Effect of Irregular Worker Protection Law on Welfare Benefits Payment

MyoungHwan Kim and GiSeung Kim

Since the 1997 Asian financial crisis, the polarization of wages and welfare benefits by the type of employment contract in the Korean labor market has intensified. The Korean government enacted the Irregular Worker Protection Law (hereafter denoted as IWPL), which focuses on non-discrimination in 2007. From the characteristics of personnel management in Korea, a hypothetical mechanism can be proposed that companies ensure long-term and stable employment in the internal labor market by suppressing the expenditure of welfare benefits, a type of quasi-fixed labor cost, in response to IWPL. To test this hypothesis, we construct the treatment group with similar characteristics to the comparison group through propensity score matching (hereafter denoted as PSM). Then, the difference in difference (hereafter denoted as DID) is performed on two matched groups. As a result of the analysis, IWPL is confirmed to have a negative effect on welfare benefits payment, and this reduction effect gradually increases with the passage of time. Finding shows the possibility that companies have minimized the negative employment effect of IWPL and protected the internal labor market by adopting personnel management that reduces quasi-fixed labor costs such as welfare benefits.

Keywords: Welfare benefits, Quasi-fixed labor costs, Self-selection bias, Matched DID

JEL Classification: J08, J32, J42

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I. Introduction

Since the 1997 Asian financial crisis, the Korean labor market has changed considerably. Immediately after the crisis, the Korean government introduced layoffs by revising the Labor Standards Act and permitted dispatched employment by enacting the Protection of Dispatched Workers Act. Such a series of labor market flexibility policies contributed to rationalizing management by reducing enterprises' labor costs but raised the controversy over the polarization by increasing the proportion of irregular workers. According to Statistics Korea, approximately one-third of Korean wage workers are irregular workers, and their relative wage compared with regular workers is only 69.7% in 2019.

As response to this situation, the Korean government enforced IWPL in 2007,[1] a representative employment protection legislation (hereafter denoted as EPL) of Korea. IWPL is a collective term for a series of legal systems to protect fixed-term workers, part-time workers, and dispatched workers (hereafter denoted as FPDs) among various types of irregular workers, including the Protection of Fixed-Term and Part-Time Workers Act[2] and the Protection of Dispatched Workers Act.[3] This law was introduced with the purpose of improving the labor quality of irregular workers by protecting them from discrimination and inducing the conversion of the type of employment contract to regular workers.

Common contents of IWPL are the prohibition of discrimination without rational reason and the obligation to convert irregular workers employed for more than two years as regular workers. From the perspective of the theory of labor demand, the policy to induce the

[1] IWPL was implemented July 1, 2007, but the application timing of the clause of anti-discrimination was determined differently depending on the firm size to minimize the shock on the labor market. Thus, IWPL was expanded to all workplaces with five or more employees from July 2009.

[2] The Protection of Fixed-Term and Part-Time Workers Act was newly established in 2007. It stipulates restrictions on the duration of the employment contract, the discrimination correction system, and protection of part-time workers.

[3] The Protection of Dispatched Workers Act was enacted in 1998 and then amended in 2007. In the amended law, the scope of work allowed for dispatch was expanded, and the direct employment obligation of employees in case of illegal dispatch and the discrimination correction system were newly introduced.

conversion of the type of employment contract to regular workers is likely to reduce labor demand by increasing quasi-fixed labor costs (Oi, 1962). Several previous studies reported empirical conclusions that IWPL decreases employment by increasing the expenditure on welfare benefits (Nam and Park, 2010).

However, contrary to typical theoretical predictions, a possibility also exists that IWPL does not always have a negative effect on employment. Looking at domestic previous studies, IWPL increases employment in companies with a strong internal labor market (Kim and Kim, 2014), and the decline in employment due to IWPL is restored by corporate personnel management that adapts to regulations (Yoo and Kang, 2013).

As such, several domestic previous studies published after the implementation of IWPL reported that IWPL has different effects on employment depending on personnel management or workplace characteristics, unlike typical predictions of labor demand theory. However, no previous studies suggest and empirically analyze the hypotheses on the reasons for the different employment effects of IWPL.

Korean companies with seniority-based personnel management systems have attempted to prevent turnover and induce long service by establishing a strong internal labor market and providing firm-specific training for employees.[4] Therefore, companies have an incentive to maintain a long-term stable employment relationship with their employees to stably recover the invested training costs over a long period of time (Baron, Davis-Blake, & Bielby, 1986; Wachter & Wright, 1990).

From this characteristic of personnel management in Korea, a hypothetical mechanism can be proposed that companies ensure long-term and stable employment in the internal labor market by suppressing the expenditure of quasi-fixed labor costs in response to IWPL. In other words, Korean companies possibly intend to maintain the employment level by reducing quasi-fixed labor costs in response to IWPL to protect the internal labor market.

Quasi-fixed costs include recruitment and dismissal costs, training costs, and welfare benefits. Among them, IWPL explicitly prohibits

[4] The seniority-based personnel system—in which promotion and compensation are determined by seniority within a rigid internal labor market—has been predominant in Korea.

discrimination on welfare benefits,[5] thus, the incentive for companies to reduce welfare benefits is expected to be greater than other types of quasi-fixed labor costs. Therefore, we attempt to propose a mechanism for Korean companies to respond to IWPL based on the theory of quasi-fixed labor costs by estimating the effect of IWPL on welfare benefits payment.

To test this hypothetical mechanism, setting FPDs covered by IWPL as the treatment group is necessary. However, FPDs are essentially a type of employment contract chosen by the individual worker. Such choice is influenced by gender, region, and educational background, among others, thereby possibly causing self-selection bias. Therefore, we construct the comparison group with similar characteristics to the treatment group through PSM to minimize self-selection bias. Then, DID, a representative technique for analyzing the effect of a policy, is performed on two matched groups. This methodology combined with PSM and DID (*i.e.*, matched DID) is expected to increase the reliability of the analysis results by balancing the observed variables and unobservable characteristics. For empirical analysis, this study uses the Korean Labor & Income Panel Study (hereafter denoted as KLIPS) of the Korea Labor Institute, which includes information on whether or not welfare benefits are paid.

