Effects of Restricting Overtime Hours on the Gender Pay Gap*

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Abstract:

This paper estimates the causal impact of restricting overtime hours on the gender pay gap and investigates whether this effect varies by occupational returns to long working hours. South Korea has enforced a maximum of 52 work hours per week since July 2018. Using policy enforcement as a natural experiment, it provides causal evidence regarding the relationship between long work hours and the gender wage gap. The empirical strategy employs the triple difference estimator, exploiting the variation in policy application time by establishment size and industry. The findings reveal that imposing limits on maximum work hours narrows the gender gaps in overtime hours and hourly wages. The gender pay gap converges more markedly in occupations with higher returns to long hours among highly educated workers.

JEL classification: J16, J22, J24, J3, J38

Keywords: gender wage gap, gender work-hour gap, overtime, work hour regulation

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I. Introduction

Women's shorter working hours relative to those of men account for the gender wage gap because workers can accumulate a higher level of human capital through long working hours (on-the-job learning) (Cook et al., 2021). However, even in the absence of a human capital disparity, the working hours gap can drive the gender wage gap due to the nonlinear wage structure that pays a wage premium for long working hours (Cha and Weeden 2014; Cortés and Pan 2019; Goldin 2014). If it is true that men working longer hours than women lead to a gender wage gap, does the pay gap close when no one can work long hours? This paper examines whether limiting overtime hours narrows the gender wage gap by exploiting the implementation of the compulsory 52-hour workweek in South Korea (hereafter Korea) as a natural experiment.

Cook et al. (2021) study the gender earnings gap among Uber ride-sharing drivers in Chicago, United States. Despite ride-sharing services being known for flexible work schedule and their absence of gender discrimination, a 7 percent hourly wage gap is estimated between men and women. The authors explain that men's longer work hours lead them to have the knowledge to find the best timeslots and locations to earn a profit. If the work hours gap generates only such human capital differences between male and female workers, restricting long work hours will not affect the gender wage gap, at least in the short term. If banning long work hours immediately reduces the gender wage gap, then it could indicate causal evidence aligning with Goldin's (2014) notion of a nonlinear wage structure. This paper investigates whether restricting overtime hours reduces the gender wage gap and whether the gap narrows more greatly in occupations where longer working hours yield higher returns.

Korea has been renowned for its extensive work hours[1]. The Korean government has amended legislation aimed at reducing work hours to address concerns regarding public health and improve overall quality of life. The latest amendment in March 2018 specifically targeted curtailing overtime hours without changing statutory regular working hours, while previous revisions of the Labor Standards Act focused on shortening regular working hours[2]. Prior to the March 2018 amendment, the maximum working hours per week totaled 68—the sum of the 40 hours of statutory (regular) working hours, 12 hours of weekday extended work hours, and 16 hours for days off/weekends.

The 2018 amendment restricts the 12 hours of weekday extended work hours and 16 hours of a day off/weekend to a total of 12 hours without distinguishing them. Consequently, weekly work hours, encompassing weekends, cannot exceed 52 hours in total: 40 hours for regular work and 12 hours for overtime (establishing a 52-hour workweek). The restriction on overtime hours is an enforceable regulation, not merely a recommendation, whereby employers whose employees work beyond the legal limit can be sentenced to a maximum of two years of prison or a maximum fine of 20 million KRW (approximately 20,000 USD).

According to Landivar (2015), shorter maximum weekly work hours are associated with a smaller work-hour gap between couples. The 52-hour workweek policy directly reduces the work hours of individuals exceeding the 52-hour threshold; indirectly, employees who work fewer hours or who do not work overtime may need to increase their work hours in response to the policy

[1] Average annual hours worked in Korea in 2022 were 1,901, the fourth-highest figure among OECD countries, after Mexico, Costa Rica, and Chile.

[2] For example, through the Labor Standards Act amendment of March 1989, statutory working hours were reduced from 48 to 44 hours per week. They decreased again from 44 to 40 with the August 2003 amendment.

unless work substitutability is zero. The policy might have narrowed the gender gap in overtime hours by curbing the labor supply of overworked men[3], unless all those individuals who cover the tasks of workers working more than 52 hours per week are men.

Men who previously worked more than 52 hours would receive lower wage rates after the policy was implemented when a nonlinear wage structure was in place. This adjustment could contribute to narrowing the gender wage gap. Additionally, if some women turn out to work more by taking over some of the tasks previously handled by overworked men, then this could lead to a further decrease in the gender pay gap due to potential increases in their wage rates.

My empirical strategy leverages the variation in the timing of policy application by establishment size and industry. Initial enforcement began on July 1, 2018, followed by subsequent phases until July 1, 2021; in addition, certain industries were exempted. I apply the triple difference estimator by industry, establishment size, and policy enforcement date to a decade's worth of data from the "Survey on Labor Conditions by Employment Type" (2013–2022), administered by Korea's Ministry of Employment and Labor. The data provide a rich set of information on the personal and employment characteristics of more than 700,000 paid workers annually. I also conducted several robustness checks to validate the findings.

This paper finds that the 52-hour workweek policy reduces the gender difference in overtime hours and, more importantly, narrows the gender wage gap. This result is consistent with the findings of Bolotnyy and Emanuel (2022), who study the gender earnings gap among bus and train operators in the Massachusetts Bay Transportation Authority. They state that the gender

[3] More than 80 percent of those who work over 52 hours per week are male in the data.

earnings gap is observed even in workplaces with identical tasks, wage rates, and promotion schedules, attributing it to fewer overtime shifts worked by women than men.

Moreover, this study reveals that the gender wage gap has converged more markedly in occupations with higher returns to long work hours among high-education workers after the 52-hour workweek policy has taken effect. This outcome aligns with Cortés and Pan's (2019) finding of a causal relationship between the work-hour gap and the wage gap in the highly skilled labor market. The set of empirical results is robust against potential impacts from COVID-19, staggered treatment timing (heterogeneous treatment effects), a couple of assumptions made for empirical analysis, and changes in worker composition.

This study contributes to the literature on the gender wage and work hours gap by showing how pay responds to hours and how limiting work hours impacts the gender wage gap. Goldin (2014), Cha and Weeden (2014), and Denning et al. (2021) highlight that the wage premium for long working hours has been increasing over the past 40 years; the nonlinear wage structure and the gender gap in working hours account for the persistent gender wage gap. Cubas, Juhn, and Silos (2021) also revealed that women encounter more work interruptions than men during core business hours (8 am to 5 pm) due to household responsibilities, resulting in reduced work hours and subsequently lowered wages. However, examining the causal relationship between gender differences in working hours and wages is challenging due to endogeneity, and most studies in this domain have offered descriptive evidence rather than causal links.

Cortés and Pan (2019) initially provide causal evidence that the gender gap in work hours and high returns to long work hours widen the gender wage gap among highly skilled workers. Using the change in inflows of low-skilled immigrants across metropolitan areas over time, they

demonstrate that the gender pay gap decreases when women's work hours increase exogenously. They also show that the gender pay gap decreases more for occupations paying a higher premium for long working hours. Cortés and Pan (2019) use the exogenous change in women's labor supply as a driver for mitigating the gender disparity in working hours. In this research, I exploit a policy affecting both men and women engaged in long working hours to estimate the causal effect. Given that men are more likely to work long hours than women are, the policy has a greater influence on men's working hours, consequently reducing the gender gap in overtime hours worked.

Additionally, this research adds to the literature by including low-skilled workers in the analyses, whereas Cortés and Pan (2019) limit their study to the highly skilled labor market[4]. The low-skilled labor market exhibits differences in worker substitutability and the degree of non-linearity of the wage structure compared to the high-skilled labor market. This paper explores whether the male-centric culture of long working hours impacts the gender wage gap even in the low-skilled labor market and highlights the differing effects of overtime restrictions for low-skilled workers compared to high-skilled workers.

This paper adds value to the related literature because it is the first study on a country with working-hours characteristics distinct from those in the United States. Frase and Gornick (2013) indicate that working hours by education level are heterogeneous across countries. In higher-income countries, including the U.S., more educated workers tend to work longer hours, while middle-income countries exhibit the opposite pattern. In Korea, workers in low-skilled (low-wage) occupations tend to work longer hours than do those in highly skilled (high-wage) occupations, in

[4] They consider the mechanism of low-skilled labor supply increasing highly skilled women's work hours by reducing the price of market-provided housework services. Therefore, the applicability of their empirical model is constrained to highly skilled women who can afford such market-provided housework services.

contrast to the U.S. labor market. The findings in this paper provide pioneering evidence demonstrating that men's inclination to work long hours causes a gender wage gap even in a labor market characterized by low-skilled workers working longer hours. This finding adds new information to prior research that has focused primarily on labor markets where highly skilled workers are inclined to work longer hours.

