to its synthetic control, and the industry described is also a lower wage industry, like the industry for the Manufacture of Electric Machinery.

As such, many of the findings in this section point to a decrease in hours per worker following increases to the minimum wage of around 2-3% during its implementation period. In particular, there does seem to be a strong negative effect of the minimum wage on hours worked per employee in the Manufacture of Electric Machinery industry. However, the lack of evidence for the common trends assumption and the synthetic control approach yielding various results for different industries provides skepticism to claims regarding the overall impact of the minimum wage on labor hours.

Part B. Effects on Real Hourly Earnings

As we have done for determining the effect of the minimum wage on hours worked per employee, we can repeat a similar analysis in determining the effect of the minimum wage on a worker's hourly wage.

To begin, we will use Equation 1 from the empirical specification of Section 4 using the natural log of real hourly earnings as the dependent variable. The outcomes of the regressions using Equation 1 can be found below in Table 10. From column 1 of Figure 10, we can interpret that the hourly wage in 1986 for workers in a non-minimum wage affected industry was $e^{8.511}$ or roughly 4,969.13 won per hour. The average hourly wage in 1986 for someone in an industry that would eventually have a minimum wage implemented was 47% less than that of the non-minimum wage industry. By 1989, the average hourly wage in the non-minimum wage sector increased by 18.7%. Meanwhile, the average hourly wage in the sectors affected by the minimum wage would have increased by roughly 37.1% compared to their hourly wage in 1986 as can be shown by summing the coefficient on POST and TREATMENT*POST. Thus, assuming we are using the correct model, the minimum wage implementation in 1988 and subsequent increase in 1989 can be said to have caused a 18.4% increase in real hourly wages.

Table 10. Basic DiD Effect of the Minimum Wage on ln(Hourly Wage)

	1986-1989	1989-1992	1992-1994	1994-1996	1996-1998
	(1)	(2)	(3)	(4)	(5)
TREATMENT	-0.470*** (0.002)	-0.286*** (0.007)	-0.251*** (0.005)	-0.193*** (0.005)	-0.199*** (0.005)
POST	0.187*** (0.006)	0.221*** (0.008)	0.097*** (0.006)	0.175*** (0.005)	-0.033*** (0.004)
TREATMENT*POST	0.184*** (0.007)	0.035*** (0.009)	0.058*** (0.007)	-0.006 (0.007)	0.019*** (0.005)
Constant	8.511	8.698	8.919	9.015	9.191
Absolute Change in Real Min Wage	1613.36	350.05	115.32	143.24	77.52
Percent Increase in Min Wage	N/A	21.70%	5.87%	6.89%	3.49%
Observations	609,871	70,957	82,512	83,784	419,774
R^2	0.123	0.118	0.075	0.075	0.036

** = Significant at the 10% level, ** = Significant at the 5% level, *** = Significant at the 1% level (Standard errors are in parentheses)*

From Table 10, we can see how the initial implementation of the minimum wage seems to have had a large positive effect on hourly wages and that future increases in the minimum wage have a smaller and smaller impact on the minimum wage until there is a negative effect in column 5 between 1996 and 1998.

In order for the interpretation above to be seen as causal, the common trends assumption that workers in the minimum wage industries were experiencing the same wage growth as the non-minimum wage industries prior to its implementation would have to hold true. We test this assumption by using Equation 1 on different years prior to 1988 wherein we falsely assume that the minimum wage had been implemented between the two time periods in the regression. If the coefficient on TREATMENT*POST is statistically indistinguishable from zero, then that provides evidence in favor of the common trends assumption and leading credence to the claim that the coefficients found before are the causal effect of the minimum wage on the hourly wage of workers.

The results of these regressions to check the common trends assumption are shown below in Table 11. Columns 2 and 4 give credence to the common trends assumption as wage growth between industries that will have the minimum wage and those that will not have the minimum wage are roughly the same between 1976 and 1980 as well as 1983 and 1986. However, columns 1 and 3 show that this common trends assumption may not be true. Between 1971 and 1976, real wages in manufacturing, construction, and mining firms fell by 3.4% more than in other industries as can be seen in column 1. Additionally, between 1980 and 1983, manufacturing, construction, and mining workers actually had an increase in their hourly wage of 2.5% relative to workers in other industries.