This study is constructed as follows. Section II reviews the previous studies. Section III introduces the matched DID technique. Section IV shows the descriptive statistics. Section V presents the empirical results, and section VI concludes.

II. Literature Review

IWPL prohibits discrimination against wages, bonuses, and welfare benefits. Such EPL is expected to significantly affect welfare benefits payment by changing the structure of personnel expenses. However, no previous study analyzes the relationship between IWPL and welfare benefits. Therefore, we comprehensively review several previous studies on the influence of IWPL to obtain intuitive ideas of analytical methods and confirm the need to prove our hypothesis.

[5] Act on the protection, ETC. of fixed-term and part-time workers/ employees 2 3 (d), Act on the Protection, ETC. of temporary agency workers article 2 7 (d).

The most frequent theme is the employment effect. According to the theory of labor demand, the policy to induce the conversion to regular workers is likely to reduce labor demand by increasing quasi-fixed labor costs (Oi, 1962). Labor costs include quasi-fixed labor costs independent of working hours, such as recruitment and training costs and welfare benefits as well as fluid costs, such as wages (Hosono *et al.*, 2015). Among them, quasi-fixed labor costs are incurred per individual worker and increase when the type of employment contract converts from irregular to regular workers. Employers hiring FPDs for over two years are required to convert the type of employment contract according to IWPL. Thus, the burden for quasi-fixed labor costs is weighted, resulting in the increase in working hours of existing workers and the decrease in employment.

The effect of the increase in quasi-fixed labor cost due to EPL has been analyzed in several previous studies. Hopenhayn and Rogerson (1993) analyzed the data from 22 countries and found that hiring and firing costs have a negative effect on the employment rate. Nam and Park (2010) argued that the conversion of the type of employment contract to regular workers forced by IWPL causes an increase in the expenditure on welfare benefit and thus decreases employment. They analyzed the employment effect by combining DID and regression discontinuity (hereafter denoted as RD)[6] to obtain unbiased estimates by controlling endogeneity. They set people under the age of 55 covered by the clause of IWPL on regular employment conversion as a treatment group and took people lying closely on either side of 55-year-old workers as analysis targets. The results showed that IWPL negatively affects the employment of wage workers.

However, unlike typical theoretical predictions, another possibility is that IWPL does not always have a negative effect on employment.

Bentolila and Bertola (1990) analyzed the relationship between EPL and employment by using recruiting and dismissal costs as parameters and then announced that the increase in quasi-fixed costs does not affect labor demand. Additionally, Belot *et al.* (2002) argued that

[6] RD is a quasi-experimental design that aims to estimate the causal effects of treatment by assigning a cutoff above or below which treatment is assigned. By comparing observations lying closely on either side of the cutoff, analyzing the average treatment effect is possible in environments in which randomization is unfeasible (Angrist and Pischke, 2009).

adequate employment protection increases long-term labor demand by inducing investment in firm-specific human capital.

Yoo and Kang (2013), who employed RD and DID, noted that a negative employment effect of IWPL mostly disappears over time. They said because companies preemptively reduce employment at the beginning of the implementation of IWPL, the employment level recovers over time as companies shift to personnel management tailored to IWPL. Kim and Kim (2014) also analyzed using the same analysis methodologies and announced that IWPL has a positive employment effect on companies with more than 100 people. They explained that such finding is due to large companies' attempt to protect the internal labor market as much as possible even if quasi-fixed labor costs increase due to employment protection.

As such, several domestic literatures published after the full implementation of IWPL in 2009 reported that IWPL has different effects on employment depending on personnel management or workplace characteristics, unlike typical predictions of the labor demand theory. However, few authors suggest and empirically analyze the hypotheses about the reasons for the different employment effects of IWPL.

Meanwhile, other previous studies on the impact of IWPL are also worth reviewing to gain intuitive ideas of analytical methods.

Choi (2018) analyzed the effect of IWPL on job satisfaction using the matched DID and then announced that IWPL increases job satisfaction, and this positive effect grows over time. Unlike previous studies on the employment effect of IWPL, he set irregular workers as the treatment group. Meanwhile, Busk *et al.* (2017) analyzed the effect of the relaxation of irregular employment regulation on job satisfaction in Germany using matched DID and then argued that the regulation relaxation reduces the job satisfaction of employees.

Prior empirical studies pointed out that although DID is effective in analyzing the effect of IWPL, combining DID with complementary methodologies such as RD or PSM is necessary to eliminate self-selection bias.

III. Empirical Strategies

The effectiveness of the policy is evaluated as the difference between the factual outcome of the group covered by the policy and the counterfactual outcome that the same group would have obtained if the

policy had not been applied. However, a group cannot be subject to a specific policy while being excluded from the same policy. Therefore, the counterfactual outcome should be obtained from the comparison group that is similar to the treatment group but to which no policy is applied.

FPDs covered by IWPL are basically a kind of the type of employment contract arbitrarily chosen by individual workers. Considering that the choice of the type of employment contract is affected by gender, region, and educational background, differences may exist in the characteristics between FPDs and other then FPDs. In this case, whether the difference in the payment rate of welfare benefit between the two groups is the net causal effect of IWPL is not clear. Therefore, controlling for self-selection bias is important in evaluating the influence of IWPL.

The main purpose of PSM, first introduced by Rosenbaum and Rubin (1983), is to control self-selection bias by creating a situation similar to random experiments. Concretely, PSM minimizes the difference between the treatment and comparison groups based on observed covariates (Caliendo and Kopeinig, 2008).

The propensity score, $e(x)$, a function of x, a vector of observed characteristics, is modeled using the probit model and denoted as follows:

$$e(x) = pr(z = 1 \mid x) = \vartheta[h(x)] \tag{1}$$

where φ is the cumulative distribution function of the probit model, and $h(x)$ is a function of covariates.

The above equation shows that the propensity score is an index of several observed characteristics abbreviated into a single dimension. PSM constructs the comparison group with characteristics most similar to the treatment group by matching observations with each other using this propensity score.

