*Jieun Lee**

# Effects of a national work hours restriction in a high hours country

## Abstract

This paper examines the effect of a new maximum work hour restriction introduced in South Korea in 2018 that limited maximum working hours from 68 h/week to 52 h/week. I use difference-in-differences analysis with continuous treatment measuring the prevalence of those working longer than 52 h/week prior to the policy change across industry-occupation-education groups. I find that the policy reduces work hours while increasing monthly earnings and hourly wages for male full-time workers. However, I find that the policy does not significantly affect total work hours, total employment, and total worker pay at the industry-occupation-education group level.

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**Corresponding author:** Jieun Lee
Jieun.Lee-1@colorado.edu

University of Colorado Boulder, Boulder, CO 80309, USA

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# 1 Introduction

Long work hours cause negative impacts to the health and safety of workers, families, and society overall. (Harrington, 2001; Caruso, 2006; Caruso, 2014). As South Korea has been known for its long work hours compared to other Organization for Economic Cooperation and Development (OECD) countries (OECD, 2020), the South Korean government tried to decrease work hours by passing an amendment to the Korean Labor Standards Act in February 2018. According to the amendment, the maximum work hours per week decreased from 68 h to 52 h, including overtime and weekend work.

In this paper, I study how the new workweek limit in Korea affects individual-level labor market outcomes including work hours, monthly earnings, and hourly wages. Changes in individual worker hours, wage, and earnings, however, will not fully capture the policy effects, as employers may also adjust employment levels. To understand the effect of the policy on the amount of labor hired and labor costs of employers, I also analyze total worker hours, total employment, and total worker pay at the industry-occupation-education group level.

If the new work hour restriction induces a decline in work hours, the resulting labor supply decrease should increase the hourly wage. However, the policy impact on average worker earnings is ambiguous, depending on the offsetting effects on work hours and hourly wage. At the industry-occupation-group level, total work hours hired by firms should fall in response to the hourly wage increase. The policy impact on employment is ambiguous, since the negative effect of rising wages may be offset by the need to hire additional workers to compensate for the hours restriction. The policy impact on total worker pay at the industry-occupation-group level is also ambiguous because it depends on the magnitude of the decrease in total work hours relative to the increase in hourly wage. Therefore, the effect of the new work hour restriction is an empirical question.

The new work hour limit first went into effect in July 2018 for establishments with more than 300 employees in most industries, and it was phased in over time for most other industries and establishment sizes. Trends in actual hours worked, however, show that work hours declined relatively quickly after July 2018 even for industries and establishments that were phased in later. Therefore, analysis using the phase-in as an identification strategy will not find a significant effect on the labor market outcomes of interest. Instead, I use a difference-in-differences approach where I exploit variation in the proportion of workers who worked longer than 52 h/week before the passage of the amendment at the industry-occupation-education level, which ranges from a low of 0.9% workers to a high of 86.2%. This is because industry-occupation-education groups that are characterized by prevalent long work hours are likely to experience more dramatic changes in the outcome variables under the new work hour restriction.

My results indicate that the new work hour restriction has a negative effect on work hours while it has a positive impact on monthly earnings and hourly wages at the individual level. On the other hand, the policy change has a statistically insignificant effect on total work hours, total employment, and total worker pay at the group level, although these point estimates are negative. To illustrate the magnitude, consider an industry-occupation-education group with 20% of workers working at least 52 h/week in the pre-period. For such a group, full-time workers are predicted to experience a 51 min decline in actual hours worked a week and a 55 min

decline in usual hours worked a week, relative to a group with 0% above 52 h in the pre-period. In addition, the percent change in monthly earnings and hourly wages are predicted to be 1.7 percentage points and 3.38 percentage points higher, respectively, compared to groups with no such workers.

This paper contributes to the literature on labor policy change and its impacts on labor markets in two ways. First, to my knowledge, the impact of the 2018 South Korean policy has not been studied. The policy setting itself is unique, since long work hours are commonly prevalent in South Korea. Before the new work hour limit was enacted, 19.63% of male full-time workers in the sample worked longer than 52 h/week and the average hours worked among those workers were 60.35 h/week.

Second, the Korean policy differs from the standard workweek policies studied in prior literature (Chemin and Wasmer, 2009; Costa, 2000; Hunt, 1999; Kawaguchi et al., 2008; Kim and Lee, 2012; Raposo and van Ours, 2008; Sánchez, 2013; Yoo and Lee, 2014). The standard workweek policies previously studied reduce the number of hours that can be worked without overtime pay, usually to between 40 h and 48 h, but they do not limit the number of overtime hours. In contrast, the new work hour restriction in South Korea outlaws work hours above 52 h/week regardless of pay. Specifically, employers who violate the new work hour restriction are subject to criminal penalty of up to 2 years in prison or a fine of up to 20 million Korean won (approximately US$ 15,634). Therefore, the Korean 52 work hour limit is potentially a stronger constraint on work hours than typical standard workweek limits. In fact, my estimates suggest that the magnitude of effects on hours and wages lies in the range of estimates in the prior literature.

South Korean employers raised concerns about the difficulty of cutting work hours and a consequent negative impact on employment through increased labor costs borne by employers. Some workers were also opposed to the policy change due to a possible decline in their incomes. Amid concerns over the new work hour limit, the South Korean government provided consulting services, subsidies, and even grace periods during which violations would not be subject to criminal prosecution. While subsidies have incentivized employers to comply with the new limit sooner rather than later, grace periods could have deferred a rigorous adoption of the new limit. This paper estimates the short-term effects of the policy change while subsidies and grace periods were still in effect, and the long-term effects may therefore be different. Long-term analysis is not pursued in this paper because these effects are confounded by the Coronavirus disease of 2019 (COVID-19) pandemic.

## 2 Institutional Background

Policies that aim to reduce work hours have been carried out mostly in the form of a reduction in the standard work week in many countries. South Korea also decreased its standard workweek from 44 h/week to 40 h/week in 2004 and onwards but long work hours had been still prevalent. In part, that was because workers were able to be engaged in overtime or weekend work in exchange for a higher working allowance, which makes overtime and weekend work particularly attractive for workers with a relatively low base pay. In addition, there was a legal ambiguity concerning the reference period over which the maximum weekly work hours were required to be calculated.