Finally, there is a limited body of research examining the impacts of work-hour regulation. Landivar (2015) shows a correlation between national working time limits and discrepancies in couples' work hours; Dinh, Strazdins, and Welsh (2017) investigate the effect of work-hour regulation on the health of men and women. Regarding Korea's overtime restriction policy, Kim (2021) scrutinizes the effect of the 52-hour workweek policy on employment using month-level data. He finds a short-term negative impact on employment only for daily and temporary workers, with no effect observed among regular full-time workers. This paper extends the literature on work-hour regulations by estimating their causal effects on workers' wage rates and the gender pay gap.

The paper proceeds as follows. The next section describes the features of occupations characterized by long working hours in Korea. Section 3 describes the data and variables, and Section 4 introduces the overtime restriction policy and explains the empirical strategy, which relies on the triple difference estimator. This section is followed by the findings on the effects of limiting overtime hours worked on the gender pay gap. Section 6 presents the robustness analyses. Finally, I conclude the paper in Section 7 with potential avenues for future research.

II. Background: Characteristics of Occupations with Long Working Hours

Before beginning the main analyses, I present several characteristics of occupations with long working hours in Korea to provide a comparison with the United States—an area extensively explored in major previous research. Figure 1 illustrates the relationships between occupational work hours and job characteristics. First, I compute the average male work hours per week by occupation in the years preceding the implementation of the overtime restriction (2013−2018). The x-axis of all the graphs denotes men's average weekly working hours by year and occupation[5].

Panels A and B show that the longer the working hours, the greater the residual gender gaps in earnings and probabilities of overworking. To estimate the gender earnings gap, I regress the log value of monthly earnings on the interactions of gender and occupation with monthly work hours, personal and employment characteristics, and occupation fixed effects. The regressions are conducted separately for each year. Similarly, the gender gaps in the probability of working more than 52 hours are estimated using the same specification but without total work hours. The negative values of the gender gap indicate that women receive comparatively lower incomes and are less likely to work more than 52 hours.

Panel C illustrates the relationships between average occupational working hours and the returns to long working hours. To estimate the returns to long work hours, I regress the log of monthly earnings on the interaction between occupation dummies and the log of monthly work hours with occupation fixed effects and individual characteristics for each year. Occupations with longer work hours are likely to exhibit greater returns to long work hours.

[5] I employed the regression sample used in the main analysis of this study to illustrate the occupational characteristics. For a detailed understanding, please refer to the data section for comprehensive information.

Finally, the relationship between occupational work hours and the share of highly educated workers is depicted in Panel D. Occupations with longer working hours are characterized by a lower percentage of highly educated individuals. This pattern is different from that in the U.S. labor market, where high-wage and highly skilled workers are likely to work longer hours. Nevertheless, Panels A through C are consistent with previous research findings: the gender pay gap tends to widen in occupations with a large gender gap in working hours and high returns to long working hours.

Also, in line with Goldin (2014), I estimate the gender gaps in work hours and earnings by adding control variables to investigate the role of within-occupation differences (e.g., occupational returns to long work hours) in the gender gap. The results, as depicted in Table 1, using the sample before 2019, mirror similar patterns to those reported in Goldin (2014)[6]. The dependent variables are the log of total work hours and monthly earnings. In the baseline estimation, women work 3.3 percent fewer hours than men do, and the gap decreases to 3.0 percent when I add a set of occupation indicators.

Regarding earnings, the baseline estimates present a 26.0 percent earnings gap between men and women. This gap decreases to 22.2 percent when I include education and total work hours. However, it decreases the most, to 19.4 percent, when I add occupation indicators. These estimates closely align with Goldin's (2014) findings for the U.S. labor market, indicating that the gender

[6] Goldin (2014) uses American Community Survey (ACS) waves 2009−2011, and the dependent variable is the log of annual earnings. Her baseline specification includes demographic characteristics, and she estimates the gender earnings gap by adding work hours, education, and occupations dummies sequentially. In her results, the coefficient on the female dummy in the baseline specification is -0.248. The gap narrows most markedly to -0.192 when she adds occupation dummies.

earnings gap in Korea might also be related to nonlinear returns to work hours within occupations despite differing relationships between skill level and long work hours in the two labor markets.

II. Data and Variables

The data are from the "Survey on Labor Conditions by Employment Type" from 2013 through 2022, comprising a large set of repeated cross-sectional data[7]. The survey is conducted annually in June by Korea's Ministry of Employment and Labor. It contains information on personal and labor conditions such as gender, age, education, employment type, wage, work hours, and social insurance. The survey covers approximately 32,000 establishments with five or more employees[8]. The response is based on the wage ledger that establishments hold (in which income-related information for employees is recorded) as opposed to individual employees' answers to the survey. As mandated by legislation, firms are obliged to respond to the survey when they are selected as survey subjects. If respondents refuse to answer or major errors are discovered, an investigator visits the workplace for re-examination. Due to these survey characteristics, the survey has relatively minimal noise on work hours and income. The data have the advantage of providing 2-digit codes for industries and 2-digit or 3-digit codes for occupations.

The data survey work hours and wages in June of the survey year. I drop employees who joined the workplace in the survey month because they had fewer working days than others. Alternate-day or part-time workers and those whose regular working hours were fewer than 60[9]

[7] The data are not publicly available but can be obtained from the Korea's Ministry of Employment and Labor on request.
[8] The 52-hour workweek policy only applies to establishments with five or more employees.
[9] Employees who work less than 15 hours per week are classified as short-hour part-time workers in Korea.

during the survey month were also excluded from the regression sample. The number of remaining observations is 6,928,329.

Table 2 shows the descriptive statistics for the regression sample of the selected years. The years 2013 and 2022 are the first and last in the sample; 2019 is the first sample year in which the overtime restriction applied. Thirty-seven percent of paid workers were supposed to be barred from working more than 52 hours per week in 2019. Subsequently, the number of workers in the treatment group increases to 88 percent in 2022. The proportion of female workers has risen from 34 to 38 percent. Workers' average age and education level also increased over time. The average ages were 39.29, 39.97, 40.64, and 41.27 years for the specified years. Forty percent of workers had a 4-year college degree in 2013, whereas more than half of workers were college graduates in 2022.

The average tenure of employees is growing longer, implying that dropout or turnover rates are declining during the period. The average tenure at the current workplace has increased to 90.78 months by 2022, marking a year's rise since 2013. Shift workers make up slightly more than 10 percent of the sample. Approximately 40 percent of the workforce works in establishments with fewer than 30 employees, and a similar percentage operates in workplaces with 30 to 299 employees. Approximately 20 percent belong to establishments with 300 or more employees.

Regarding policy exemptions, five industries are designated exemptions and are not subject to the restriction policy; these five industries account for 10−12 percent of the sample workers. Workers working in industries designated exempt at first but whose exemptions were canceled later, denoted as "excluding exemptions" in the table, represent approximately 30 percent of the sample.

Weekly work hours indicate the average working hours for five regular working days. I divide the monthly work hours by the fixed working days to calculate the average work hours on a regular working day[10]. The data cover the total hours worked in June, but comparing the monthly working hours across years is not ideal because of variations in the number of holidays in June across different years. For example, in 2018, Memorial Day and local elections coincided on a Wednesday, while in 2020, Memorial Day fell on a Saturday with no local elections, leading to a disparity in the number of working weekdays between these two years.

The average work hours per week decrease over time, from 44.38 hours in 2013 to 42.67 hours in 2022. Thirty-seven percent of workers worked beyond regular working hours, including on holidays. The proportion of workers working overtime remains unchanged even after the overtime restriction policy. However, their average overtime hours in the survey month are reduced significantly from 42.28 in 2013 to 28.42 in 2022.

"Monthly income" consists of regular pay and overtime pay. Despite a reduction in overtime hours, the average income increases from 2,955,000 KRW in 2013 to 3,570,000 KRW[11] in 2022. I calculate the hourly wage by dividing total monthly income by total work hours. Hourly wage rates also increase from 17,000 KRW to 21,000 KRW during the period. The income variables are valued in 2020 KRW.

[10] The data provide the number of fixed working days (regular working days) for each employee.
[11] Approximately 2,955 USD and 3,570 USD.

IV. Empirical Method

1. The policy restricting overtime work hours (52-hour workweek policy)

The policy limiting overtime work hours was implemented at different times based on establishment size and industry. The application dates of the policy restricting overtime work are organized in Table 3. The policy took effect on July 1, 2018, for workplaces with more than 300 employees; on January 1, 2020, for workplaces with more than 50 employees; and on July 1, 2021, for workplaces with more than five employees.

Five industries have been designated exemptions and are not subject to the restriction policy. These industries include ground transport (excluding passenger vehicle transport), marine transport, air transport, other transport-related services, and healthcare. Twenty-one industries were initially designated exemptions but later had their exemptions canceled. Workplaces with more than 300 employees in these industries were subject to policy application beginning on July 1, 2019, a year after July 1, 2018.