Looking at the PSM in further detail, the average treatment effect on the treated group is calculated by the following equation:

$$\tau_{PSM} = \frac{1}{N^{Gt}} \sum_{i \in Gt} y_i{}^t - \frac{1}{N^{Gt}} \sum_{j \in G_c} W_{ij} y_j^c \tag{2}$$

where N^{Gt} is the number of observations in a treatment group G^t, and W^{ij} indicates the weight assigned to the distance between i and j. The observation for an individual i in the treatment group is matched

to a counterfactual observation created using a weighted average of observation j in the comparison group G^c. Here, bootstrapping is typically used to obtain the standard error of the estimate.

Meanwhile, DID, a representative technique for analyzing the effect of the policy using panel data, has been very widely utilized after Ashenfelter and Card (1985). This method controls for unobserved characteristics by subtracting the post-treatment difference between the treatment and comparison groups from the pre-treatment difference between them (Angrist and Pischke, 2009). To obtain an unbiased estimator using DID, a parallel-trend must be assumed (Athey and Imbens, 2006). That is, characteristics other than treatment assignment should be similar in the treatment and comparison groups.

Previous studies explained the reason for combining DID and PSM (*i.e.*, matched DID) as follows. First, the parallel-trend assumption can be secured by making the treatment and comparison groups similar to each other. Second, controlling the errors caused by changes in the composition of the two groups is possible before and after IWPL enforcement. Third, both observable variables and unobservable characteristics between the two groups can be balanced (Busk *et al.*, 2017; Choi, 2018).

The current research set up the following estimation model to analyze the net casual effect of IWPL on the payment of various types of welfare benefits:

$$y_{it} = \beta_0 + \beta_1 S_t + \beta_2 T_t + \beta_3 S_i T_t + \beta_4 Z_{it} + \varepsilon_{it}, \tag{3}$$

where i and t are index of individuals and time of investigation, respectively. y_{it} indicates whether the employer who employs an individual worker provides welfare benefits to their employees, that is, the payment rate of welfare benefits. Here, welfare benefits are classified into statutory and non-statutory benefits. Concretely, statutory benefits include statutory retirement allowance, paid leave, maternity leave, and child-care leave. In addition, non-statutory benefits indicate progressive retirement allowance, meal benefit, children's education allowance, and private medical insurance premiums.

β_3 is the coefficient of the interaction term between treatment group variable S_i and the investigation period variable T_t, which is an estimator of DID and captures the effect of IWPL. Z_{it} indicates the control variables including gender, whether a workplace is in a metropolitan area,

whether the worker graduated from a university or higher, company size, and occupations, and ε_{it} is an error term.

Concretely, S_i is a dummy variable that identifies treatment and comparison groups, and takes a value of 1 if an individual observation is FPDs covered by IWPL, and a value of 0 if other than FPDs.[7] Regarding the setting of the treatment group, numerous views exist on the concept and category of irregular workers (Barker and Christensen, 1998; Polivka and Nardone, 1989; Grubb, Lee and Tergeist, 2007; Yoo, 2010; Kim, 2017; and others), but IWPL defines FPDs as irregular workers. Therefore, the current study sets FPDs as the treatment group (S_i = 1 if FPDs, S_i = 0 if other than FPDs). The comparison group refers to workers not covered by IWPL and is not necessarily limited to regular workers. For example, special form workers are not generally classified as regular workers in Korea, but they are assigned to the comparison group in this paper.

We use PSM to construct these treatment and comparison groups similar to each other. PSM is classified into nearest-neighbor matching, caliper matching, radius matching, stratified matching, and kernel matching, among others, according to the weighting method. Among them, kernel matching uses all observations for analysis and thus minimizes information loss. Thus, we decide to employ it. In kernel matching, the weight is set in inverse proportion to the distance of the propensity score of the observations using a non-parametric kernel function as follows:

$$w_{ij}^{km} = \frac{K(\frac{p_j - p_i}{v})}{\sum_c K(\frac{p_k - p_i}{v})}, \tag{4}$$

where $K(\cdot)$ is the kernel function, v is the number of samples in the bandwidth, and c indicates a comparison group. p_i is the propensity score of observation i of the treatment group, and p_j and p_k represent the propensity scores of observations j and k of the comparison group, respectively.

[7] As seen in previous studies, two criteria exist for setting the treatment group in the effect analysis of IWPL: minimum-age restriction and the type of employment contract. The present study adopted the latter.

Meanwhile, T_t is a dummy variable indicating whether before or after IWPL enforcement. Although IWPL was implemented July 1, 2007, the application timing of the clause of anti-discrimination was determined differently depending on the firm size to minimize the shock on the labor market. Concretely, IWPL was applied to the public sector and workplaces with 300 or more employees from July 2007 to workplaces with 100–299 employees from July 2008. It was then expanded to all workplaces with five or more employees from July 2009. To analyze the overall effect of IWPL, we use the data from the period after IWPL was applied to all workplaces with five or more employees as post-treatment data. Moreover, the composition of treatment and comparison groups may vary from year to year (Busk *et al.*, 2017). Therefore, we match the two groups by the same four-year interval ($T_t = 0$ if 2006, $T_t = 1$ if 2010, 2014, 2018).

IV. Descriptive Statistics

To analyze the impact of IWPL on welfare benefits payment, we need information on whether the employer provides welfare benefits to their employees. KLIPS is highly useful for academic research because it contains a rich variety of information, including household demographics, economic activities and labor market mobility, income activities, education, and vocational training. Moreover, this survey provides information on whether or not various types of welfare benefits such as statutory and non-statutory benefits are paid. Thus, we decide to use KLIPS for empirical analysis. As discussed in the previous section, the present study employs KLIPS, the individual-level panel data, as repeated cross-sectional data for the periods of 2006, 2010, 2014, and 2018.

Meanwhile, IWPL applies only to workplaces with five or more employees and individual workers under the age of 55, implying that firm size and age can also be another setting criterion for the treatment group. For a clearer identification of FPDs as a treatment group, this study excludes the observations older than 55 years or belonging to workplaces with fewer than five employees from the sample.