Before the amendment to the Labor Standards Act was passed by the National Assembly in February 2018, South Korean workers were legally allowed to work up to 68 h/week.[1] The relevant provisions are as follows: Article 50 (*Work Hours*) paragraph 1 of the Labor Standards Act states that *work hours shall not exceed 40 hours a week, excluding hours of recess*. Article 50 paragraph 2 states that *work hours shall not exceed eight hours a day, excluding hours of recess*. Article 53 (*Restrictions on Extended Work*) paragraph 1 states that *where an agreement is made between the parties, work hours referred to in Article 50 may be extended by up to 12 hours per week*. However, weekend work had not been regarded as extended work because the ministry of Employment and Labor had interpreted that 1 week in the Labor Standards Act is Monday to Friday. Therefore, South Korean workers could work up to 68 h from Monday to Sunday, which consisted of 40 h of standard workweek, 12 h of extended work during weekdays, and 16 h of work during weekends. The amendment to the Labor Standards Act added a new paragraph to Article 2 (*Definition*) that the term "1 week" means 7 days including holidays, effectively restricting the legally allowed maximum work hours to 52 h/week. Additionally, while formerly exemptions from Article 59 had been granted to 26 industries, so that workers in these industries could work extended hours in excess of the 12 h/week limit imposed under Article 53(1), the present amendment also decreased this number to only five exempted industries.

The new work hour limit was applied sequentially depending on establishment size. Phase 1 technically began on July 1, 2018, in workplaces with 300 or more employees (big). However, the new limit was enforced on July 1, 2019 for workplaces forming part of those 21 industries that were no longer regarded as special cases in Article 59 because they were granted one more year to comply with the new limit. Phase 2 began on January 1, 2020 for workplaces with 50–299 employees (medium) in every industry. Phase 3 began on July 1, 2021 for workplaces with 5–49 employees (small) in every industry.

The new limits have been enforced in big workplaces with a 9-month grace period and in medium workplaces with a 1-year grace period, during which workplaces are not subject to labor audits for long work hours and employers are given 6 months to correct their practices even if violations are detected. Although small workplaces have not been given a grace period, they were allowed to extend work hours up to 60 h/week until 2022 if their employees agree to do so.

As the policy has been rolled out, the South Korean government has also provided financial assistance for establishments when they hired additional employees as a response to a reduction in work hours or when they did not cut their employees' salaries along with a reduction in work hours. To encourage early adoptions from establishments with later enforcement dates, the government offered larger amounts of subsidies with longer periods to establishments that reduced work hours more than 6 months earlier than their enforcement dates.

Establishments with more than 300 employees received about US$ 477 per newly hired worker per month for 1 year when they hired new employees to reduce work hours. Establishments with less than 300 employees were given up to US$ 637 per newly hired worker per month for up to 3 years if they conformed with the law on the enforcement date while they could have received up to US$ 796 per newly hired worker per month if they had complied earlier.

1 If a worker had only 1 day off a week, the maximum working hours was allowed to be 60 h/week before the amendment.

One concern about the new work hour restriction was that workers who used to work longer than 52 h/week would experience a decrease in their income because overtime and extended work usually pay a premium and thereby take up a significant portion of their monthly earnings. To mitigate this concern, the government has provided temporary compensation for establishments that preserve employees' salary income despite a reduction in work hours. Establishments with more than 300 employees received US$ 80–319 per employee per month for 1–2 years as a subsidy, and establishments with less than 300 employees received the same amount of subsidy for up to 3 years if they complied with the new policy earlier.

## 3 **Data**

I use the microdata of the Economically Active Population (EAP) Survey from January 2016 to December 2019, which is collected by Statistics Korea and provided through the Microdata Integrated Service of Statistics Korea. The target population of the survey is people aged 15 or older who reside in South Korea. The sample size of the EAP is 35,000 households, and the reference week is the week which contains the 15th day of the month. A survey for each month becomes publicly available in the following month. The EAP includes interviews from all members of each household aged 15 or older every month and it collects information on demographic characteristics such as age, sex, marital status, and educational attainment. It also provides job characteristics such as actual hours worked in the reference week, occupation, industry, status in employment, and establishment size.

The EAP asks additional questions for wage and salary workers every August. Such additional questions include the average earnings over the last 3 months and usual hours worked per week, which are outcome variables of interest in this paper. For outcome variables using the August surveys, I include the August 2015 survey in the analysis so that I observe two pre-period changes instead of one.

I classify the outcome variables into three categories based on data source. First, by using the individual-level monthly data, I study the policy impact on actual hours worked in the reference week. Second, I use individual-level annual data from the August surveys to measure usual hours worked per week, monthly earnings, and hourly wages. Third, I aggregate the individual-level data to the industry-occupation-education group level to analyze total employment, total work hours, and total worker pay. This aggregation is necessary to understand the policy effects on total labor quantity and total labor costs of employers.

For actual hours worked, I consider male workers aged between 25 and 55, who work longer than 34 h in the reference week. For usual hours worked, monthly earnings, and hourly wages, I consider male workers aged between 25 and 55, whose usual hours worked are longer than 34 h. I use usual hours worked per week to complement the measure of actual hours worked because using usual hours worked per week could avoid any shocks in work hours that occurred in the reference week. Monthly earnings is obtained from average monthly earnings over the last 3 months in the August survey. Since the August survey does not collect hourly wages, unless a worker reports him/herself as an hourly worker, nor effective premia for overtime and weekend work, I manually calculate hourly wages. I first obtain total hours worked per month by dividing the usual hours worked per week by 7 and then multiply it by 30.4. Next, I divide average monthly earnings over the last 3 months by total hours worked per month.

I use the constructed hourly wages for salary workers while using reported hourly wages for hourly workers.

For the group-level outcome variables, I measure each variable by using the work hours data for all workers and full-time workers individually. Specifically, for total work hours, I individually sum actual hours worked of all workers and full-time workers at the industry-occupation-education group level. Total employment is constructed by counting the number of male workers aged between 25 and 55, who worked at least an hour[2] or who took temporary leave during the reference week of survey. In addition to total employment, total full-time employment is constructed by counting the number of male workers aged between 25 and 55, who worked longer than 34 h in the reference week of survey. For total pay, I individually aggregate the monthly earnings of all workers and full-time workers at the industry-occupation-education group level for each year. While I define full-time workers by using actual hours worked for total work hours and total employment, for total pay, I define full-time workers by using usual hours worked.

Figure 1 shows the distribution of hours worked before the new work hour limit was introduced. Figure 1A particularly illustrates that a non-trivial amount of workers worked longer than 52 h/week. Panel A of Table 1 shows summary statistics for the outcome variables for all male full-time workers while Panel B is for the outcome variables for male workers working longer than 52 h/week. Before the passage of the amendment to the Labor Standards Act, the average actual hours worked of all male full-time workers were 46.97 h/week and the average usual hours worked were 43.45 h/week. On the other hand, the average actual and usual hours worked of male workers working longer than 52 h/week were 60.35 h/week and 59.89 h/week, respectively. The proportion of male full-time workers working more than 52 h/week was 19.63% prior to the policy change, which indicates that the limit affects a non-trivial amount of the labor force. Comparing Panel A and B of Table 1 shows that working longer than 52 h/week is associated with lower hourly wages and thereby lower monthly earnings.