The workplace size categories provided in the data are divided into six groups: 5–9 people, 10–29 people, 30–99 people, 100–299 people, 300–499 people, and more than 500 people. Due to data limitations, I address the workplaces of 30–299 people according to the application standards for workplaces with 50–299 employees.

Since the survey is conducted every June, nonexempt large firms are included in the treatment group from the 2019 sample, medium firms are included from the 2020 sample, and small firms are included only in the 2022 sample. One concern is that a considerable number of medium-sized establishments in nonexempt industries have preemptively responded to the policy restricting overtime work hours (Kim, 2021). Consistent with Kim's findings (2021), the data used

in this paper indicate a decline in the average work hours of medium-sized establishments in nonexempt industries starting from the June 2019 sample ahead of their designated treatment date in January 2020, akin to the trend observed in nonexempt large-sized establishments. Acknowledging the proactive response of a significant number of nonexempt medium-size firms to policy changes, I incorporate them into the treatment group from the 2019 sample.

In the empirical analysis, there are two relevant issues regarding medium-sized firms. First, small firms (30−49 employees) were unavoidably categorized as medium-sized firms when classifying medium-sized firms. Second, for nonexempt medium-sized firms, the treatment time was considered earlier than the statutory date of policy application. To examine whether the results are robust against these treatments, I additionally conduct the same analysis, excluding the medium-sized establishments, and confirm that the estimation results remain consistent (see Section 6).

To assess whether employees at establishments subject to the 52-hour workweek policy reduced their overtime hours even before the policy was implemented, I use an event-study type regression. The regression incorporates a set of event-time dummies with fixed effects for survey year and establishment size by industry. The dependent variable is the likelihood of working more than 52 hours a week, weekly work hours, and overtime hours worked (both inclusive and exclusive of 0 overtime work hours). It estimates the changes in work hours compared to those in the year before policy implementation.

Figure 2 presents the results. Panels A to D illustrate the changes in the probability of working more than 52 hours per week, weekly work hours, overtime hours, and overtime hours only for workers working overtime. Zero on the x-axis represents the initial enforcement of the

overtime restriction policy, varying by industry exemption status and establishment size. Generally, working hours before policy implementation do not differ from working hours the year before policy implementation. Following the application of the 52-hour workweek policy, there was a significant decrease in the probability of working over 52 hours per week, weekly work hours, and overtime hours. I observed analogous patterns for both men and women when conducting the same regression by gender separately (see Appendix Figure A1).

Similarly, I examine whether the gender gaps in wages[12] and overtime hours among employees in treatment firms begin to narrow even before policy enforcement. I include interactions between female and event-time dummies, excluding the base year (event time = –1). The specification additionally includes a set of event-time dummies, a female indicator, and fixed effects for year and establishment size by industry. The coefficient estimates for interaction terms indicate changes in the gender gap in the dependent variable compared to that in the year before policy implementation. The results represent the absence of pre-treatment trends in the gender gaps in wage rates and overtime hours (see Appendix Figure A2).

2. Specification

Whether the overtime restriction is implemented depends on the workplace size, industry, and year. The baseline model thus relies on the triple difference estimator.

[12] The result for monthly earnings is qualitatively the same as for wage rates.

$$y_{ijst} = \beta_0\left(female_i \times 52h_{jst}\right) + \beta_1 52h_{jst} + \beta_2 female_i + \beta_3 X_{ijst} + \mu_{jt} + \mu_{st} + \mu_{js} + \mu_j + \mu_s + \mu_t + e_{ijst} \quad (1)$$

Subscripts i, j, s, and t denote an individual, 2-digit level industry, establishment size, and survey year, respectively. The dependent variable is salary income. The income variables are monthly salary and hourly wage, both of which are represented in log values. In addition, I consider average work hours per week and overtime hours to examine whether the overtime restriction policy affects the gender gap in work hours, especially the gap in overtime hours[13].

The variable of interest is the interaction between the female and 52-hour cap indicators. The coefficient for the 52-hour workweek policy β_1 represents the effect of the overtime restriction policy on labor market outcomes for male workers. The coefficient for the interaction β_0 is the difference in the policy effect for women relative to the effect for men. A positive value of β_0 indicates that the 52-hour workweek policy reduces the gender gap in the dependent variable. For instance, while Figure 1 illustrates a decline in overtime hours after the implementation of the 52-hour workweek policy, equation (1) identifies the impact of the policy on the gender gap in overtime hours.

Fixed effects for workplace size (5−9, 10−29, 30−99, 100−299, 300−499, 500 or more), survey year, 2-digit industry and interactions of pairs of variables among the three are included. The other controls, X_{ijst}, are age and its square term, education indicators (high school, some

[13] This is because the policy is targeting overtime work hours without impacting regular work hours and the analysis focuses on the full-time employees.

college, 4-year college, or more than college), tenure in the current job, and an indicator of shift work.

I modify the specification to estimate whether the effects are greater in occupations with high returns to long work hours. To this end, I first estimate the occupational returns to long work hours (elasticity of income with respect to work hours) for 95 occupations in the sample. Following previous literature (Cortés and Pan 2019; Goldin 2014), I regress the log of monthly earnings on the interaction between occupation dummies and the log of monthly work hours with occupation and year fixed effects and individual characteristics. The regression includes only male workers, and I use the returns in years before the 52-hour workweek policy began (2013−2018)[14]. The specification to estimate the policy effects by returns to long working hours is as follows:

$$y_{iogt} = \beta_0\left(female_i \times Return_o \times 52h_{gt}\right) + \beta_1\left(Return_{o2016} \times 52h_{gt}\right) + \beta_2(female_i \times Return_o) + \beta_3\left(female_i \times 52h_{gt}\right) + \beta_4 female_i + \beta_3 X_{iogt} + \mu_{ot} + \mu_{gt} + \mu_{og} + \mu_o + \mu_g + \mu_t + e_{iogt} \quad (2)$$

Subscript o denotes a 2- or 3-digit-level occupation. I introduce a new grouping, denoted as g, which is a group of three industry groups by exemption[15] interacting with six workplace size indicators, for a total of 18 categories. I reduce the dimension of industry to alleviate computational burdens. Note that the newly defined group contains all the necessary information. $Return_o$

[14] The results are robust even when using returns estimated from different sample years, such as the first three years of the sample.

[15] Recall that the three industry groups are exempt industries (5 industries), industries with excluded exemptions (21 industries), and nonexempt industries, for which the policy application timing varies.

denotes the returns to long working hours in occupation o during 2013-2018. Finally, $52h_{gt}$ cannot be separately included in the specification because it is absorbed by the newly defined group g and year interaction fixed effects, μ_{gt}.

The coefficient of the triple interaction term estimates whether the effect of the overtime restriction reduces the gender pay gap more markedly in occupations with large wage premiums to long working hours. β_1 indicates the effect of the overtime restriction, potentially varying according to the wage returns to long working hours. In cases where the effect of the overtime restriction remains constant, regardless of the income elasticity with respect to work hours, the β_1 estimates will be insignificant.

Unfortunately, part of the sample period overlaps with the COVID-19 pandemic. Given that the initial confirmed case in Korea emerged on January 20, 2020, it is possible that the effects of the overtime restriction policy were entangled with the impact of COVID-19. I provide evidence that the pandemic's impact has not driven this paper's main results. Further discussions on the ramifications of COVID-19 are elaborated upon in the robustness checks in Section 6.

V. Findings

1. Effects of the overtime restriction on work hours

Table 4 shows the impact of the 52-hour workweek policy on the gender gap in work hours. The coefficient estimates for female indicate that women work 1.20 fewer hours per week than men. Among employees working overtime, women's monthly overtime hours are 7.66 hours less than men’s.

Overtime restriction reduces weekly work hours by 0.27. The policy narrows the gender gap in weekly work hours by 0.07, but the change is not statistically significant. This lack of significance might be attributed to the great proportion of regular work hours (40 hours per week) in total working hours remaining unaffected by the policy. Meanwhile, the overtime restriction reduces the gender gap in overtime hours among employees working overtime by 1.70 hours a month. Notably, I do not find evidence indicating that the overtime restriction changes the probability of working overtime for either men or women when I run the regression using an overtime indicator as the dependent variable.

According to the estimated results, women's hours spent working longer would increase after the policy was implemented. The 52-hour workweek policy obliges firms to curtail the work hours of employees who previously worked more than 52 hours per week. If work substitutability is not zero, employers may need to substitute the labor performed by workers working over the 52-hour threshold either by hiring new employees or by extending the work hours of existing workers. Kim (2021) finds that the overtime restriction did not have a short-term effect on full-time employment. The empirical results in this paper and the findings of Kim (2021) imply that existing workers whose extended work hours are less than 12 hours a week are likely to work longer hours; women, who typically work shorter hours than men, may experience increased overtime hours. Among male workers working more than regular work hours, those working over 52 hours should have reduced their overtime hours, and some who work less than 52 hours would have increased their overtime hours.