The number of observations in 2006—before the enforcement of IWPL—is 2,204, and the numbers of observations in 2010, 2014, and 2018—after the full application of IWPL—are 2,697, 2,841, and 3,054, respectively.

Table 1 shows the composition of the treatment group by year. The proportion of FPDs among the entire wage workers in 2006 is 10.6%, and in 2010, 2014, and 2018 are 12.5%, 11.8%, and 12.3%, respectively. Looking at each type in detail, the proportion of fixed-term workers increased from 5.2% in 2006 to 6.3% in 2010 and further increased to 6.8% in 2014 and 6.7% in 2018. In the case of part-time workers, a slight decrease occurred in 2014 compared with 2010. However, it also increased from 4.5% in 2006 to 6.8% in 2018. However, that of dispatched workers continued to decrease from 1.5% in 2006 to 0.3% in 2018.

Considering the low proportion of observations belonging to the treatment group, errors may occur in the empirical results when the composition of the treatment and comparison groups changes annually. If FPDs and other than FPDs are matched using the propensity score, this problem can be solved because the two groups become similar (Busk *et al.*, 2017).

Table 2 shows the distribution of the payment rate of welfare benefits for the treatment and comparison groups by year. The statutory benefit with the highest payment rate is the statutory retirement allowance. For FPDs and other than FPDs, they increased from 43.8% and 67.8% in 2006 to 55.7% and 87.2% in 2018, respectively. In addition, the payment rate of paid leave decreased in 2010 shortly after the full implementation of IWPL but increased over time into 2014 and 2018. In 2018, the payment rates of maternity and child-care leave, which are primarily distributed to female workers, decreased for FPDs but increased for other than FPDs compared with 2006.

Meanwhile, payment rates of non-statutory benefits are usually lower than those of statutory benefits, but meal benefit is higher than most of the statutory benefits except for the statutory retirement allowance. Additionally, the payment rate of the progressive retirement allowance for other than FPDs increased over time from 2006 to 2018, whereas that for FPDs declined again in 2018. Payment rates for children's education allowance and private medical insurance premiums are rising and falling without a certain trend.

However, we cannot be sure whether such a change in welfare benefits payment in descriptive statistics is a consequence of IWPL enforcement. Therefore, the net effect of IWPL in which the influence of other factors is controlled as much as possible, should be examined

using quasi-experimental methods.[8]

IV. Empirical Results

A. Analysis Results of Traditional DID

The effect of IWPL on welfare benefits payment is obtained from the estimated coefficient of the interaction term between the enforcement time variable and the treatment group variable. We contain control variables such as gender, region, occupation, and firm size into the model to control for individual characteristics of observations.[9]

Looking at the DID estimates for the statutory benefit rate, the estimates of the statutory retirement allowance are not all statistically significant. Those of paid leave and maternity leave are statistically significant only in 2018, and payment rates decrease by 7.8% and 11.5% compared with 2006, respectively. For child care leave, which is statistically significant for all years, payment rates decrease by 9.1% in 2010, 9.4% in 2014, and 17.7% in 2018 compared with 2006.

With respect to non-statutory benefits, the estimates of children's education allowance are not all statistically significant. Estimated coefficients of the progressive retirement allowance and private medical insurance premiums are statistically significant only in 2018 and decrease by 8.6% and 8.0% compared with 2006, respectively. Rates of decrease in meal benefit, for which all estimated coefficients are statistically significant, gradually increase over time to 9.0% in 2010, 11.1% in 2014, and 13.8% in 2018.[10]

[8] Appendix Table 1 shows the descriptive statistics on control variables such as gender, whether a workplace is in a metropolitan area, whether a graduate from a university or higher, firm scale, and occupations.

[9] Contact author for details on the estimation results of other control variables.

[10] As part of a placebo test, we assume that the IWPL was implemented before 2007 when actually implemented, and then run DID. Concretely, hypothetical situations are presented that IWPL was implemented at a certain point from 2003–2005 ($T_t = 0$ if 2003, $T_t = 1$ if 2005) and from 2004-2006 ($T_t = 0$ if 2004, $T_t = 1$ if 2006). Looking at Appendix Table 2, results of most variables with significant negative values at the true DID are reported as statistically non-significant values or significant positive values.

Table 1
Composition of Treatment Group by Year

FPDs (Treatment group)		0.106	0.125	0.118	0.123
	Fixed-term workers	0.052	0.063	0.068	0.067
	Part-time workers	0.045	0.058	0.054	0.068
	Dispatched workers	0.015	0.012	0.011	0.003

Note: Figures refer to the proportion of FPDs among the entire wage workers.

Table 2
Distribution of Payment Rate of Welfare Benefits by Year

		2006		2010		2014		2018	
		(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Statutory benefits	Statutory retirement allowance	0.438	0.678	0.459	0.715	0.548	0.793	0.557	0.872
	Paid leave	0.322	0.544	0.302	0.528	0.360	0.612	0.377	0.716
	Maternity leave	0.253	0.398	0.154	0.358	0.199	0.415	0.191	0.474
	Child-care leave	0.210	0.288	0.124	0.315	0.205	0.410	0.199	0.478
Non-statutory benefits	Progressive retirement allowance	0.112	0.243	0.112	0.277	0.164	0.333	0.119	0.355
	Meal benefit	0.601	0.770	0.438	0.704	0.455	0.748	0.467	0.787
	Children education allowance	0.167	0.299	0.074	0.242	0.083	0.250	0.061	0.261
	Private medical insurance premiums	0.082	0.087	0.038	0.071	0.039	0.083	0.040	0.139
Number of Obs		233	1,971	338	2,359	336	2,505	377	2,677

Note: (a) and (b) indicate FPDs and other than FPDs, respectively.