Table 11. Basic DiD Effect of Fake Minimum Wage on ln(Hourly Wage)

	1971-1976	1976-1980	1980-1983	1983-1986
	(1)	(2)	(3)	(4)
TREATMENT*POST	-0.028** (0.011)	-0.015 (0.010)	0.015*** (0.003)	0.023*** (0.003)
Observations	217,946	433,681	987,362	1,162,086
R^2	0.098	0.104	0.115	0.138

** = Significant at the 10% level, ** = Significant at the 5% level, *** = Significant at the 1% level (Standard errors are in parentheses)*

Table 12. DiD Effect of Minimum Wage w/ Controls and Fixed Effects on ln(Hourly Wage)

	1986-1989	1989-1992	1992-1994	1994-1996	1996-1998
	(1)	(2)	(3)	(4)	(5)
POST	0.164***	0.190***	0.069***	0.175***	-0.078***
	(0.004)	(0.005)	(0.004)	(0.003)	(0.002)
TREATMENT*POST	0.181***	-0.020***	0.002	-0.019***	0.010***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.003)
Age	0.034***	0.027***	0.025***	0.029***	0.034***
	(0.0005)	(0.001)	(0.001)	(0.001)	(0.0004)
Age^2	-0.0004***	-0.0003***	-0.0002***	-0.0003***	-0.0003***
	(~0)	(~0)	(~0)	(~0)	(~0)
Female	-0.188***	-0.170***	-0.158***	-0.123***	-0.110***
	(0.001)	(0.004)	(0.003)	(0.003)	(0.002)
Married	0.118***	0.087***	0.086***	0.088***	0.081***
	(0.001)	(0.004)	(0.003)	(0.003)	(0.001)
Female*Married	-0.261***	-0.192***	-0.177***	-0.207***	-0.213***
	(0.002)	(0.006)	(0.005)	(0.005)	(0.002)
Education FE					
Middle School	0.087***	0.090***	0.087***	0.086***	0.107***
	(0.002)	(0.005)	(0.005)	(0.005)	(0.003)
High School	0.207***	0.211***	0.217***	0.229***	0.282***
	(0.002)	(0.006)	(0.005)	(0.006)	(0.003)
2-Year College	0.435***	0.366***	0.343***	0.344***	0.393***
	(0.003)	(0.007)	(0.006)	(0.006)	(0.003)
4-Year College	0.740***	0.611***	0.561***	0.549***	0.607***
	(0.002)	(0.006)	(0.006)	(0.006)	(0.003)
Experience FE					
1-3 Years	0.086***	0.066***	0.052***	0.053***	0.030***
	(0.001)	(0.004)	(0.003)	(0.004)	(0.002)
3-5 Years	0.149***	0.132***	0.125***	0.122***	0.092***
	(0.001)	(0.004)	(0.004)	(0.004)	(0.002)
5-10 Years	0.268***	0.242***	0.233***	0.224***	0.187***
	(0.002)	(0.004)	(0.004)	(0.004)	(0.002)
10+ Years	0.441***	0.426***	0.421***	0.410***	0.363***
	(0.002)	(0.005)	(0.005)	(0.005)	(0.002)
Location FE	X	X	X	X	X
Industry FE	X	X	X	X	X
Absolute Change in Real Min Wage	1613.36	350.05	115.32	143.24	77.52
Percent Increase in Min Wage	N/A	21.70%	5.87%	6.89%	3.49%
Observations	609,871	70,957	82,512	83,784	419,766
R^2	0.768	0.713	0.690	0.669	0.627

** = Significant at the 10% level, ** = Significant at the 5% level, *** = Significant at the 1% level (Standard errors are in parentheses)*

Since the common trends assumption may not hold for the simple model, we again attempt to remedy this problem through the use of control variables and fixed effects as described in Equation 2 in the empirical specification of Section 4. The regression results for this equation are shown above in Table 12 and the equivalent regressions for an imaginary minimum wage prior to 1988 are shown in Table 13 below to retest the common trends assumption.