2. Effects of the overtime restriction on the gender pay gap

Most importantly, Table 5 shows the policy effects on the gender earnings gap. Restricting overtime affects employees' wages in two ways. First, men who previously worked more than 52 hours receive lower wage rates when a nonlinear wage structure exists, reducing the gender wage gap. If some women turn out to work more by taking over some of the work of overworked men, then the gender gap may decrease further as their wage rates increase.

Meanwhile, overtime restrictions may reduce overall wage rates. The policy could have an adverse effect on firms' profits unless there is perfect substitutability among workers because firms bear transaction costs in the process of reallocating tasks previously carried out by workers working long hours. Firms with a low degree of substitutability among workers may reduce their total output due to high transaction costs in the short run when capital–labor substitution is difficult. The adverse impact of decreased total output may result in lower wage rates for both male and female workers.

The empirical results show that overtime restriction leads to a decrease in men's wages, with a relatively smaller decline observed in women's wage rates. According to Table 5, the overtime restriction reduces men's total earnings and wages by 2.6 and 2.5 percent, respectively. In contrast, the effects on women's earnings and wages are positive, contributing to a narrowing of the gender gap in salaries and hourly wages.

The impact of the policy could differ depending on the presence of children, but unfortunately, the data lack information on marital status and children. I thus restrict the sample to individuals aged 30−39, as their labor supply is most likely to be influenced by responsibilities toward young children, and I conduct the same regressions. Women with children might encounter

challenges in augmenting their work hours owing to family responsibilities. Conversely, they might feel compelled to work more to replace overworked men if they initially worked fewer hours than other workers.

The regression results (Appendix Table A1) reveal that overtime restriction reduces the gender gap in earnings and hourly wage rates among workers in their 30s. The overtime restriction policy reduces the monthly earnings and hourly wages for men in their 30s, but these effects are not statistically significant. The effects on women's earnings relative to men's, however, are similar to the estimates from the entire sample, implying a more pronounced narrowing of the gender wage gap among workers in their 30s compared to other age groups. Even when the sample is restricted to workers most likely affected by the presence of children, the positive effects of limiting overtime hours on the gender wage gap persist.

Finally, I investigate the effects of overtime restrictions on the gender wage gap by education. Table 6 shows that overtime restriction reduces the wages of highly educated workers by a greater amount than that of less-educated workers. Monthly earnings (hourly wages) decline by 3.2 (4.3) percent for highly educated men, while they decrease by 1.9 (0.7) percent for men without a 4-year college degree. However, the policy consistently diminishes the gender wage gap across education levels. Among highly educated (low-education) workers, the policy results in women's hourly wages being 3.8 (2.7) percentage points less affected than men's wages.

3. Effects on the gender pay gap in occupations with high returns to long work hours

Table 7 reports the results obtained from estimating Equation (2). The first two columns display the entire sample results, and the last columns depict the results by education. The variable "R"

denotes the returns to work hours before the policy implementation (2013–2018) at the occupation level.

The coefficient estimates for the interaction between female and treatment dummies are consistent with the previous results: overtime restriction reduces the gender pay gap (row c). The overtime restriction decreases the earnings and wages of male workers, especially in occupations offering higher returns to long work hours (row b). This impact is more notable among highly educated workers than among less educated workers.

When working long hours is prohibited, monthly earnings for low-skilled workers decline more in occupations with higher returns to long work hours due to reduced work hours, but their hourly wages do not change significantly (row b). Meanwhile, both earnings and wage rates for high-skilled workers are further reduced in occupations with more convex wage structures. As Goldin (2014) noted, workers can be more easily substituted in the low-skilled labor market than in the high-skilled labor market, resulting in a wage structure close to linear in the low-skilled labor market. In the high-skilled labor market, where substituting long hours with the work of multiple individuals is challenging, hourly wages are notably influenced by the overtime restriction policy.

In the entire and low-education samples, the narrowing of the gender pay gap after the overtime restriction does not differ for occupations with higher returns to long working hours. However, the coefficient estimates for the triple interaction are positive for highly educated workers, indicating that the gender pay gap shrinks more as the returns to long work hours increase. These results corroborate Goldin (2014) and Cortés and Pan (2019), who report that the premium for long working hours sustains the gender pay gap among high-skilled workers.

VI. Robustness Checks

1. Impact of COVID-19

The first confirmed case of COVID-19 in Korea was on January 20, 2020. The surveys conducted after June 2020 must have reflected the combined influence of COVID-19 and the overtime restriction. Previous studies on the impact of COVID-19 on labor market outcomes have mostly reached the conclusion that the pandemic has been more detrimental to women than to men because of increased childcare responsibilities during school closures and the greater representation of women in face-to-face service occupations. If COVID-19 had different influences depending on firm size and industry, this could affect the estimation of treatment effects.

Additionally, specific firms might have ceased operations during the pandemic. For example, if businesses employing women for fewer hours and offering lower wages were disproportionately affected by closures amidst COVID-19, this could drive the selection of firms during the pandemic periods. For these reasons, it is necessary to examine whether the impact of COVID-19 drives the estimated results on the effects of overtime restrictions.

I estimate the effects of the 52-hour workweek policy on the gender pay gap in labor market outcomes, excluding some years after COVID-19. In 2020, the first COVID-19 outbreak led to the implementation of stringent public health measures. Kindergarten closures and online classes in primary and secondary schools were concentrated, and male and female employment rates declined notably in 2020. Although these measures were considerably relaxed in 2021, marked by the resumption of face-to-face classes and a recovery in employment rates, social

distancing measures persisted in Korea throughout 2021. Social distancing measures were lifted completely in early 2022 in Korea.

I first estimate the policy effects excluding the years 2020 and 2021, when Korea's social distancing measures were in effect. Subsequently, I limited the sample to only the years prior to 2019. The overtime restriction policy took effect solely for large firms in nonexempt industries in 2019, but I can completely exclude the impact of COVID-19 from the analysis by restricting the sample to years up to 2019.

The results are presented in Table 8. The policy effects estimated from the restricted samples are qualitatively consistent with the main results. The overtime restriction policy reduces the gender wage gap and reduces men's wages.

2. Staggered treatment timing

Recent econometric studies have brought attention to a potential concern regarding the reliability of difference-in-differences estimators in cases of staggered adoption of regulations. This occurs due to the influence of earlier-treated firms, which can impact the treatment effect for subsequently treated firms (e.g., Callaway and Sant'Anna 2021; Goodman-Bacon 2021; Sun and Abraham 2021). The staggered difference-in-differences estimator is unbiased when treatment effects are homogeneous over time and across firms (Baker, Larcker, and Wang, 2022; Sun and Abraham 2021).

The sample used in this paper is divided into firms subject to the overtime restriction policy from the 2019, 2020, and 2022 surveys. Biases derived from the dynamic treatment effect may be negligible because only two consecutive treatment time points exist when excluding small

firms. However, given the potential variations in the impact of restricting overtime hours depending on firm size and industry, an examination is conducted to assess whether biases resulting from multiple treatment periods influence the main results of this paper.

First, I excluded sample 2022 from the regression sample for simplicity. By doing so, small-sized firms subject to the policy only in 2022 serve as a control group alongside firms in exempt industries. Note that even in the original sample, the nonexempt small-sized firms acted as a control group for large and medium-sized firms until 2021; their influence on the treatment effect in the entire sample was not substantial enough to change the average treatment effect. The first two columns of Table 9 present the treatment effects on the gender pay gap after excluding the 2022 sample. As expected, the magnitudes of the estimates are almost the same as those of the main results presented in Table 5.

Then, I examine whether the cohorts subject to the overtime restriction policy since 2019 and 2020 exhibit consistent results. I estimate whether the overtime restriction policy narrows the gender pay gap even after excluding the early- and later-treated firms. This approach results in leaving only one treatment timing in the regression sample. The control groups remain consistent across both regressions for the early- and later-treatment groups. Additionally, I employed Sun and Abraham's (2021) method to examine the robustness of the results for all sample years, including 2022.

Columns (3) and (4) in Table 9 show the treatment effects on the gender pay gap of firms under treatment since 2019. Those are estimated after dropping later-treated firms. Similarly, columns (5) and (6) show the treatment effects for firms subjected to the policy beginning in 2020. Even without the early-treated or later-treated groups, the estimated treatment effects are consistent

with the results derived from the entire sample (columns (1) and (2)). Restricting overtime hours decreases the gender pay gap by exerting a less negative impact on women's wages than men's wages.

Finally, I applied Sun and Abraham's (2021) interaction-weighted (IW) estimator without imposing any sample restrictions. Sun and Abraham propose this estimation method as an alternative to the two-way fixed effects estimator in the presence of heterogeneous treatment effects by groups with different treatment timings. The IW estimator is a consistent estimator for the cohort-specific average treatment effect on the treated (Sun and Abraham, 2021). Since the IW estimator is based on the event-study type regression, I aggregate the estimates for event time dummies to derive the average treatment effect, following the authors' suggested approach[16].