Notably, FPDs covered by IWPL are basically a kind of the type of employment contract arbitrarily chosen by individual workers. Thus, randomizing the assignment to treatment group is difficult because the

Table 3
Analysis Results of Traditional DID

		Statutory retirement allowance	Paid leave	Maternity leave	Child-care leave
Statutory benefits	2006–2010	-0.001 (0.043)	0.018 (0.041)	-0.038 (0.036)	-0.091*** (0.034)
	2006–2014	0.021 (0.042)	0.008 (0.041)	-0.038 (0.037)	-0.094*** (0.036)
	2006–2018	-0.046 (0.042)	-0.078* (0.041)	-0.115*** (0.037)	-0.177*** (0.036)
		Progressive retirement allowance	Meal benefit	Children's education allowance	Private medical insurance premiums
Non-statutory benefits	2006–2010	-0.017 (0.031)	-0.090** (0.043)	-0.013 (0.031)	-0.018 (0.0222)
	2006–2014	-0.015 (0.033)	-0.111** (0.044)	-0.000 (0.032)	-0.023 (0.0223)
	2006–2018	-0.086*** (0.031)	-0.138*** (0.043)	-0.046 (0.031)	-0.080*** (0.0227)

Note: 1) Standard errors are in parentheses.
2) ***, **, and * represent statistical significance with 1%, 5%, and 10% levels, respectively.

choice of individual workers regarding the type of employment contract can be affected by gender, region, and educational background. Therefore, DID estimates in Table 3 may have self-selection bias.

B. Estimation Process of PSM

We perform PSM to solve the selection bias problem as the following procedure. First, the propensity score, which is the probability that the observation belongs to the treatment group, is estimated using probit analysis. Concretely, the dependent variable is set to 1 if the observation is FPDs; and gender, workplace location, marital status, company size, educational background, and occupation are set as control variables. Then, probit analysis is conducted. Through this process, the human characteristics of employees who choose FPDs are confirmed, and the

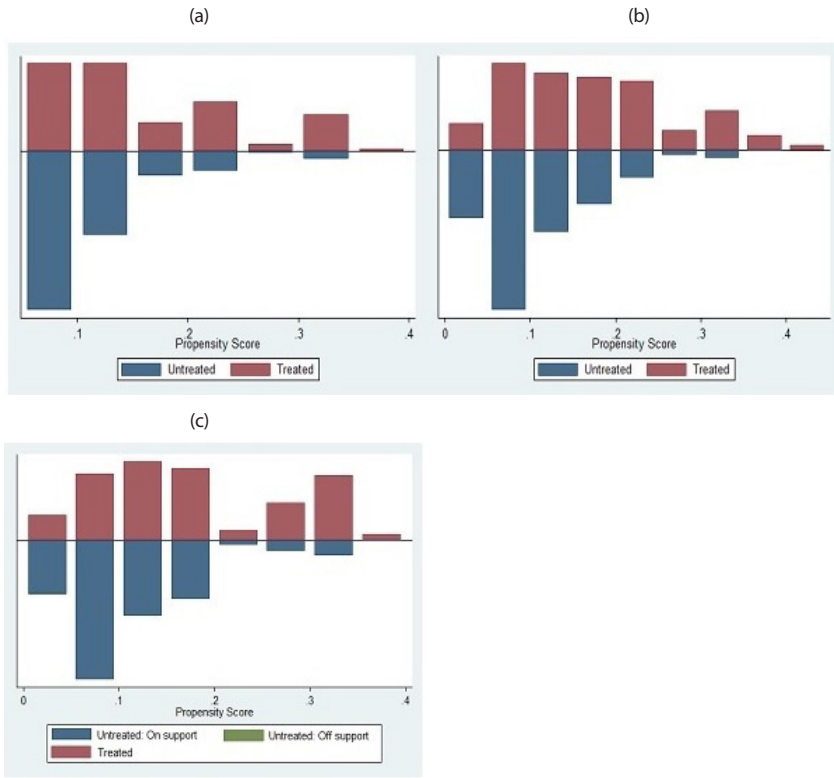
propensity score is estimated. Next, after matching, common support is checked, and the quality of matching is evaluated.

Table 4 shows the results of the probit analysis. Given that the coefficient of gender variable has negative statistical significance, males tend not to choose FPDs. Moreover, most coefficients of occupation variables have negative statistical significance, thus concluding that these occupations will less likely choose the treatment group than the unskilled occupation. Meanwhile, employees tend not to be employed as FPDs as the company size increases, but its coefficient is statistically insignificant. In addition, whether the observations of living in the metropolitan area or attainment at a university or higher have no statistically significant effect on the selection of the type of employment contract.

Rosenbaum and Rubin (1983) showed that self-selection bias can be controlled by using only propensity scores if a strongly ignorable treatment assignment is established for propensity score, even if the data are not randomly extracted. Accordingly, the conditional

Table 4
Probit Analysis for Estimating Propensity Score

	2006–2010			2006–2014			2006–2018		
	Coef.	Std. Er	P > z	Coef.	Std. Er	P > z	Coef.	Std. Er	P > z
Male	-0.480	0.051	0.000	-0.587	0.052	0.000	-0.522	0.050	0.000
Capital area	0.011	0.049	0.823	0.012	0.049	0.803	-0.023	0.048	0.636
University or higher	0.014	0.063	0.828	0.062	0.061	0.306	0.0212	0.056	0.705
100–299 firms	0.090	0.113	0.425	0.127	0.105	0.224	-0.142	0.117	0.226
300 or more firms	-0.039	0.061	0.521	-0.121	0.061	0.048	-0.049	0.061	0.422
Management	-0.490	0.250	0.050	-0.707	0.243	0.004	-1.054	0.310	0.001
Expert	-0.592	0.091	0.000	-0.698	0.090	0.000	-0.600	0.087	0.000
Office worker	-0.628	0.089	0.00	-0.845	0.091	0.000	-0.723	0.090	0.000
Service worker	-0.284	0.100	0.005	-0.294	0.100	0.003	-0.083	0.098	0.399
Sales worker	-0.187	0.109	0.085	-0.420	0.112	0.000	-0.232	0.109	0.034
Skilled worker	-0.552	0.085	0.000	-0.655	0.086	0.000	-0.663	0.089	0.000
Constant	-0.463	0.088	0.000	-0.278	0.088	0.002	-0.377	0.089	0.000
	N 4901	LR chi2(11) 202.67		N 5045	LR chi2(11) 288.44		N 5258	LR chi2(11) 297.91	
	Prob>chi2 0.000	Pseudo R2 0.0575		Prob>chi2 0.000	Pseudo R2 0.0811		Prob>chi2 0.000	Pseudo R2 0.0789	



Note: (a), (b), and (c) represent 2006-2010, 2006-2014, and 2006-2018 data sets, respectively.