Table 13. DiD Effect of Fake Minimum Wage w/ Controls and Fixed Effects on ln(Hourly Wage)

	1971-1976	1976-1980	1980-1983	1983-1986
	(1)	(2)	(3)	(5)
TREATMENT*POST	0.058***	-0.040***	-0.021***	0.041***
	(0.007)	(0.007)	(0.002)	(0.002)
Observations	217,946	433,224	986,905	1,162,086
R^2	0.663	0.740	0.757	0.770

** = Significant at the 10% level, ** = Significant at the 5% level, *** = Significant at the 1% level (Standard errors are in parentheses)*

Controls: Age, Age^2, Female, Married and Female*Married (except for 1971-1976 which does not include Married or Female*Married since there is no marital status data for 1971), Education Fixed Effects (where 2-year and 4-year college are placed in the same category for 1971-1976 due to lack of data), Experience Fixed Effects, Location Fixed Effects, Industry Fixed Effects

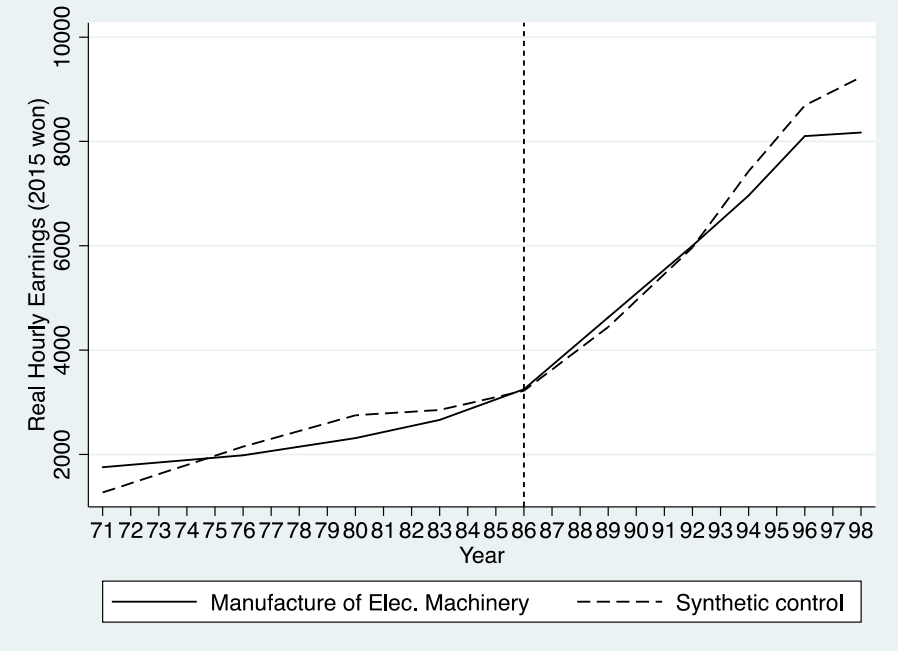
As can be seen in Table 12, the implementation of the minimum wage still seems to have a large positive effect of about 18.1% on real hourly wages between 1986 and 1989. Future increases in the minimum wage have smaller effects on real hourly wages ranging from -2% to +1%. However, it is important to note that all of our robustness checks for testing the common trends assumption now have coefficients that are statistically significant from zero and, as is the case in column 1 of Table 13, appear to show that a minimum wage that never occurred increased real hourly wages by as much as 5.8% over the course of a 5-year window.

Thus, since we still have not been able to confirm the common trends assumption, we proceed to the synthetic control approach. Figure 2 shows the real wage growth between the synthetic control industry and the Manufacture of Electric Machinery industry. It appears as

though there is an almost negligible positive increase in real hourly wages from the minimum wage in the first three years that becomes negative the longer the minimum wage is in place. Synthetic controls for other industries affected by the minimum wage are shown in the Appendix in Figures B5-B8. Similar effects can be found for these industries except for coal mining which has real hourly wage which are consistently positively affected by the minimum wage.

In summary, the difference-in-differences method would lead us to believe that there are large positive effects of the implementation of the minimum wage on real hourly wages of roughly 18% with future increases in the minimum wage having statistically significant but only 1% effects on real hourly wages in both the positive and negative direction. However, the lack of evidence for the common trends assumption and synthetic control approach yielding no clear results add skepticism to this claim.