However, the IW estimator does not allow the inclusion of interactions between females and relative time indicators. Consequently, I estimate the treatment effects separately for men and women and compare the magnitudes of the estimates. Although the results from this approach are not precisely comparable to the main results of this paper, I can examine whether the IW estimates qualitatively support the finding that the negative treatment effects are more severe for male workers than for female workers.

Note that I used the original sample without any restrictions when employing the IW estimator. The results indicate that the 52-hour workweek policy decreases women's earnings by 1.2 percent, and this reduction is statistically insignificant. In contrast, for men, the policy leads to a 3.8 percent reduction in monthly earnings, which is significant at the 95 percent confidence level. Additionally, both women's and men's hourly wages decrease by 2.2 percent and 3.3 percent,

[16] The "lincom" STATA command is used as the authors suggested.

respectively, after restricting overtime hours (both are significant at the 99 percent confidence level). The treatment effects estimated using Sun and Abraham's method suggest that the overtime restriction policy has a more adverse impact on men's earnings, consequently contributing to a narrowing of the gender pay gap.

3. Exclusion of medium-sized firms

In the data, firm sizes are given in bins. One of the bins (30–99 employees) includes both small-sized (5–49 employees) and medium-sized (50–299 employees) firms, each with different policy implementation timings, as outlined in Table 3. For analytical purposes, all entities within the 30–99 employee range are treated as medium-sized firms.

Additionally, the treatment time for medium-sized firms in nonexempt industries is considered from the 2019 sample, not from the 2020 sample, due to the considerable number of these firms taking preemptive action before policy enforcement. Acknowledging that these assumptions might involve some level of arbitrariness, I conducted an estimation of the treatment effects excluding medium-sized firms (30–299 employees) from the regression sample, aiming to test the robustness of the results.

The results are presented in Table 10. The negative effects on men's earnings and wages are slightly greater than the estimates derived from the entire sample, and the policy does not change women's income. Consistent with the main findings, the results affirm a significant reduction in the gender pay gap after the policy was implemented, even when medium-sized firms were excluded from the analysis.

The effects of the policy on the gender gap in overtime hours worked are also robust against the pandemic, staggered treatment timing, and assumptions regarding medium-sized firms. I present the results in Appendix Table A2.

4. Changes in composition

Last, I investigate whether overtime restrictions lead to new employment and change the composition of workers. After the policy implementation, employers may need to distribute the remaining work handled by workers working more than 52 hours per week among existing workers or recruit new workers to cover that work. The gender gap could narrow, particularly if newly hired men receive lower wages or if women who cannot work additional hours opt to leave their jobs. Even though Kim (2021) has already shown no immediate impact of the policy on employment using different data, I reconfirm the effects on new employment and the share of female workers to examine whether restricting overtime hours leads to changes in the composition of workers in the short term.

Given that the data are sourced from a workplace survey, the surveyed population comprises exclusively paid employees. The survey sample is drawn from establishments nationwide, with workers selected randomly within each workplace. I estimate the employment effect using new hires rather than work status because the survey does not encompass the unemployed. New employment is defined as individuals hired within the preceding 12 months.

I regress one of the indicators for new workers or women on the treatment dummy and the control variables in specification (1), including all fixed effects. When estimating the policy's impact on the share of female workers, I consider both the proportion of women among the total

workers and the number of newly employed individuals. The estimation results reveal that the overtime restriction policy does not have a significant impact on the composition of workers (Appendix Table A3), implying that the estimated treatment effects are not primarily driven by changes in worker composition.

VII. Conclusions

This paper investigates whether restrictions on working long hours reduce the gender pay gap. It is well documented that the gender disparity in working hours is associated with the gender pay gap. Even in the absence of a difference in human capital, men's tendency toward longer work hours often translates to higher hourly wages, particularly in occupations with a convex workhour–wage relationship. Apart from the work of Cortés and Pan (2019), few studies demonstrate a cause-and-effect link between the gender gaps in work hours and wages.

This study seeks to elucidate the impacts of capping overtime hours on the gender wage disparity through a causal lens, offering insights distinct from those of prior studies. Using a policy prohibiting working more than 52 hours per week, this paper provides causal evidence that men's long working hours contribute to the gender wage gap.

The main finding is that imposing legal limits on overtime hours leads to a reduction in the gender wage gap in the short run. The overtime restriction policy diminishes the gender disparity in overtime hours among employees exceeding regular work hours. The gender wage gap shows a more notable decrease in occupations with a large wage premium for long working hours among highly educated employees. The empirical results are robust with respect to the impacts of COVID-19 and staggered policy implementation timing.

The discourse on overwork often highlights its impact on an individual's quality of life, including health and work-life balance. This paper contributes by revealing that imposing limits on extended work hours is associated with mitigating gender gaps in the labor market. Investigating the potential adverse effects of the overtime restriction on firms' profit-optimizing inputs and capital–labor substitutability in the long run could serve as a valuable avenue for future research.

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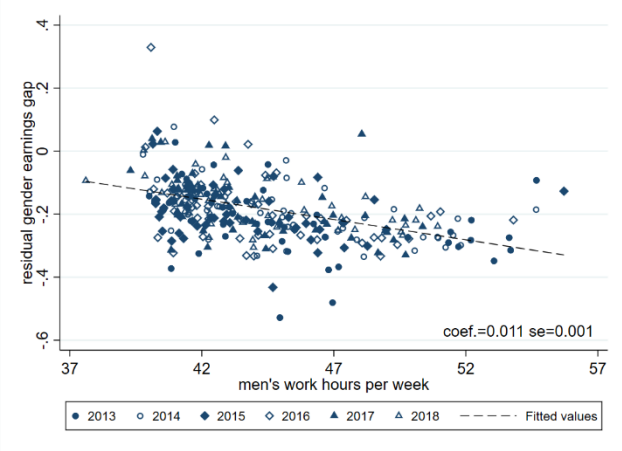
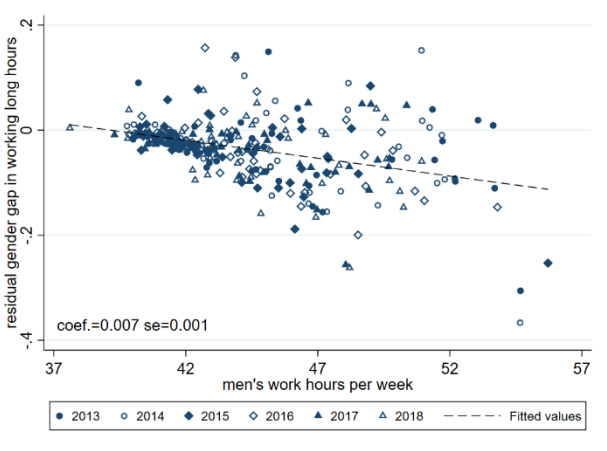
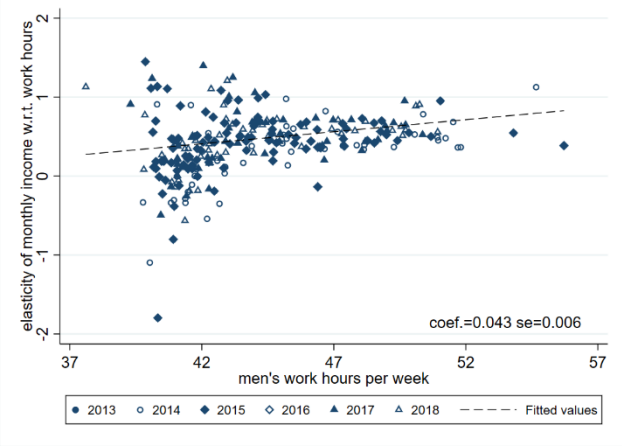
Figure 1. Relationship between Occupation Characteristics and Work Hours