## 4 Identification Strategy

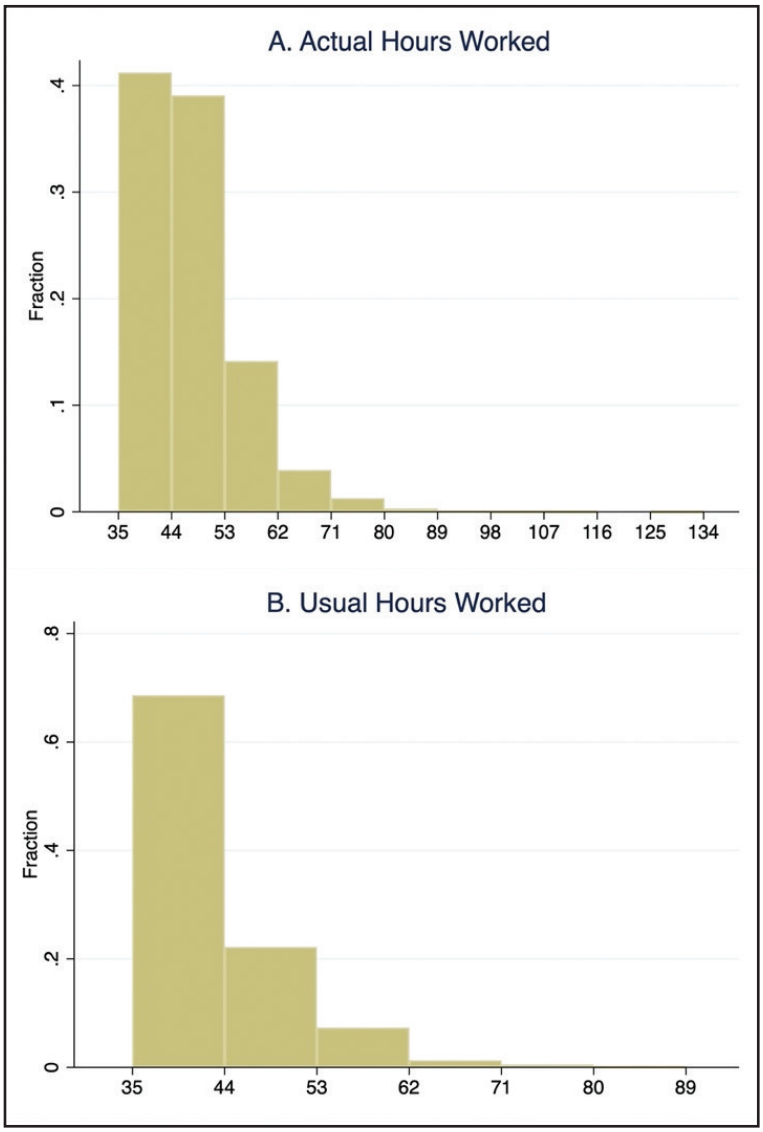
I first demonstrate why the policy roll-outs by industry and establishment size cannot be used to estimate policy effects, and then describe my identification strategy based on treatment intensity by industry-occupation-education group. First, I checked trends in actual hours worked by classifying industries into three groups. This is because the EAP contains only 1-digit codes of the Standard Industrial Classification (SIC) whereas enforcement varied across industries depending on 2- or 3-digit codes of SIC.

The first group includes industries where the new restriction was enforced in all subsectors in July 2018.[3] The second group includes industries where either the new work hour

2 This follows the definition of an employed person from the International Labour Organization (ILO); a person is regarded as employed if he or she works for any amount of time during the reference week for wages or salary in cash or in kind.

3 According to 1-digit of Korean Standard Industrial Classification (KSIC) codes, the first group consists of 10 industries: Agriculture, forestry and fishing (A), Mining and quarrying (B), Manufacturing (C), Electricity, gas, steam, and air conditioning supply (D), Construction (F), Real estate activities (L), Public administration and defense; compulsory social security (O), Arts, sports and recreation related services (R), Activities of households as employers; undifferentiated goods-and-services-producing activities of households for own use (T), and Activities of extraterritorial organizations and bodies (U).

**Figure 1** Distribution of hours worked before the policy change.




*Notes*: (A) Male workers between the ages of 25 and 55, who worked more than 34 h in the reference week, in all industries and establishment sizes subject to the new restriction. (B) Male workers between the ages of 25 and 55, who usually worked more than 34 h/week in all industries and establishment sizes subject to the new restriction.

restriction was enforced in July 2019 or where it was enforced in some subsectors in July 2018 and in other subsectors in July 2019.[4] The third group includes industries where it was enforced in some subsectors in July 2019 but it would not be compulsory in other subsectors due to their legal designation as a *special case*.[5] Many subsectors in the second and third groups of industries had previously been exempted from the prior 68 weekly hour limit. While these sectors were not subject to the 52 h restriction until July 2019, they became subject to the old 68 h restriction starting in July 2018.

4 According to 1-digit of KSIC codes, the second group consists of nine industries: Water supply; sewages, waste management, and materials recovery (E), Wholesale and retail trade (G), Accommodation and food service activities (I), Information and communication (J), Financial and insurance activities (K), Professional, scientific, and technical activities (M), Business facilities management and business support services; rental and leasing activities (N), Education (P), and Membership organizations, repair, and other personal services (S).

5 According to 1-digit of KSIC codes, the third group consists of two industries: Transportation and storage (H) and Human health and social work activities (Q).