Figure 2. Synthetic Control Approach: Effect of Minimum Wage on Real Hourly Earnings in the Manufacture of Electric Machinery Industry



Section 7. Conclusion

Overall, it seems as though the minimum wage has a negative effect on the number of hours for which an employee works and a positive effect on a worker's wage. These labor market effects are particularly strong for workers that are paid particularly close to the minimum wage. However, the magnitude of these effects is difficult to ascertain due to lack of a common trend between workers in industries directly affected by the minimum wage effects. While the creation of a synthetic control group helped combat this problem somewhat, the effects of the minimum wage seemed to depend on the subindustry treatment chosen. The synthetic control on the effect of the minimum wage on labor hours in the Manufacture of Electric Machinery industry seemed to provide convincing evidence of a negative impact on labor hours per worker. Other industries synthetic controls had no conclusive evidence as to the effect of the minimum wage on labor hours.

In comparison to previous literature such as Baek and Park (2016) which examined the effects of the South Korean minimum wage implementation using plant-level data in manufacturing, the difference-in-differences results of this paper give credence to their findings of minimum wage implementation increasing wages per worker by 12.8%. The synthetic control approach used in this paper, however, found almost no effect of the minimum wage on the hourly wage. Additionally, our paper provided additional context to their findings in that while they found no effect of the minimum wage on the number of employees at a plant, it may be the case that the employer simply reduces the number of hours people work instead.

Future research on this topic could explore other methods of estimating these same minimum wage labor market effects such as by using methods that allow for departures from the parallel trends assumption such as those found in Rambachan & Roth (2020). Additionally, if

the full OWS dataset were available to a researcher, then the synthetic controls would potentially be more consistent estimators of the treated industries as there would be more years for which one could control. Additionally, if the full OWS dataset included more people from each year, then one might be better able to accurately estimate the effects of the minimum wage on low-wage workers by running similar difference-in-differences regressions and synthetic controls on the groups of people making close to the minimum wage.

Section A. Appendix

Table A1. # of Observations by Industry and Education level in 1986

Education 1986	Manufacturing Observations	Mining Observations	Construction Observations	Other Industry Observations
Elementary School	36,483	6,119	556	9,052
Middle School	150,631	6,123	1,582	29,190
High School	174,433	4,858	6,466	62,257
2-Year College	11,274	262	1,716	9,155
4-Year College	30,872	547	6,713	32,701

Table A2. Mean Monthly Working Hours by Education Level for Each Industry 1986

Education 1986	Manufacturing Total Monthly Working Hours	Mining Total Monthly Working Hours	Construction Total Monthly Working Hours	Other Industry Total Monthly Working Hours
Elementary School	251.00	187.05	220.92	232.97
Middle School	246.75	185.84	226.53	238.49
High School	235.89	205.59	214.24	212.98
2-Year College	218.82	216.50	211.03	201.48
4-Year College	203.94	206.48	212.49	193.30

Table A3. Mean Hourly Wage by Education Level for Each Industry 1986

Education 1986	Manufacturing Real Hourly Earnings (2015 won)	Mining Real Hourly Earnings (2015 won)	Construction Real Hourly Earnings (2015 won)	Other Industry Real Hourly Earnings (2015 won)
Elementary School	2,623.07	5,481.20	3,666.97	3,901.30
Middle School	2,596.82	5,739.73	4,194.00	4,214.96
High School	3,483.19	5,362.10	5,054.47	4,823.45
2-Year College	4,880.80	6,073.68	6,242.80	5,982.38
4-Year College	7,940.71	8,930.90	9,250.01	10,539.79

Note: Smallest category is mining workers with a 2-year college education with 262 workers. Generally speaking, there are more people with a high school education is the most common.