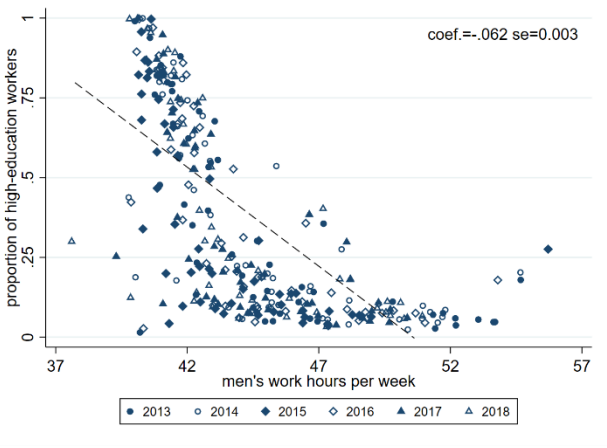
A. Residual gender earnings gap



B. Residual gender gap in working over 52 hours



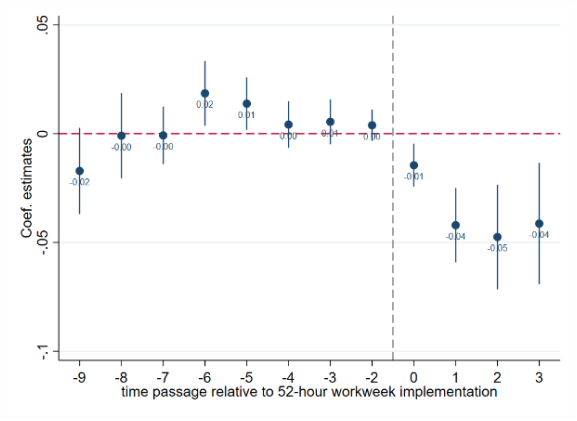
C. Elasticity of monthly income



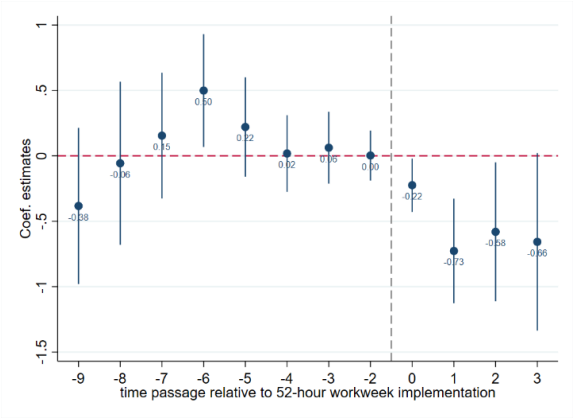
D. High-education workers

Notes: Figures show the relationship between occupation work hours and occupation characteristics. I estimate the residual gender earnings gap and the gender gap in the probability of working more than 52 hours by regressing the log value of monthly earnings (and an indicator of working more than 52 hours) on the interactions of gender and occupation with personal and employment characteristics and occupation fixed effects. The elasticity of monthly income is considered with respect to monthly work hours; I regress the log of monthly earnings on the interaction between occupation dummies and the log of monthly work hours with occupation fixed effects and individual characteristics using the male sample. The coefficient estimates and standard errors for the fitted lines are written on each graph.

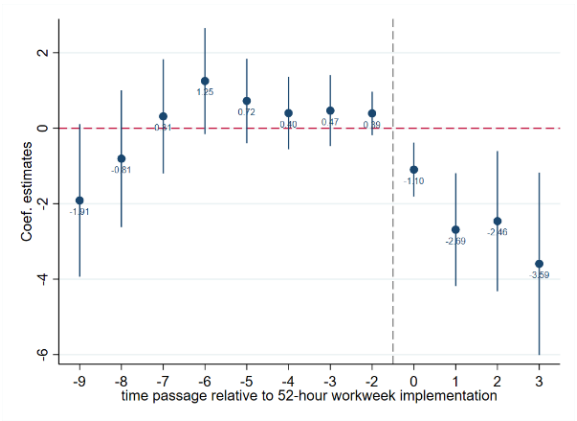
Figure 2. Changes in Working Hours



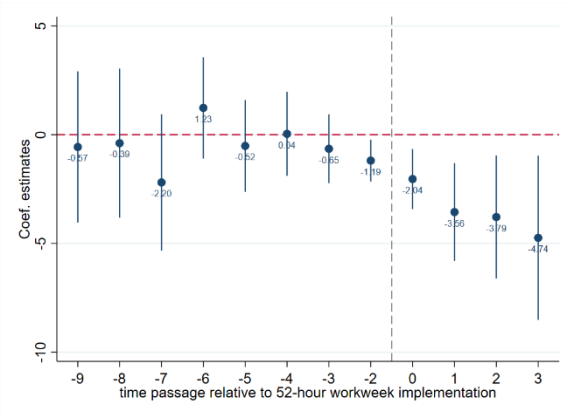
A. Likelihood of working over 52 hours



B. Weekly work hours



C. Overtime hours



D. Overtime hours (only overtime workers)

Notes: Figures show the coefficient estimates with 95 percent confidence intervals representing the changes in work hours relative to the year before the 52-hour workweek policy was implemented. Zero denotes the first year of policy enforcement, which varies by industry exemption status and establishment size. I regress the event-study-type regressions on the set of event-time dummies with fixed effects for establishment size by industry and survey year. Panels A through C include all employees, and Panel D includes only employees who worked overtime. Standard errors are clustered at the industry and workplace size levels.

Table 1. Residual Gender Differences in Work Hours and Earnings

	gender work-hour gap 2013–2018	gender earnings gap 2013–2018
Baseline	-0.033***	-0.260***
	(0.000)	(0.001)
Baseline, education	-0.038***	-0.238***
	(0.000)	(0.001)
Baseline, education, work hours	NA	-0.222***
		(0.001)
Baseline, education, work hours, occupation	-0.030***	-0.194***
	(0.000)	(0.001)
N	4,041,416	4,041,416

* p < 0.10, ** p < 0.05, and *** p < 0.01.

Notes: Each cell shows the coefficient estimates for the female indicator. The baseline specification includes age, age squared, establishment size, tenure, and year fixed effects. “Education” refers to 5 education level indicators. “Work hours” is the log of monthly work hours. “Occupation” is an occupation at the 2- or 3-digit index level. The dependent variables are the log of monthly work hours or the log of monthly earnings. Note that the regressions of work hours cannot include work hours as a control variable.

Table 2. Summary Statistics

	2013		2016		2019		2022	
	mean	sd	mean	sd	mean	sd	mean	sd
overtime restriction	0.00	(0.00)	0.00	(0.00)	0.37	(0.48)	0.88	(0.32)
female	0.34	(0.47)	0.36	(0.48)	0.38	(0.48)	0.38	(0.49)
age	39.29	(9.84)	39.97	(10.06)	40.64	(10.34)	41.27	(10.31)
4-year college	0.40	(0.49)	0.44	(0.50)	0.47	(0.50)	0.51	(0.50)
Tenure in month	78.65	(86.97)	79.36	(86.74)	83.20	(91.32)	90.78	(95.49)
shift system								
no shift	0.87	(0.34)	0.88	(0.32)	0.89	(0.32)	0.88	(0.32)
two-shifts	0.07	(0.26)	0.07	(0.25)	0.06	(0.24)	0.07	(0.25)
three-shifts	0.06	(0.23)	0.05	(0.22)	0.05	(0.22)	0.05	(0.22)
workplace size								
5–9	0.16	(0.37)	0.16	(0.37)	0.17	(0.37)	0.15	(0.36)
10–29	0.23	(0.42)	0.24	(0.43)	0.24	(0.42)	0.24	(0.43)
30–99	0.23	(0.42)	0.24	(0.42)	0.22	(0.42)	0.22	(0.42)
100–299	0.16	(0.37)	0.17	(0.37)	0.16	(0.36)	0.16	(0.36)
300–499	0.05	(0.22)	0.05	(0.21)	0.05	(0.23)	0.05	(0.22)
500–	0.15	(0.36)	0.15	(0.36)	0.16	(0.37)	0.17	(0.38)
exemptions								
NA	0.59	(0.49)	0.59	(0.49)	0.58	(0.49)	0.58	(0.49)
Exempt	0.11	(0.32)	0.11	(0.31)	0.10	(0.31)	0.12	(0.32)
Excluding exemptions	0.29	(0.46)	0.30	(0.46)	0.32	(0.47)	0.31	(0.46)
labor market outcomes								
work hours per week	44.38	(8.52)	43.35	(6.77)	42.75	(6.26)	42.67	(5.70)
overtime or not	0.39	(0.49)	0.37	(0.48)	0.37	(0.48)	0.38	(0.49)
overtime hours (all)	16.65	(30.73)	13.68	(25.73)	11.23	(21.27)	10.84	(19.59)
overtime hours	42.28	(36.25)	36.79	(30.52)	30.28	(25.37)	28.24	(22.55)
monthly earnings	2,955.0	(1837.55)	3,156.7	(1974.75)	3,438.7	(2003.84)	3,570.1	(2153.18)
hourly wage	17.38	(12.01)	17.47	(11.60)	20.92	(12.79)	21.09	(13.24)
Observations	642,970		649,608		734,831		722,421	

Notes: The table shows the summary statistics for the selected sample years. The years 2013 and 2022 are the first and last sample years, respectively. The year 2019 is the sample year when the overwork restriction policy was first applied. “Overtime restriction” denotes the proportion of workers who are supposed to be banned from working over 52 hours per week. “Exempt” indicates the five industries that are exempt from the restriction policy. "Excluding exemptions” refers to twenty-one industries that were designated exempt at first but whose exemptions were canceled. Income variables are valued in 2020 KRW, and the unit is 1,000 KRW (approximately 1 USD).