Figure 1
Common Support of Propensity Scores

independence assumption and the common support assumption must be satisfied (Dehejia and Wahba, 2002). Here, the common support assumption means that distributions of observable variables in treatment and comparison groups should fall within the same range.

Figure 1 shows the distributions of the estimated propensity score for the treatment and comparison groups on and off the region of common support. These figures visually show that the two groups contain observations with propensity scores across the full range of the distribution after dropping observations off common support. The existence of such substantial overlaps between the characteristics of treatment and comparison groups confirm to us the validity of the

common support assumption. Therefore, we can conclude that the two groups are well-balanced with respect to the propensity score.

The quality of matching can be tested in various ways (Leuven and Sianesi, 2003), but we decided to use the t-test. Table 5 shows the mean values of observations' characteristics before and after matching derived by the t-test.

Both matching are compared for the following reasons. First, whether treatment and comparison groups are similar can be observed through matching. Second, confirming the decrement of bias is possible by examining the degree of decrease in the average difference between the two groups for each variable. Third, matching provides information on the characteristics of a person employed by an irregular worker.

For treatment and comparison groups to be balanced, no statistical difference between the two groups should exist after matching. In other words, if the difference between the two groups after matching is reduced compared with before matching in most variables, both similar groups can be evaluated to be matched with each other.

Table 5 shows that a statistically significant difference exists between the mean values of pre-matching treatment and comparison groups for many variables. By contrast, the mean values of the characteristics of the two groups have no statistically significant differences for all variables after matching. This finding suggests that a self-selection bias might exist in DID estimates without matching. However, the variables are balanced, and self-selection bias is minimized after matching.

Meanwhile, Figure 2 indicates how individual control variables balance before and after matching. Here, the x-axis displays the standardized bias, which is the percentage difference in the sample means in the treated and non-treated subsamples as a percentage of the square root of the average of the sample variances in the treatment and comparison groups (Rosenbaum and Rubin, 1985). This figure shows that the covariate bias between the two groups decreases after matching than before matching.

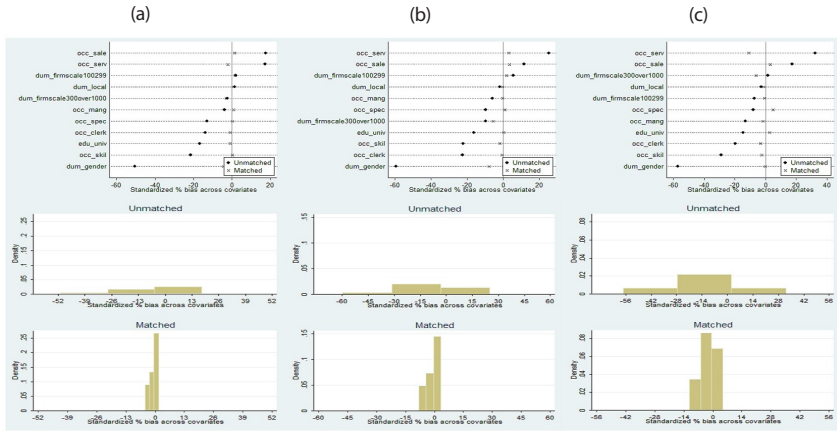
C. Analysis results of matched DID

One of the main concerns of empirical analysis is to obtain an unbiased estimate by controlling the unobserved heterogeneity. PSM makes a very strong assumption that self-selection bias due to unobserved characteristics does not occur in the estimator. However,

Table 5
Comparison of Two Groups Before and After Matching

	Before matching				After matching			
2006–2010	FPDs	Other than FPDs	t	(p > t)	FPDs	Other than FPDs	t	(p > t)
Male	0.392	0.637	-11.380	(0.000)	0.392	0.414	-0.740	(0.458)
Capital area	0.061	0.056	0.500	(0.615)	0.061	0.057	0.290	(0.775)
University or higher	0.736	0.746	-0.540	(0.592)	0.736	0.748	-0.490	(0.624)
100–299 firms	0.257	0.333	-3.640	(0.000)	0.257	0.261	-0.130	(0.893)
300 or more firms	0.009	0.013	-0.810	(0.420)	0.009	0.008	0.160	(0.876)
Management	0.205	0.259	-2.790	(0.005)	0.205	0.204	0.060	(0.955)
Expert	0.177	0.232	-2.980	(0.003)	0.177	0.180	-0.140	(0.887)
Office worker	0.130	0.077	4.320	(0.000)	0.130	0.135	-0.290	(0.773)
Service worker	0.102	0.054	4.490	(0.000)	0.102	0.098	0.220	(0.823)
Sales worker	0.196	0.287	-4.590	(0.000)	0.196	0.194	0.090	(0.929)
Skilled worker	0.541	0.534	0.330	(0.738)	0.541	0.538	0.130	(0.900)
2006–2014	FPDs	Other than FPDs	t	(p > t)	FPDs	Other than FPDs	t	(p > t)
Male	0.355	0.640	-13.360	(0.000)	0.355	0.393	-1.310	(0.189)
Capital area	0.506	0.515	-0.390	(0.699)	0.506	0.508	-0.050	(0.962)
University or higher	0.285	0.361	-3.570	(0.000)	0.285	0.284	0.040	(0.968)
100–299 firms	0.079	0.064	1.360	(0.175)	0.079	0.074	0.310	(0.759)
300 or more firms	0.698	0.742	-2.250	(0.025)	0.698	0.723	-0.940	(0.349)
Management	0.009	0.015	-1.200	(0.228)	0.009	0.009	-0.080	(0.936)
Expert	0.227	0.268	-2.100	(0.036)	0.227	0.223	0.140	(0.890)
Office worker	0.160	0.250	-4.740	(0.000)	0.160	0.162	-0.110	(0.914)
Service worker	0.151	0.072	6.550	(0.000)	0.151	0.141	0.470	(0.638)
Sales worker	0.086	0.056	2.830	(0.005)	0.086	0.077	0.550	(0.584)
Skilled worker	0.176	0.268	-4.750	(0.000)	0.176	0.184	-0.350	(0.723)
2006–2018	FPDs	Other than FPDs	t	(p > t)	FPDs	Other than FPDs	t	(p > t)
Male	0.361	0.636	-13.260	(0.000)	0.361	0.362	-0.040	(0.971)
Capital area	0.497	0.511	-0.680	(0.495)	0.497	0.505	-0.280	(0.781)
University or higher	0.326	0.396	-3.330	(0.001)	0.326	0.313	0.480	(0.631)
100–299 firms	0.046	0.063	-1.630	(0.104)	0.046	0.048	-0.130	(0.896)
300 or more firms	0.754	0.748	0.320	(0.747)	0.754	0.781	-1.100	(0.274)
Management	0.003	0.016	-2.460	(0.014)	0.003	0.005	-0.440	(0.662)
Expert	0.256	0.292	-1.870	(0.062)	0.256	0.234	0.870	(0.386)
Office worker	0.167	0.247	-4.350	(0.000)	0.167	0.180	-0.580	(0.565)
Service worker	0.169	0.066	8.940	(0.000)	0.169	0.204	-1.590	(0.113)
Sales worker	0.098	0.053	4.510	(0.000)	0.098	0.090	0.470	(0.635)
Skilled worker	0.143	0.258	-6.250	(0.000)	0.143	0.153	-0.500	(0.616)