**Table 1** Summary statistics

| | Before | | After | |
|---|---|---|---|---|
| | **Mean** | **SD** | **Mean** | **SD** |
| **A. Outcome variables for full-time workers** | | | | |
| Actual hours worked | 46.971 | 8.134 | 45.188 | 7.056 |
| Usual hours worked* | 43.450 | 6.401 | 43.246 | 5.857 |
| Monthly earnings (10,000 Won)* | 329.171 | 153.306 | 353.503 | 169.142 |
| Hourly wages (10,000 Won)* | 1.783 | 0.906 | 1.909 | 0.981 |
| **B. Outcome variables for workers working >52 h/week** | | | | |
| Actual hours worked | 60.345 | 6.612 | 59.814 | 6.284 |
| Usual hours worked* | 59.894 | 5.627 | 59.436 | 5.453 |
| Monthly earnings (10,000 Won)* | 272.004 | 111.977 | 307.123 | 128.292 |
| Hourly wages (10,000 Won)* | 1.050 | 0.446 | 1.186 | 0.499 |
| **C. Demographic characteristics** | | | | |
| Age | 40.050 | 8.358 | 40.149 | 8.393 |
| Marital status | | | | |
| Single | 0.283 | 0.450 | 0.313 | 0.464 |
| Married | 0.683 | 0.465 | 0.655 | 0.476 |
| Widowed | 0.004 | 0.062 | 0.004 | 0.059 |
| Divorced | 0.030 | 0.171 | 0.029 | 0.167 |
| **D. Job characteristics** | | | | |
| Fixed-term contract | 0.100 | 0.300 | 0.107 | 0.310 |
| Status in employment | | | | |
| Regular workers | 0.844 | 0.363 | 0.859 | 0.348 |
| Temporary workers | 0.089 | 0.284 | 0.079 | 0.269 |
| Daily hired workers | 0.038 | 0.194 | 0.034 | 0.180 |
| Self-employed with employees | 0.029 | 0.169 | 0.028 | 0.166 |
| Self-employed without employees | 0.000 | 0.004 | 0.000 | 0.002 |
| Unpaid family workers | 0.000 | 0.015 | 0.000 | 0.020 |
| Establishment size | | | | |
| 5–9 employees | 0.187 | 0.390 | 0.183 | 0.386 |
| 10–29 employees | 0.246 | 0.430 | 0.249 | 0.433 |
| 30–99 employees | 0.221 | 0.415 | 0.216 | 0.411 |
| 100–299 employees | 0.137 | 0.343 | 0.137 | 0.344 |
| 300+ employees | 0.211 | 0.408 | 0.215 | 0.411 |
| **E. Additional job characteristics*** | | | | |
| Special type of employment | 0.012 | 0.107 | 0.010 | 0.097 |
| Flexible work hours | 0.064 | 0.245 | 0.152 | 0.359 |
| Employer-sponsored pension | 0.897 | 0.304 | 0.913 | 0.282 |
| Employer-sponsored health care | 0.900 | 0.300 | 0.914 | 0.280 |
| Employment insurance | 0.794 | 0.404 | 0.842 | 0.365 |
| Severance pay | 0.890 | 0.313 | 0.906 | 0.292 |
| Bonus | 0.873 | 0.332 | 0.859 | 0.348 |
| Overtime pay | 0.670 | 0.470 | 0.669 | 0.471 |
| Paid vacation | 0.810 | 0.393 | 0.827 | 0.378 |
| Training | 0.681 | 0.466 | 0.675 | 0.468 |
| Salary form | | | | |
| Monthly | 0.593 | 0.491 | 0.580 | 0.494 |
| Annually | 0.303 | 0.459 | 0.320 | 0.467 |
| Others | 0.104 | 0.305 | 0.100 | 0.300 |

(*Continued*)

**Table 1** Continued

| | Before | | After | |
|---|---|---|---|---|
| | **Mean** | **SD** | **Mean** | **SD** |
| Union | | | | |
| No union | 0.656 | 0.475 | 0.660 | 0.474 |
| Not eligible for union | 0.076 | 0.265 | 0.077 | 0.266 |
| Eligible but did not join union | 0.078 | 0.268 | 0.082 | 0.275 |
| Union member | 0.190 | 0.392 | 0.181 | 0.385 |
| Observations for all male full-time workers | 174,870 | | 113,651 | |
| Observations for male workers working >52 h/week | 34,322 | | 14,212 | |
| Observations for all male full-time workers* | 20,699 | | 13,103 | |
| Observations for male workers working >52 h/week* | 1,914 | | 901 | |

*Notes*: *These variables are drawn from the August surveys.

*Sources:* The EAP Survey.

EAP, economically active population.

Figure 2 illustrates trends in actual hours worked among male workers between the ages of 25 and 55, who worked more than 34 h in the reference week. Figure 2A shows that work hours have declined since the amendment was passed in February 2018, even in establishments with less than 300 employees where the new work hour restriction was not mandatory. This could be because the government has provided more generous subsidies for establishments that complied with the new limit earlier than their corresponding effective dates.

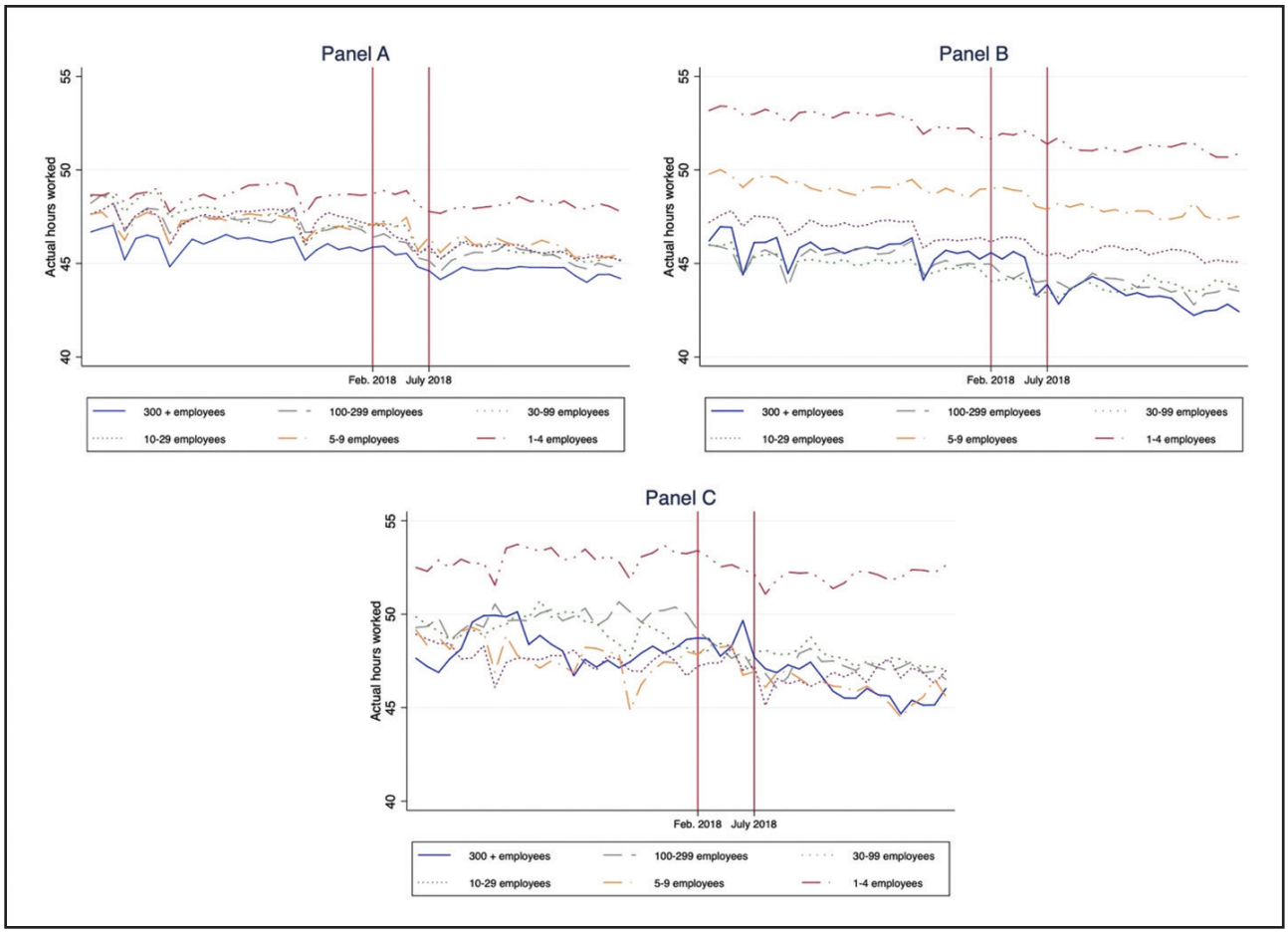
Figure 2B shows that establishments with more than 300 employees in the second group of industries decreased work hours around July 2018, which was 1 year earlier than the enforcement date for many of those industries. Establishments with less than 300 employees showed declines in work hours but it is not clear if it resulted from the policy change or a secular decline in work hours. Figure 2C shows that work hours in the third group of industries have declined compared to those before the passage of the amendment.