Table 3. Application Date of the Policy Restricting Overtime Hours

		Workplace size		
		Over 300 people	50–299 people	5–49 people
Exemptions	Nonexempt	2018.07.01	2020.01.01	2021.07.01
	Excluding exemptions (21 industries)	2019.07.01	2020.01.01	2021.07.01
	Exempt (5 industries)	.	.	.

Notes: The table presents the policy implementation dates by workplace size and industry exemption status. “Exempt” refers to the five industries that are exempt from the restriction policy. "Excluding exemptions” refers to the twenty-one industries that were designated exempt at first but whose exemptions were canceled.

Table 4. Effects of Overtime Restriction on Work Hours

	(1) Weekly work hours	(2) Overtime hours
female × 52-hour cap	0.065	1.703***
	(0.100)	(0.629)
52-hour cap	-0.265*	-1.221
	(0.159)	(1.051)
Female	-1.204***	-7.656***
	(0.100)	(0.551)
mean of the dependent var.	43.045	34.024
N	6,928,329	2,807,108

* p < 0.10, ** p < 0.05, and *** p < 0.01

Notes: The table shows the effects of the overtime restriction policy on weekly work hours and overtime hours. The effects on overtime hours include employees with positive overtime hours. Workplace size, year, and industry fixed effects and the interactions of pairs among the three variables are included in all regressions. Standard errors are clustered at the industry and workplace size levels.

Table 5. Effects of Overtime Restriction on the Gender Pay Gap

	(1) ln(monthly earnings)	(2) ln(wage)
female × 52-hour cap	0.040***	0.037***
	(0.005)	(0.005)
52-hour cap	-0.026***	-0.025***
	(0.009)	(0.009)
female	-0.217***	-0.188***
	(0.007)	(0.007)
mean	3,300.71	18.92
N	6,928,329	6,928,329

* p < 0.10, ** p < 0.05, and *** p < 0.01

Notes: The table shows the effects of overtime restrictions on monthly earnings and hourly wage rates. All dependent variables are log values. Workplace size, year, and industry fixed effects and the interactions of pairs among the three variables are included in all regressions. Standard errors are clustered at the industry and workplace size levels.

Table 6. Heterogeneous Effects of Overtime Restriction by Education

	High education		Low education	
	(1)	(2)	(3)	(4)
	Monthly earnings	wage	Monthly earnings	wage
female ×52-hour cap	0.040***	0.038***	0.034***	0.027***
	(0.008)	(0.008)	(0.007)	(0.006)
52-hour cap	-0.032***	-0.043***	-0.019*	-0.007
	(0.010)	(0.011)	(0.010)	(0.011)
female	-0.164***	-0.147***	-0.227***	-0.187***
	(0.009)	(0.009)	(0.009)	(0.008)
mean	3937.539	23.287	2765.795	15.245
N	3497303	3497303	3431026	3431026

* p < 0.10, ** p < 0.05, and *** p < 0.01

Notes: The table reports the effects of the overtime restriction on the gender pay gap by education level. High education refers to workers with a 4-year college degree. All individual characteristics and fixed effects denoted in the specification are included. Standard errors are clustered at the industry and workplace size levels.

Table 7. Treatment Effects by Occupational Returns to Long Working Hours

	Entire sample		High education		Low education	
	(1) earnings	(2) wage	(3) earnings	(4) wage	(5) earnings	(6) wage
(a) female×R×52h	0.006	-0.004	0.107**	0.099*	0.003	-0.002
	(0.018)	(0.016)	(0.053)	(0.054)	(0.017)	(0.015)
(b) R×52h	-0.065***	-0.023	-0.106***	-0.081***	-0.047**	-0.026
	(0.019)	(0.019)	(0.026)	(0.025)	(0.021)	(0.021)
(c) female×52h	0.057***	0.054***	0.042***	0.041***	0.044***	0.036***
	(0.007)	(0.006)	(0.008)	(0.008)	(0.008)	(0.008)
(d) female×R	-0.082***	-0.032	-0.117**	-0.076	0.008	0.040**
	(0.021)	(0.022)	(0.057)	(0.059)	(0.020)	(0.018)
female	-0.200***	-0.184***	-0.152***	-0.142***	-0.241***	-0.210***
	(0.009)	(0.009)	(0.010)	(0.010)	(0.008)	(0.009)
mean	3,300.709	18.917	3,937.539	23.287	2,765.795	15.245
N	6,928,329	6,928,329	3,497,303	3,497,303	3,431,026	3,431,026

* p < 0.10, ** p < 0.05, and *** p < 0.01

Notes: The table shows the effects of the overtime restriction on the gender pay gap by occupational returns to long work hours. "R" indicates the earnings returns to work hours in 2013−2018 at the occupation level. High education refers to workers with a 4-year college degree. All individual characteristics and fixed effects denoted in the specification are included. Standard errors are clustered at the industry and workplace size levels.

Table 8. Treatment Effects with Restricted Sample Years

	2013-2019 & 2022		2013-2019	
	(1) Monthly earnings	(2) wage	(3) Monthly earnings	(4) wage
female × 52-hour cap	0.042***	0.043***	0.039***	0.046***
	(0.005)	(0.004)	(0.009)	(0.010)
52-hour cap	-0.019*	-0.021**	-0.019*	-0.021*
	(0.010)	(0.010)	(0.011)	(0.012)
female	-0.218***	-0.189***	-0.216***	-0.187***
	(0.007)	(0.007)	(0.007)	(0.007)
N	5,498,668	5,498,668	4,776,247	4,776,247

* p < 0.10, ** p < 0.05, and *** p < 0.01

Notes: The table shows the effects of the overtime restriction on the gender pay gap. The regression sample is restricted according to the survey year. The first two columns exclude the data from 2020 to 2021, when social distancing was enforced due to the COVID-19 pandemic. The last two columns include the period until 2019, before the pandemic outbreak. Income variables are log values. Workplace size, year, and industry fixed effects and the interactions of pairs among the three variables are included in all regressions. Standard errors are clustered at the industry and workplace size levels.

Table 9. Treatment Effects by Treatment Timing

	Entire sample		Treatment since 2019		Treatment since 2020	
	(1) earnings	(2) wage	(3) earnings	(4) wage	(5) earnings	(6) wage
female × 52-hour	0.040***	0.036***	0.038***	0.034***	0.053***	0.047***
	(0.006)	(0.006)	(0.008)	(0.008)	(0.011)	(0.010)
52-hour	-0.027***	-0.023**	-0.038**	-0.033*	-0.042***	-0.036*
	(0.010)	(0.011)	(0.017)	(0.019)	(0.016)	(0.019)
female	-0.216***	-0.187***	-0.221***	-0.191***	-0.211***	-0.182***
	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)	(0.006)
mean	3,268.110	18.654	3,185.608	18.049	3,125.044	18.043
N	6,205,908	6,205,908	4,671,043	4,671,043	3,464,489	3,464,489

* p < 0.10, ** p < 0.05, and *** p < 0.01

Notes: Sample years are restricted to 2013−2021. The third and fourth columns exclude later-treated firms, and the last two columns exclude early-treated firms. The control groups are never treated establishments, which are firms in exempt industries and small businesses, for all regressions. All dependent variables are log values. Workplace size, year, and industry fixed effects and the interactions of pairs among the three variables are included in all regressions. Standard errors are clustered at the industry and workplace size levels.

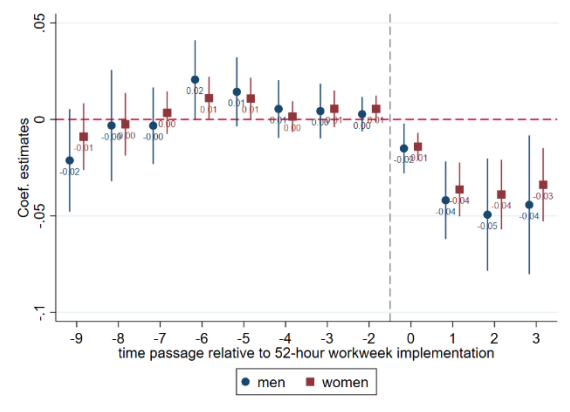
Table 10. Treatment Effects Excluding Medium-Sized Establishments

	(1) ln(monthly earnings)	(2) ln(wage)
female × 52-hour	0.050***	0.044***
	(0.006)	(0.007)
52-hour	-0.051***	-0.044***
	(0.012)	(0.013)
female	-0.208***	-0.177***
	(0.008)	(0.007)
mean	3,331.397	19.258
N	4,237,801	4,237,801

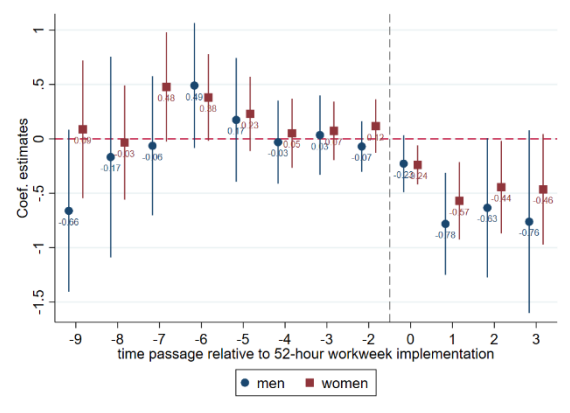
* p < 0.10, ** p < 0.05, and *** p < 0.01

Notes: The table shows the effects of the overtime restriction on the gender pay gap, estimated excluding medium-sized establishments (30−299 employees). All dependent variables are log values. Workplace size, year, and industry fixed effects and the interactions of pairs among the three variables are included in all regressions. Standard errors are clustered at the industry and workplace size levels.