Note: P-values are in parentheses.



Note: (a), (b), and (c) represent 2006–2010, 2006–2014, and 2006–2018 data sets, respectively.

FIGURE 2
STANDARDIZED % BIAS ACROSS COVARIATES BEFORE AND AFTER MATCHING

the absence of unobserved characteristics to influence the policy effect analysis cannot be proven, and unobserved characteristics cannot be used in calculating the propensity score. Fortunately, effective analysis is known to be possible if the matching method based on the observable characteristics of baseline data investigated prior to the enforcement of the legal system is combined with other techniques. In this study, considering that DID, which can control unobservable characteristics, is combined with PSM, controlling bias due to unobservable heterogeneity is possible.

Table 6 shows the results of analyzing the effect of IWPL on welfare benefits payment by combining PSM and DID (*i.e.*, matched DID).[11] The present study estimated the effect of IWPL on the welfare benefit payment through DID using the fact that IWPL is not applied to other than FPDs and is applied to FPDs. In other words, this study uses the FPDs as treatment group and other than FPSs (*e.g.*, regular workers, atypical workers, special form workers, etc.) to which IWPL is not applied are used as comparison group. Therefore, Table 6 shows the

[11] Contact author for details on the estimation results of other control variables.

results of analyzing the effect of IWPL on welfare benefits payment using the treatment group (*i.e.*, covered by IWPL) and comparison group (*i.e.*, not covered by IWPL), which become similar to each other by matching.

Looking at the influence in 2010 with respect to statutory benefits, estimates of statutory retirement allowance and paid leave are statistically insignificant for all bandwidths. Maternity leave and child-care leave decline by approximately 9%–11% and 15%–16% compared with 2006, respectively.

The statistically significant reduction effect on statutory benefits increases over time. Payment rates of maternity leave decrease by 13%–15% in 2014, and 16%–20% in 2018 compared with 2006. The decrease in the payment rate of child-care leave is 17%–19% in 2014 and 21%–24% in 2018. Meanwhile, payment rates of paid leave decrease by 8%–10% in 2014 and 12%–15% in 2018 compared with 2006. The decrease in the payment rate of statutory retirement allowance also continues to increase, but it is only statistically significant in 2018.

Looking at the non-statutory benefit, estimates of progressive retirement allowance in 2010 are statistically insignificant for all bandwidths. Meal benefit and children's provided education allowance decrease by 14% and 9%–11%, respectively, compared with 2006. In addition, private medical insurance premiums decline by approximately 4% at a bandwidth of 0.01 relative to 2006.

Meanwhile, the reduction effect on non-statutory benefits also increases over time. The progressive retirement allowance has a statistically significant decline of 6% at bandwidth 0.06 in 2014 and 8% at bandwidth 0.06 and 0.01 in 2018. The decreases in the payment rate of meal benefit are 16%–19% in 2014 and 17%–18% in 2018, respectively. In addition, payment rates of children's education allowance fell more significantly by 10%–13% in 2014 and 10%–14% in 2018 relative to 2006. The decreases in the payment rate of private medical insurance premiums are 6%–7% in 2014 and 10%–11% in 2018.

Collectively, IWPL is confirmed to have a negative effect on welfare benefits payment, a type of quasi-fixed labor cost. In addition, this reduction effect gradually increases with the passage of time.

These findings confirm that the hypothesis—in which companies ensure long-term and stable employment in the internal labor market by suppressing the expenditure of quasi-fixed labor costs in response to

TABLE 6
ANALYSIS RESULTS OF MATCHED DID

			Statutory retirement allowance	Paid leave	Maternity leave	Child-care leave
Statutory benefits	2006–2010	0.50	-0.057 (0.047)	-0.038 (0.042)	-0.092** (0.041)	-0.149*** (0.033)
		0.06	-0.053 (0.050)	-0.017 (0.047)	-0.100** (0.041)	-0.150*** (0.040)
		0.01	-0.060 (0.044)	-0.024 (0.046)	-0.113** (0.047)	-0.160*** (0.038)
	2006–2014	0.50	-0.042 (0.044)	-0.082* (0.044)	-0.129*** (0.040)	-0.172*** (0.041)
		0.06	-0.064 (0.047)	-0.103** (0.051)	-0.145*** (0.040)	-0.180*** (0.040)
		0.01	-0.057 (0.050)	-0.094* (0.048)	-0.150*** (0.050)	-0.187*** (0.044)
	2006–2018	0.50	-0.088* (0.047)	-0.124*** (0.047)	-0.157*** (0.037)	-0.213*** (0.039)
		0.06	-0.136*** (0.047)	-0.149*** (0.046)	-0.197*** (0.049)	-0.239*** (0.044)
		0.01	-0.141*** (0.051)	-0.154*** (0.050)	-0.197*** (0.044)	-0.232*** (0.044)