Table A4. Mean Monthly Working Hours by Sex and Marital Status for Each Industry 1986

Sex and Marital Status 1986	Manufacturing Total Monthly Working Hours	Mining Total Monthly Working Hours	Construction Total Monthly Working Hours	Other Industry Total Monthly Working Hours
Married Male	237.74	191.52	214.52	216.25
Single Male	239.10	191.68	217.20	211.20
Married Female	249.07	217.06	204.08	208.51
Single Female	236.77	217.60	211.08	212.12

Table A5. Mean Hourly Wage by Sex and Marital Status for Each Industry 1986

Sex and Marital Status 1986	Manufacturing Real Hourly Earnings (2015 won)	Mining Real Hourly Earnings (2015 won)	Construction Real Hourly Earnings (2015 won)	Other Industry Real Hourly Earnings (2015 won)
Married Male	5,073.33	5,922.64	7,575.04	7,359.59
Single Male	3,235.56	4,910.64	4,852.07	4,700.96
Married Female	2,102.69	2,660.05	2,763.03	4,984.46
Single Female	2,059.22	2,412.74	2,965.51	3,381.87

Note: Smallest category is married women in construction and contains 176 workers. Generally speaking, there are more married men than single men and more single women than married women.

Table A6. Mean Monthly Working Hours by Experience in Occupation for Each Industry 1986

Experience 1986	Manufacturing Total Monthly Working Hours	Mining Total Monthly Working Hours	Construction Total Monthly Working Hours	Other Industry Total Monthly Working Hours
<1 Year	237.88	189.62	211.19	234.04
1-3 Year	239.23	185.58	217.45	235.04
3-5 Year	240.03	187.07	213.16	234.24
5-10 Year	238.98	192.27	216.17	231.62
10+ Year	233.34	201.29	212.79	224.55

Table A7. Mean Real Hourly Wage by Experience in Occupation for Each Industry 1986

Experience 1986	Manufacturing Real Hourly Earnings (2015 won)	Mining Real Hourly Earnings (2015 won)	Construction Real Hourly Earnings (2015 won)	Other Industry Real Hourly Earnings (2015 won)
<1 Year	2,262.05	4,698.50	3,780.44	3,424.65
1-3 Year	2,539.11	5,175.07	4,099.95	4,084.64
3-5 Year	2,908.58	5,406.37	5,055.27	4,810.43
5-10 Year	4,060.92	5,854.73	6,619.58	6,108.91
10+ Year	6,138.31	6,112.86	9,678.56	8,830.35

Note: Smallest category is less than 1-year experience in construction and contains 748 workers. Generally speaking, 5-10 years of experience is more common.

Figure B1. Synthetic Control Approach: Effect of Minimum Wage on Labor Hours in Manufacture of Other Chemical Products Industry

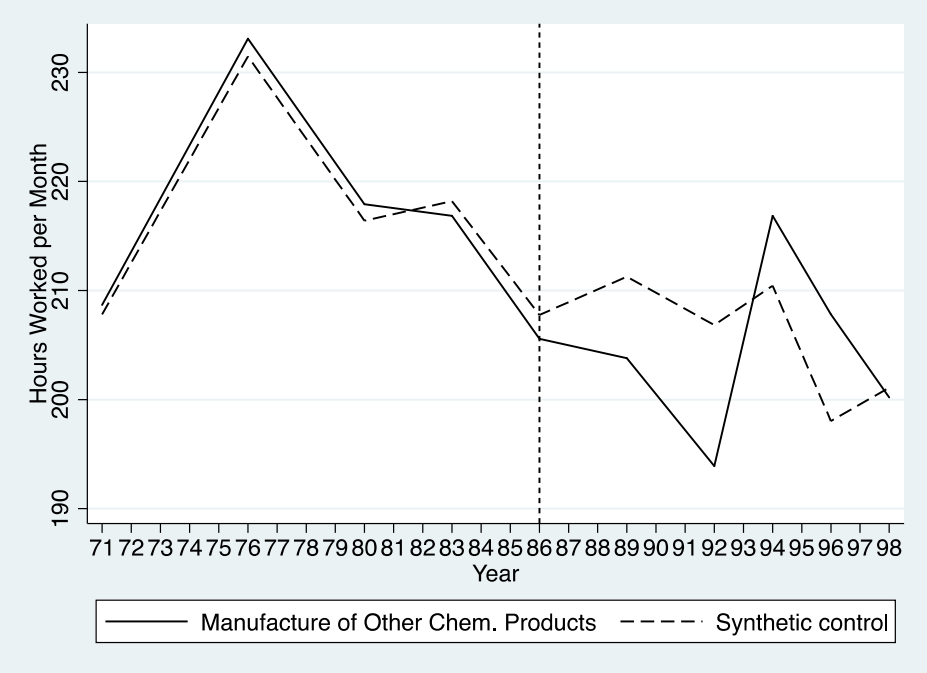


Figure B2. Synthetic Control Approach: Effect of Minimum Wage on Labor Hours in Coal Mining Industry