Considering that, on average, almost every establishment of any size has shown declines in work hours after the amendment was passed, my analysis focuses on every industry and establishment size that is subject to the new work hour restriction. Specifically, I exclude workers at establishments with less than five employees since such establishments will not be subject to the restriction. I also eliminate workers in the third group of industries, where the new work hour restriction was enforced in some subsectors in July 2019 but it would not be compulsory in the other subsectors due to the legal position of *special case*. This is because the new work hour restriction is not binding in industries that are still regarded as *special case* and I cannot identify such industries from the EAP data due to unavailability of 2- or 3-digit KSIC codes.

Restricting attention to industries and establishments that are subject to the new work hour restriction, it should be the case that employees who work at a job that is characterized by prevalent long work hours prior to the policy change will experience a more dramatic change in work hours under the new work hour restriction.[6] I use industry-occupation-education groups

6 It would have been a more direct way to measure the policy impact had individuals been assigned to treatment and comparison groups based on their past work hours being greater than 52 h a week or not. Unfortunately, the EAP does not provide an identifier for individuals nor retrospective data on work hours, which prevents me from keeping track of them over time.

**Figure 2** Trends in actual hours worked.




*Notes*: The new work hour restriction was passed on February 28, 2018 and first implemented on July 1, 2018. (A) Male workers between the ages of 25 and 55, who worked more than 34 h in the reference week in industries where the new restriction was enforced in all subsectors in July 2018. (B) Male workers between the ages of 25 and 55, who worked more than 34 h in the reference week in industries either where the new work hour restriction was enforced in July 2019 or where it was enforced in some subsectors in July 2018 and in the other subsectors in July 2019. (C) Male workers between the ages of 25 and 55, who worked more than 34 h in the reference week in industries where the new restriction was enforced in some subsectors in July 2019 but it would not be compulsory in the other subsectors due to the legal position of *special case*.

to classify workers into job types. To construct the analysis sample, I eliminate industry-occupation-education groups with less than 100 observations in at least 1 year, from 2016 to 2019, which leaves 119 industry-occupation-education groups from 15 industries, 8 occupations, and 5 education levels.

To measure the policy intensity, I exploit variation in the proportion of workers who worked longer than 52 h/week prior to the policy change across industry-occupation-education groups. Although every industry in my sample is affected by the policy change, policy intensity varies across industry-occupation-education groups, depending on how prevalent long work hours were before the passage of the amendment. As can be seen in Table 2, the policy intensity ranges from a low of 0.9% of workers above 52 h in the pre-period to a high of 86.2%, with the median worker in an industry-occupation-education group with 19.2% above 52 h in the pre-period.

I use a difference-in-differences approach to measure the policy effect on labor market outcomes that are specified in the previous section. The identifying assumption is that the

**Table 2** Summary statistics for policy intensity

| Min | 1st Quartile | 2nd Quartile | 3rd Quartile | Max | Mean | SD |
|---|---|---|---|---|---|---|
| 0.009 | 0.135 | 0.192 | 0.241 | 0.862 | 0.200 | 0.099 |
| Proportion of workers working >52 h | | | | 19.63% | | |
| Observations | | | | 174,870 | | |

*Sources*: The EAP Survey.

EAP, economically active population.

changes in labor market outcomes observed across treated industry-occupation-education groups would have been the same as those of untreated groups, in the absence of the policy change.

I use two-way fixed effect models to estimate the effect of the policy change on the outcome variables. First, since actual hours worked are drawn from individual-level monthly data, I use the following estimating equation:

$$Y_{ijmt} = Post_{mt} + \beta \cdot D_j \cdot Post_{mt} + \gamma_j + \delta_m + \delta_t + \lambda X_{ijmt} + \varepsilon_{ijmt} \quad (1)$$

where $i$ denotes an individual worker, $j$ denotes an industry-occupation-education group, $m$ denotes month, and $t$ denotes year. $Post_{mt}$ takes the value of 0 from January 2016 to February 2018, and 1 from July 2018 onwards. I exclude March to June 2018 to rule out any possible anticipation effect. $D_j$ is the proportion of workers who worked longer than 52 h/week prior to the policy change at the industry-occupation-education level and measures the policy intensity. $\gamma_j$ are industry-occupation-education fixed effects, $\delta_m$ are month fixed effects, and $\delta_t$ are year fixed effects. $X_{ijmt}$ includes demographic and job characteristics that are listed in Panels C and D in Table 1.

Second, since usual hours worked, monthly earnings, and hourly wages are drawn from individual-level annual data from the August surveys, I use the following estimating equation:

$$Y_{ijt} = \beta \cdot D_j \cdot Post_t + \gamma_j + \delta_t + \lambda X_{ijt} + \varepsilon_{ijt} \quad (2)$$

The estimating equation is similar to Eq. (1), except that I drop the month fixed effects and the post-period dummy variable in estimation. Since the August surveys collect a rich set of information on job characteristics, described in Panel E in Table 1, I include these additional job characteristics in addition to those in Panels C and D as controls in the regression. Monthly earnings and hourly wages are log transformed.

For total work hours, total employment, and total worker pay at the industry-occupation-education group level, I use the following estimating equation:

$$Y_{jmt} = Post_{mt} + \beta \cdot D_j \cdot Post_{mt} + \gamma_j + \delta_m + \delta_t + \lambda X_{jmt} + \varepsilon_{jmt} \quad (3)$$

where $X_{jmt}$ is a vector of the mean values of demographic and job characteristics at the industry-occupation-education level. For total pay, I drop the month fixed effects and the post-period dummy variable, $Post_{mt}$ because it is constructed by using annual data. All group-level outcome variables are log transformed.

In all regressions, standard errors are clustered at the industry-occupation-education level. While the individual-level regressions are weighted by individual sampling weight, the

group-level regressions are weighted by group size prior to the policy change. Specifically, for group-level outcomes that are measured for all workers, regressions are weighted by the number of all workers in groups. For group-level outcomes that are measured for full-time workers, regressions are weighted by the number of full-time workers in groups.