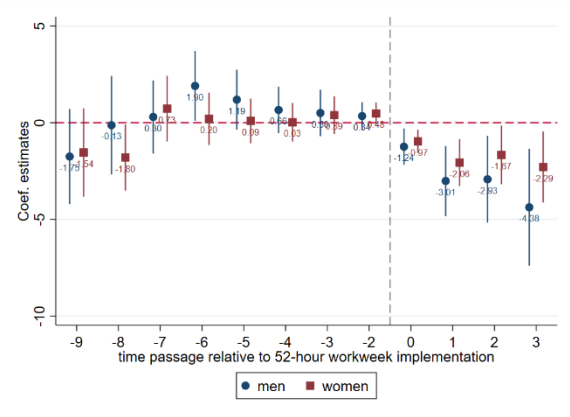
Appendix Figure A1. Changes in Working Hours by Gender



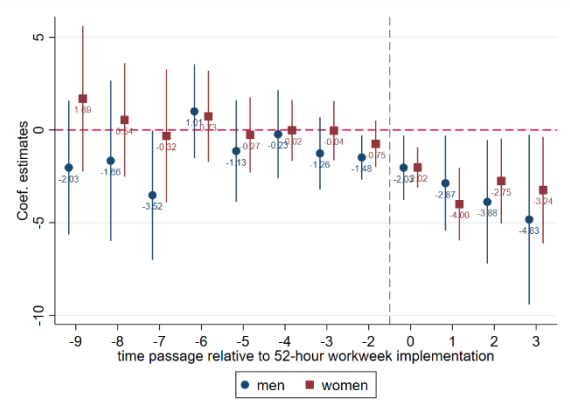
E. Likelihood of working over 52 hours



F. Weekly work hours



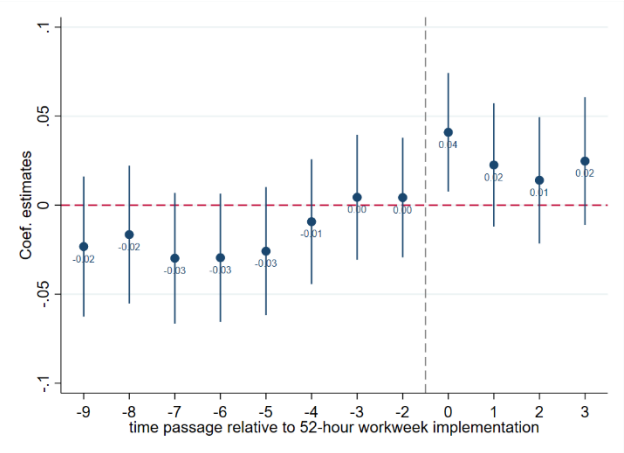
G. Overtime hours



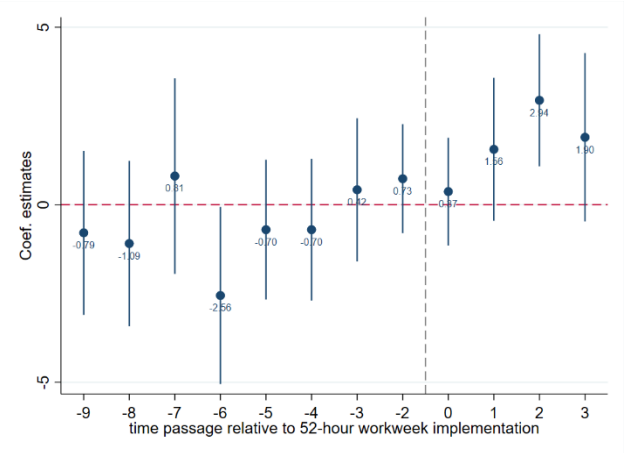
H. Overtime hours (only overtime workers)

Notes: Figures show the coefficient estimates with 95 percent confidence intervals representing the changes in work hours relative to the year before the 52-hour workweek policy was implemented by gender. Zero denotes the first year of policy enforcement, which varies by industry exemption status and establishment size. I regress the event-study-type regressions on the set of event-time dummies with fixed effects for establishment size by industry and survey year. The regressions are conducted for male and female workers separately. Panels A through C include all employees, and Panel D includes only employees who worked overtime. Standard errors are clustered at the industry and workplace size levels.

Appendix Figure A2. Pre-Treatment Trends in the Gender Gap



A. Gender wage gap



B. Gender gap in overtime hours

Notes: Figures show the coefficient estimates with 95 percent confidence intervals representing the changes in the gender gaps in wage rates and overtime hours relative to the year before the 52-hour workweek policy was implemented. The specification includes interactions between female and event-time dummies excluding the base year (event-time=−1), a set of event-time dummies, a female indicator, and fixed effects for year and establishment size by industry. Dependent variables are the log value of hourly wages and overtime hours. Zero denotes the first year of policy enforcement, which varies by industry exemption status and establishment size. Panel A includes all employees, and Panel B has only employees who worked overtime. Standard errors are clustered at the industry and workplace size levels.

Appendix Table A1. Effects of Overtime Restriction on the Gender Pay Gap among Workers Aged 30−39 Years

	(1) ln(monthly earnings)	(2) ln(wage)
female×52-hour cap	0.047***	0.035***
	(0.006)	(0.007)
52-hour cap	-0.013	-0.010
	(0.009)	(0.009)
female	-0.160***	-0.125***
	(0.007)	(0.007)
mean	3,182.140	18.272
N	2,151,479	2,151,479

* p < 0.10, ** p < 0.05, and *** p < 0.01

Notes: The table shows the effects of the overtime restriction on the gender pay gap among workers in their 30s. All dependent variables are log values. Workplace size, year, and industry fixed effects and the interactions of pairs among the three variables are included in all regressions. Standard errors are clustered at the industry and workplace size levels.

Appendix Table A2. Treatment Effects on Gender Gaps in Overtime Hours with Restricted Samples

	COVID-19		Treatment timing		No medium firms
	(1)	(2)	(3)	(4)	(5)
Overtime hours	2013-2019 & 2022	2013-2019	Treatment since 2019	Treatment since 2020	
female × 52-hour cap	1.172*	-0.343	1.770**	1.892**	2.238**
	(0.690)	(1.208)	(0.830)	(0.865)	(0.893)
52-hour cap	-2.247*	-2.302*	-0.913	1.144	-2.711**
	(1.229)	(1.312)	(1.994)	(1.810)	(1.238)
Female	-7.651***	-7.706***	-8.029***	-7.476***	-7.620***
	(0.568)	(0.568)	(0.610)	(0.580)	(0.545)
mean	35.703	36.978	36.387	29.699	30.779
N	2,208,184	1,887,507	2,017,665	1,105,484	1,691,102

* p < 0.10, ** p < 0.05, and *** p < 0.01

Notes: The table shows the effects of overtime restrictions on the gender gap in overtime hours. The regression sample for the first two columns is restricted according to the survey year. The first column excludes the sample from 2020 to 2021 when social distancing was enforced due to the pandemic. The second column includes the period until 2019, before the pandemic outbreak. The sample years are restricted to 2013–2021 for the third and fourth columns. The third column excludes later-treated firms, and the fourth excludes early-treated firms. The last column includes all sample years but excludes medium-sized establishments (30–299 employees). Workplace size, year, and industry fixed effects and the interactions of pairs among the three variables are included in all regressions. Standard errors are clustered at the industry and workplace size levels.

Appendix Table A3. Effects of Overtime Restriction on Employment and the Share of Female Workers

	(1) New employment	(2) Female	(3) Female
52-hour cap	0.002	-0.009	-0.011
	(0.004)	(0.006)	(0.011)
mean	0.189	0.365	0.436
N	6,928,329	6,928,329	1,208,463

* p < 0.10, ** p < 0.05, and *** p < 0.01

Notes: The table shows the effects of the overtime restriction policy on employment and the share of female workers. All the dependent variables are indicators. New employment is indicated by a value of 1 if an individual was hired at the current workplace in the preceding 12 months. The last column includes only newly employed workers. Workplace size, year, and industry fixed effects and the interactions of pairs among the three variables are included in all regressions. Standard errors are clustered at the industry and workplace size levels.