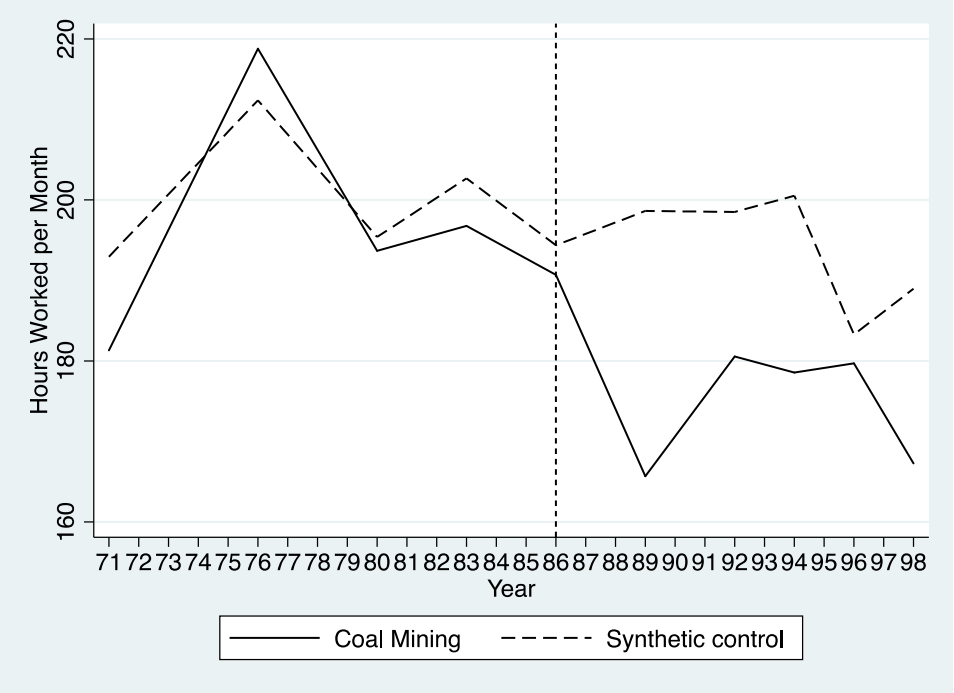


Figure B3. Synthetic Control Approach: Effect of Minimum Wage on Labor Hours in General Construction Industry

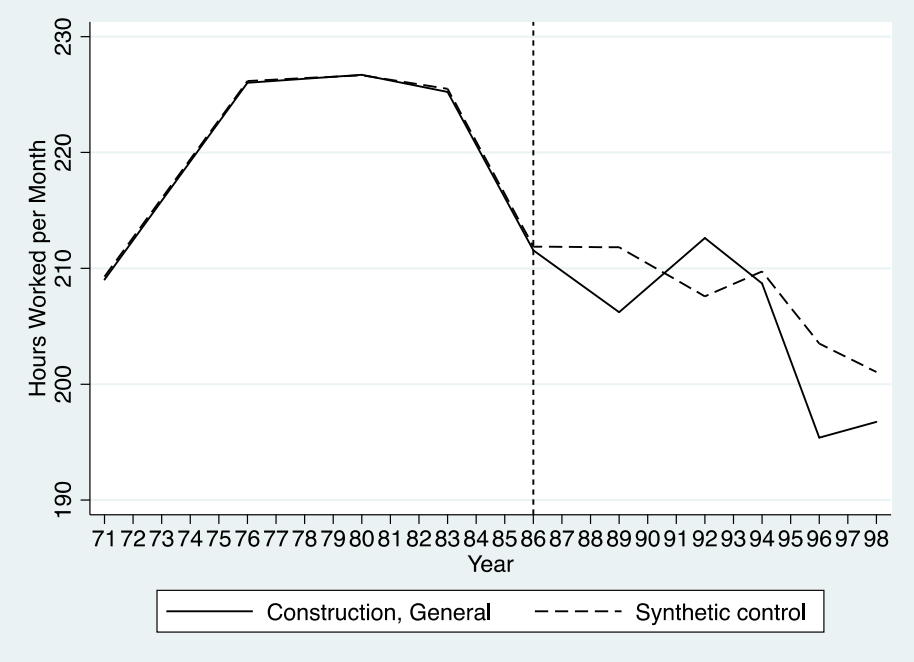


Figure B4. Synthetic Control Approach: Effect of Minimum Wage on Labor Hours in Manufacture of Scientific Equipment Industry