I also conduct event-study estimations to see heterogeneous policy effects over time. Specifically, I use the following estimating equation for an event-study estimation corresponding to Eq. (1):

$$Y_{ijmt} = \sum_{\tau} \beta_{\delta} \cdot D_j \cdot 1[\tau = \text{month } m \ \& \ year\, t] + \gamma_j + \delta_m + \delta_t + \lambda X_{ijmt} + \varepsilon_{ijmt}. \quad (4)$$

The event-study estimation results also provide supporting evidence that industry-occupation-education groups had parallel trends before the policy adoption.

## 5 Results

Table 3 shows the individual-level estimation results. First, as predicted, actual hours worked and usual hours worked of full-time workers decrease and hour wages increase. Second, monthly earnings increase despite the decline in work hours. Comparing columns (2) to (4) with columns (5) to (7) of Table 3 shows that the magnitude of the effects increases when various fringe benefits and job characteristics are also controlled for. To illustrate the magnitude, I use a value of 20% of workers working longer than 52 h/week in the pre-period in industry-occupation-education groups, which is the mean value of the treatment variable. The point estimate for actual hours worked implies that male full-time workers in industry-occupation-education groups that had 20% of workers working longer than 52 h/week before the policy change are predicted to have experienced about a 51 min decline in hours worked a week. Similarly, the point estimate for usual hours worked implies that they are also predicted to have experienced about a 55 min decline in hours worked a week. Furthermore, the percent change in monthly earnings is predicted to be 1.7 percentage points

**Table 3** Individual-level estimation results

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | **Actual hours** | **Usual hours** | **Log monthly earnings** | **Log hourly wages** | **Usual hours** | **Log monthly earnings** | **Log hourly wages** |
| Treatment effect | −4.242*** | −4.334*** | 0.068 | 0.142** | −4.566*** | 0.085* | 0.169*** |
| | (1.233) | (0.987) | (0.054) | (0.061) | (0.973) | (0.050) | (0.054) |
| Basic controls | X | X | X | X | X | X | X |
| Additional controls | | | | | X | X | X |
| Observations | 288,521 | 33,802 | 33,802 | 33,802 | 33,024 | 33,024 | 33,024 |
| *R*-squared | 0.115 | 0.147 | 0.495 | 0.500 | 0.160 | 0.525 | 0.541 |

*Notes*: Standard errors in parentheses are clustered at the industry-occupation-education group level. Estimation for actual hours uses monthly data while estimation for the other outcome variables uses annual data. Basic controls include age, age squared and dummy variables for marital status, fixed-term contract, status in employment, and establishment size. Additional controls include dummy variables for all the additional job characteristics described in Table 1.

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

higher in groups with 20% above 52 h in the pre-period than groups with 0%. The corresponding value for hourly wages is 3.38 percentage points.

These results are comparable to those in previous studies that estimated labor market impacts of reductions in the standard workweek. First of all, the estimated 51-min decline in actual hours worked a week is larger than a 43-min decline in hours worked that resulted from a 4-h reduction in the standard workweek, from 44 h/week to 40 h/week, that was rolled out in South Korea from 2004 to 2009 (Kim and Lee, 2012). On the other hand, the estimated 55-min decline in usual hours worked a week is smaller than a 2-h-46-min decrease in hours worked that resulted from a 3-h reduction in the standard workweek, from 48 h to 45 h, that was implemented in Chile in 2005 (Sánchez, 2013). In addition, the estimated hourly wage increase by 3.38 percentage points is larger than a 0.31-percentage-point increase in the hourly wage that resulted from a 2-h reduction in the standard workweek, from 42 h to 40 h, which was in effect in the United States starting October 1939 (Costa, 2000), and a 1.9 percentage point increase in the hourly wage in Chile (Sánchez, 2013), while it is smaller than a 6.6-percentage-point increase in the hourly wage that resulted from the 4-h reduction in the Korean standard workweek (Kim and Lee, 2012).

Table 4 shows the group-level estimation results. Although all the estimates at the group-level are statistically insignificant, they show that the new work hour restriction reduces total work hours, total employment, and total worker pay. Specifically, total work hours decrease,

**Table 4** Group-level estimation results

| | **A. All Workers** | | | |
|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** |
| | **Log total work hours** | **Log total employment** | **Log total worker pay** | **Log total worker pay** |
| Treatment effect | −0.143 | −0.083 | −0.135 | −0.137 |
| | (0.107) | (0.110) | (0.261) | (0.249) |
| Basic controls | X | X | X | X |
| Additional controls | | | | X |
| *R*-squared | 0.187 | 0.077 | 0.267 | 0.320 |
| | **B. Full-time Workers** | | | |
| | **(1)** | **(2)** | **(3)** | **(4)** |
| | **Log total work hours** | **Log total employment** | **Log total worker pay** | **Log total worker pay** |
| Treatment effect | −0.151 | −0.077 | −0.203 | −0.185 |
| | (0.111) | (0.116) | (0.267) | (0.279) |
| Basic controls | X | X | X | X |
| Additional controls | | | | X |
| *R*-squared | 0.411 | 0.370 | 0.248 | 0.292 |
| Number of groups | 119 | 119 | 115 | 115 |
| Observations | 5,236 | 5,236 | 575 | 575 |

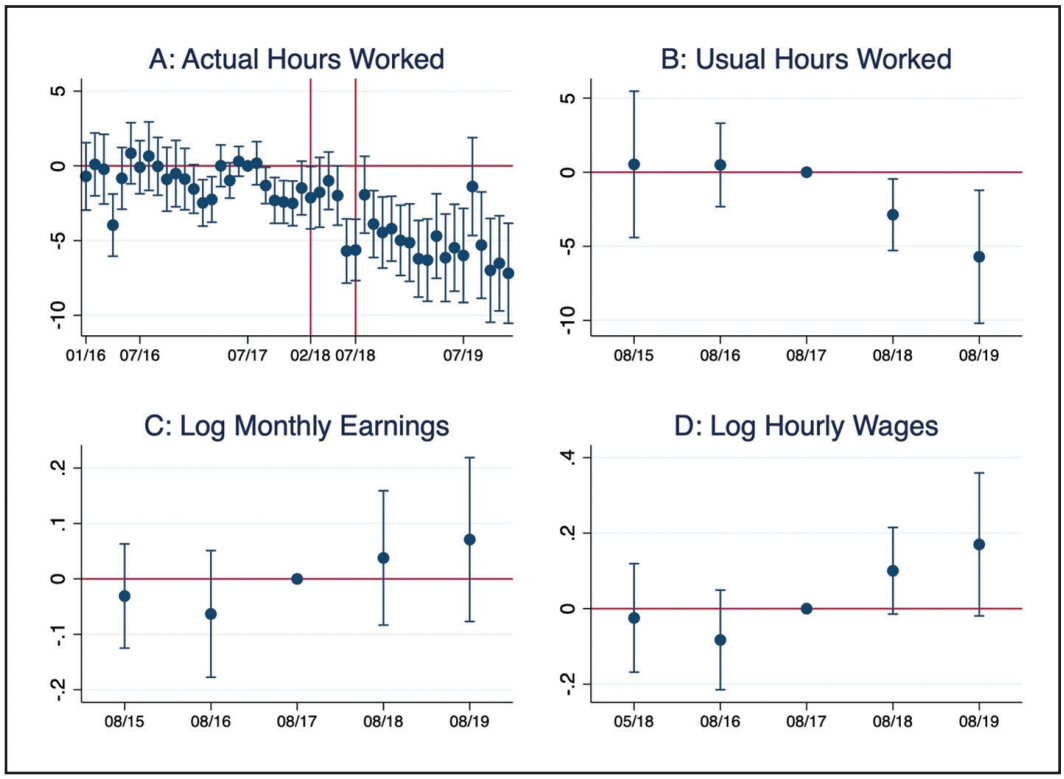
*Notes*: Standard errors in parentheses are clustered at the industry-occupation-education group level. Estimation for total work hours and total employment uses monthly data while estimation total worker pay uses annual data. Basic controls include the average age, the average age squared and dummy variables for marital status, fixed-term contract, status in employment, and establishment size. Additional controls include dummy variables for all the additional job characteristics described in Table 1.

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

which is the predicted response to the increase in hourly wage cost generated by the labor supply restriction. Total employment also declines, which implies that the downward force from higher wage costs has a larger effect on total employment than the upward force from the work hour restriction. Finally, total worker pay decreases, which indicates that the increase in the hourly wage is offset by the reduction in quantity of hours hired. These negative coefficient estimates are, however, statistically insignificant.

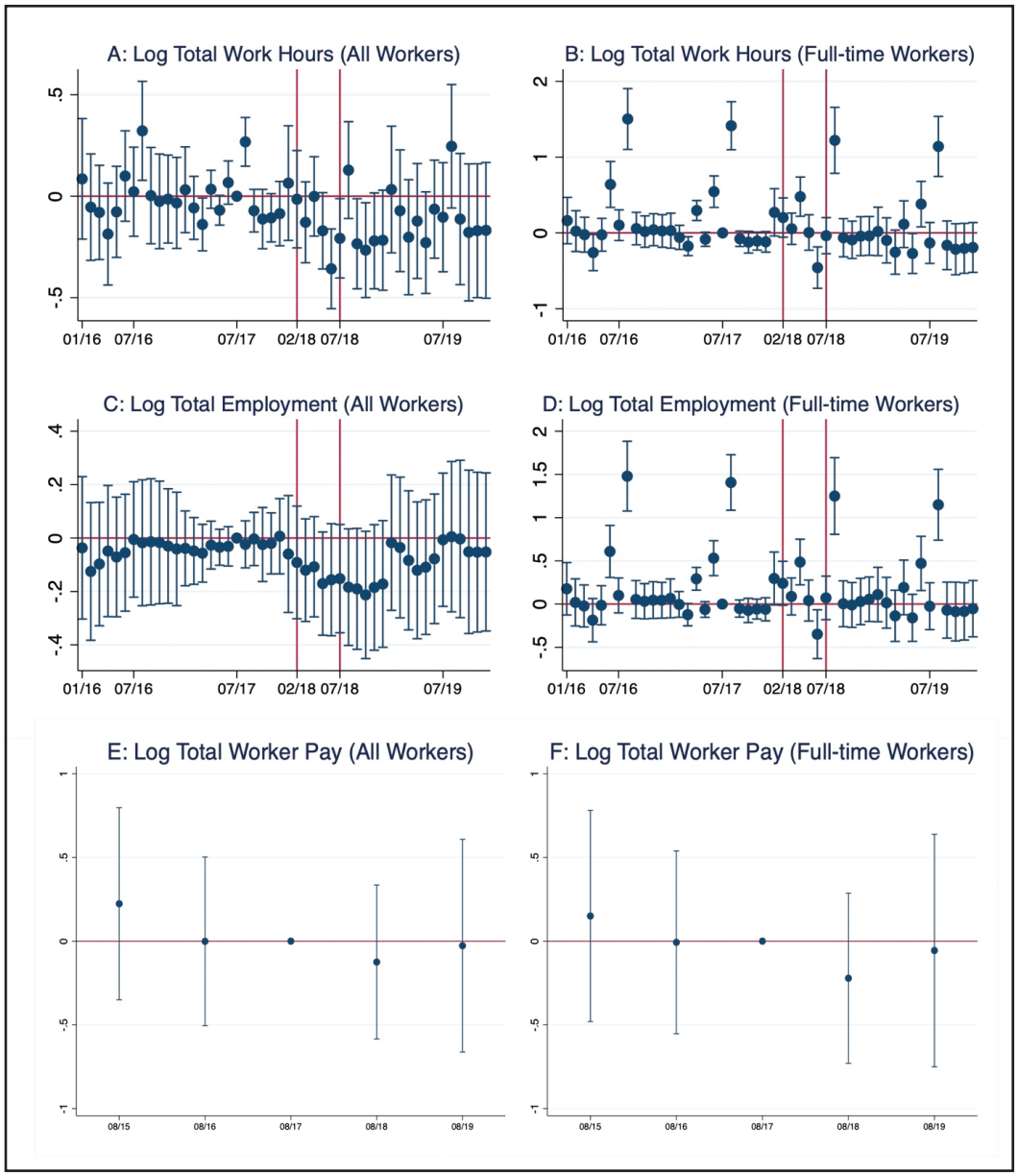
Figures 3 and 4 present the individual-level and group-level event-study estimation results, respectively. First, they show the lack of different pre-trends across industry-occupation-education groups with different policy intensities. I also formally test for pre-trends by re-estimating Eqs (1)–(3) with the data restricted to January 2016 to February 2017 for the monthly data (August 2015 to August 2017 for the annual data) and a new definition of $Post_{mt}$ that takes the value of 0 from January 2016 to February 2017 (from August 2015 to August 2016), and 1 from July 2017 to February 2018 (August 2017). The results on the pre-trend tests, as can be seen in Tables 5 and 6, support the parallel pre-trend assumption.

**Figure 3** Individual-level event-study estimates.




*Notes*: The new work hour restriction was passed on February 28, 2018 and was first implemented on July 1, 2018. (A) Male workers between the ages of 25 and 55, who worked more than 34 h in the reference week, in all industries and establishment sizes subject to the new restriction. (B) Male workers between the ages of 25 and 55, who usually worked more than 34 h/week in all industries and establishment sizes subject to the new restriction. (C) Male workers between the ages of 25 and 55, who usually worked more than 34 h/week as salaried or hourly employees in all industries and establishment sizes subject to the new restriction. (D) Male workers between the ages of 25 and 55, who usually worked more than 34 h/week as salaried or hourly employees in all industries and establishment sizes subject to the new restriction.