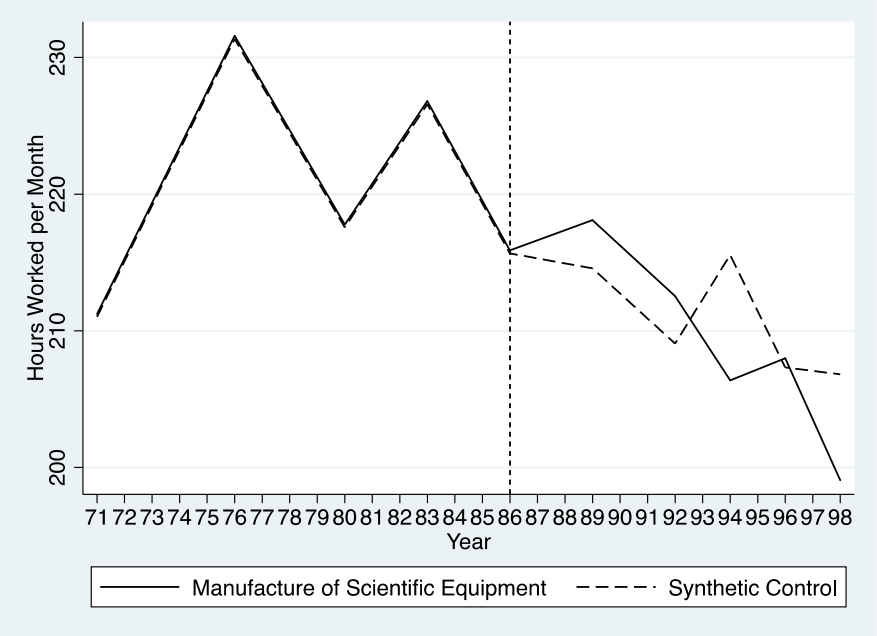


Figure B5. Synthetic Control Approach: Effect of Minimum Wage on Real Hourly Earnings in Manufacture of Other Chemical Products

Figure B6. Synthetic Control Approach: Effect of Minimum Wage on Real Hourly Earnings in Coal Mining

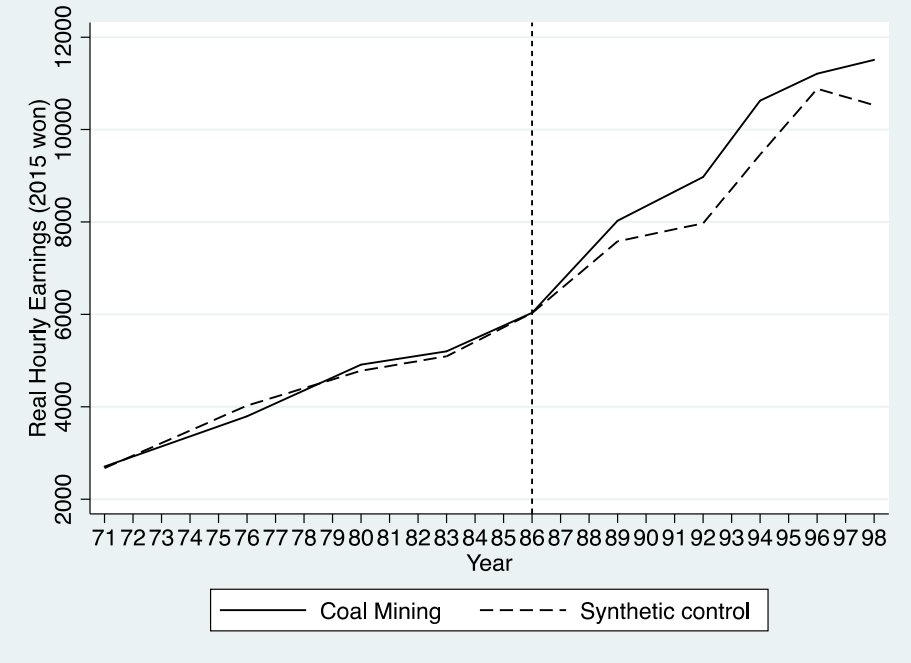


Figure B8. Synthetic Control Approach: Effect of Minimum Wage on Real Hourly Earnings in General Construction