**Figure 4** Group-level event-study estimates.




*Notes*: The new work hour restriction was passed on February 28, 2018 and was first implemented on July 1, 2018. (A) Total work hours are the sum of actual hours worked of all male workers between the ages of 25 and 55 who worked at least an hour in the reference week in all industries and establishment sizes subject to the new restriction. (B) Total work hours are the sum of actual hours worked of all male workers between the ages of 25 and 55 who worked more than 34 h in the reference week in all industries and establishment sizes subject to the new restriction. (C) Total employment is the number of all male workers between the ages of 25 and 55 who worked at least an hour in the reference week in all industries and establishment sizes subject to the new restriction. (D) Total employment is the number of all male workers between the ages of 25 and 55 who worked more than 34 h in the reference week in all industries and establishment sizes subject to the new restriction. (E) Total worker pay is the sum of monthly earnings of all male workers between the ages of 25 and 55 who usually worked at least an hour per week in all industries and establishment sizes subject to the new restriction. (F) Total worker pay is the sum of monthly earnings of all male workers between the ages of 25 and 55 who usually worked more than 34 h/week in all industries and establishment sizes subject to the new restriction.

**Table 5** Pre-trend tests for individual-level outcomes

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | **Actual hours** | **Usual hours** | **Log monthly earnings** | **Log hourly wages** | **Usual hours** | **Log monthly earnings** | **Log hourly wages** |
| Treatment effect | −1.092 | −0.588 | 0.038 | 0.044 | −0.513 | 0.038 | 0.045 |
| | (0.985) | (1.742) | (0.484) | (0.061) | (1.726) | (0.470) | (0.596) |
| Basic controls | X | X | X | X | X | X | X |
| Additional controls | | | | | X | X | X |
| Observations | 146,583 | 20,699 | 20,699 | 20,699 | 20,699 | 20,699 | 20,699 |
| *R*-squared | 0.105 | 0.159 | 0.506 | 0.512 | 0.174 | 0.542 | 0.557 |

*Notes*: Standard errors in parentheses are clustered at the industry-occupation-education group level. Estimation for actual hours uses monthly data while estimation for the other outcome variables uses annual data. Pre-trend tests re-estimate Eqs (1) and (2) with the monthly data restricted to January 2016 to February 2017 and the annual data restricted to August 2015 to August 2017. $Post_{mt}$ is defined as 0 from January 2016 to February 2017 (from August 2015 to August 2016), and 1 from July 2017 to February 2018 (August 2017). Basic controls include age, age squared and dummy variables for marital status, fixed-term contract, status in employment, and establishment size. Additional controls include dummy variables for all the additional job characteristics described in Table 1.

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

**Table 6** Pre-trend tests for group-level outcomes

| | **A. All workers** | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | **Log total work hours** | **Log total employment** | **Log total worker pay** | **Log total worker pay** |
| Treatment effect | 0.006 | 0.054 | −0.026 | 0.064 |
| | (0.100) | (0.099) | 0.275 | (0.231) |
| Basic controls | X | X | X | X |
| Additional controls | | | | X |
| *R*-squared | 0.183 | 0.081 | 0.306 | 0.448 |
| | **B. Full-time workers** | | | |
| | (1) | (2) | (3) | (4) |
| | **Log total work hours** | **Log total employment** | **Log total worker pay** | **Log total worker pay** |
| Treatment effect | 0.032 | 0.060 | 0.001 | 0.074 |
| | (0.099) | (0.095) | (0.289) | (0.250) |
| Basic controls | X | X | X | X |
| Additional controls | | | | X |
| *R*-squared | 0.458 | 0.425 | 0.280 | 0.438 |
| Number of groups | 119 | 119 | 115 | 115 |
| Observations | 2,618 | 2,618 | 345 | 575 |

*Notes*: Standard errors in parentheses are clustered at the industry-occupation-education group level. Estimation for total work hours and total employment uses monthly data while estimation total worker pay uses annual data. Pre-trend tests re-estimate the Eq. (3) with the monthly data restricted to January 2016 to February 2017 and the annual data restricted to August 2015 to August 2017. $Post_{mt}$ is defined as 0 from January 2016 to February 2017 (August 2015 to August 2016), and 1 from July 2017 to February 2018 (August 2017). Basic controls include the average age, the average age squared and dummy variables for marital status, fixed-term contract, status in employment, and establishment size. Additional controls include dummy variables for all the additional job characteristics described in Table 1.

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

Figure 3A shows that actual hours worked dropped significantly in June 2018, which could be a preemptive response. Figures 3B,D show that the policy has a stronger impact on usual hours worked and hourly wages over time. It is consistent with the fact that some industries were phased-in in 2019. On the other hand, Figure 4 shows that in general, the policy does not have a significant impact on the group-level outcome variables.

## 6 Conclusion

In 2018, South Korea adopted a reduction in legal maximum work hours, from 68 h/week to 52 h/week, which was an attempt to decrease the country's long work hours. Despite the fact that it was phased in by industry and establishment size, work hours fell in almost every establishment of any size in many industries after the first roll-out of the new work hour restriction. Therefore, I instead used variation in how prevalent long work hours were across industry-occupation-education groups before the passage of the new work hour restriction to estimate its impacts on labor market outcomes. I find that the new work hour restriction reduces work hours and raises monthly earnings and hourly wages for male full-time workers. I also find that the policy does not significantly affect total work hours, total employment, and total worker pay at the industry-occupation-education group level although point estimates are all negative.

Previous studies analyze impacts of a change in the standard workweek in South Korea as well as other countries, such as Germany, France, Portugal, Chile, and Japan. A decrease in the legal maximum workweek reduces work hours by making overtime work exceeding 52 h/week illegal while a decrease in standard workweek reduces work hours by imposing higher costs on overtime work. Despite the difference between the two regulations, in general, my results are consistent with the literature in that reduction in the workweek duration reduces work hours and increases hourly wages, and that it does not have a significant impact on employment.

Within the context of South Korea, my results are consistent with Kim and Lee (2012), which found that a reduction in the standard workweek, from 44 h/week to 40 h/week, which was rolled out in South Korea from 2004 to 2009, decreased work hours by 43 min/week and increased hourly wages by 6.6 percentage points. However, I do not find a significant impact on total employment while Kim and Lee (2012) report a 2.28 percentage point decrease in new employment. However, it should be noted that Kim and Lee (2012) estimated the long-term effects whereas I estimate the short-term effects while subsidies and grace periods were still in effect.

**Declarations**

**Availability of data and material**

The datasets used in this paper are available from the Microdata Integrated Service of Statistics Korea (mdis.kostat.go.kr).

**Competing interests**

The author declares that she has no competing interests.

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