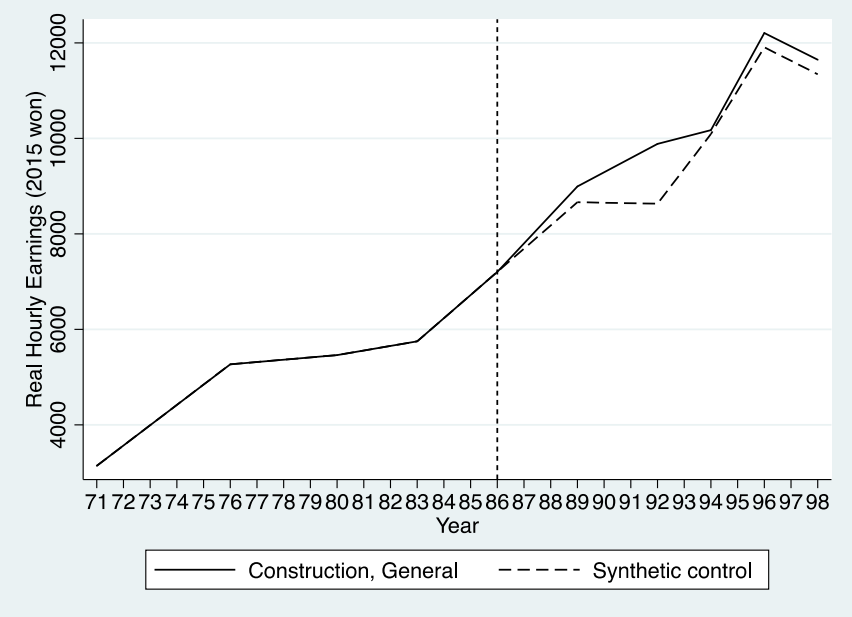
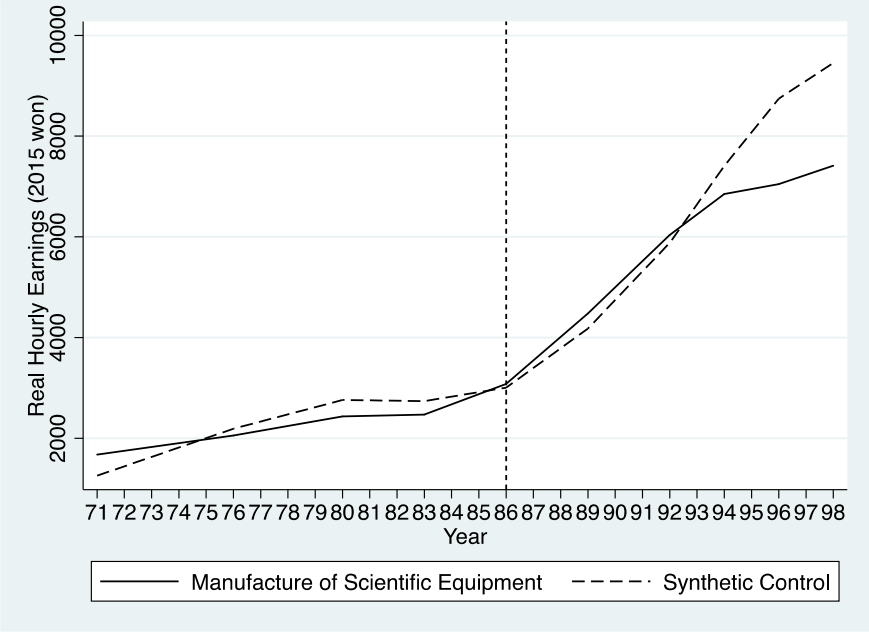


Figure B8. Synthetic Control Approach: Effect of Minimum Wage on Real Hourly Earnings in Manufacture of Scientific Equipment



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