			Progressive retirement allowance	Meal benefit	Children's education allowance	Private medical insurance premiums
Non-statutory benefits	2006–2010	0.50	-0.022 (0.032)	-0.144*** (0.050)	-0.096*** (0.030)	-0.035 (0.022)
		0.06	-0.014 (0.028)	-0.143*** (0.049)	-0.106*** (0.036)	-0.039 (0.024)
		0.01	-0.020 (0.031)	-0.139*** (0.051)	-0.113*** (0.037)	-0.042** (0.021)
	2006–2014	0.50	-0.049 (0.038)	-0.162*** (0.050)	-0.101*** (0.036)	-0.063*** (0.023)
		0.06	-0.062* (0.034)	-0.187*** (0.043)	-0.124*** (0.038)	-0.068*** (0.023)
		0.01	-0.051 (0.041)	-0.182*** (0.050)	-0.128*** (0.037)	-0.074*** (0.023)
	2006–2018	0.50	-0.055 (0.035)	-0.177*** (0.044)	-0.104*** (0.040)	-0.108*** (0.029)
		0.06	-0.082** (0.041)	-0.171*** (0.047)	-0.144*** (0.037)	-0.115*** (0.027)
		0.01	-0.081** (0.034)	-0.179*** (0.051)	-0.127*** (0.038)	-0.108*** (0.029)

Note: 1) Standard errors are in parentheses.
2) ***, **, and * represent statistical significance with 1%, 5%, 10% levels, respectively.
3) Bandwidths are 0.50, 0.06, and 0.01.

IWPL—is somewhat reasonable.

For example, employers possibly convert the type of employment contract to special form workers not protected by labor-related laws such as the Labor Standards Act. Although not a study on welfare benefits, Baek and Park (2018) likewise argued that businesses responded to IWPL by partially substituting them with unprotected irregular workers such as subcontract workers. In addition, companies could decrease statutory welfare benefits by applying exception terms of labor-related laws. For instance, in relation to the statutory retirement allowance, the interim settlements of retirement allowances under exceptional terms of the Retirement Benefits Act are widely used. Certainly, employers can decide whether or not to provide non-statutory benefits, thereby allowing them to reduce the latter in response to IWPL.

Meanwhile, the 2013 revision to IWPL that clarified welfare benefits as the object of discrimination prohibition seemed to enhance the negative impact on welfare benefits payment.[12]

With the continuous strengthening of protection policies for irregular workers, such as the conversion to regular workers in the public sector after 2017, the motivation of companies to reduce quasi-fixed labor costs is judged to have gradually increased.

V. Conclusion

Since the 1997 Asian financial crisis, the polarization of wages and welfare benefits by the type of employment contract in the Korean labor market has intensified. In response, the Korean government enacted IWPL, which focuses on non-discrimination in 2007. The reinforcement of labor protection is expected to affect welfare benefits payment—an important part of compensation in addition to wages—by changing enterprises' labor cost structures.

IWPL explicitly prohibits discrimination on welfare benefits. Accordingly, the incentive for companies to reduce welfare benefits is

[12] Discrimination against welfare benefits has been banned by judicial precedent as working condition discrimination other than wages (Supreme Court Decision 2011Du2132 Decided March 29, 2012, Supreme Court Decision 2011Du11792 Decided November 15, 2012). Then, through the revision of IWPL in 2013, the prohibition of discrimination in welfare benefits was clearly stipulated as a legal obligation.

expected to be greater than other types of quasi-fixed labor costs. From the characteristics of personnel management in Korea, a hypothetical mechanism can be proposed that companies ensure long-term and stable employment in the internal labor market by suppressing the expenditure of welfare benefits in response to IWPL.

To test this hypothesis, we set FPDs covered by IWPL as the treatment group and then analyze the effect of IWPL on welfare benefits payment, a sort of quasi-fixed labor cost. However, FPDs are essentially the type of employment contract chosen by the individual worker. Therefore, we construct the comparison group with similar characteristics to the treatment group through PSM to minimize self-selection bias. Then, DID, a representative technique for analyzing the effect of a policy, is performed on two matched groups.

As a result of the analysis, IWPL is confirmed to have a negative effect on welfare benefits payment, a type of quasi-fixed labor cost. Moreover, this reduction effect gradually increases with the passage of time. This finding shows the possibility that companies have minimized the negative employment effect of IWPL and protected the internal labor market by adopting personnel management that reduces quasi-fixed labor costs such as welfare benefits. This negative employment effect seems to have grown over time due to the continuous reinforcement of protection for irregular workers, such as the 2013 IWPL amendment that explicitly stipulated welfare benefits as objects of prohibition of discrimination.

This study is meaningful in that a mechanism of Korean companies in response to EPL is investigated through the theory of quasi-fixed costs. In addition, we confirm the robustness of the conclusion of previous studies that IWPL does not necessarily have a negative effect on employment by using quasi-fixed labor cost as a mediating factor.

This study contains limitations that require attention. First, despite the various types of quasi-fixed labor costs, such as recruitment and dismissal costs and training costs, this study only analyzed the effects on welfare benefits. Future research must analyze further the pattern of other quasi-fixed labor costs mediating the employment effect of IWPL. Second, the results of the placebo test do not completely substantiate the parallel-trend assumption. If the IWPL is assumed to have been actually implemented at some point before 2007, all DID estimation results in Appendix Table 2 should not be statistically significant. In the sense that the result of our placebo test includes positive effects apart

from no effects, the pre-treatment outcomes are probably not balanced between the treatment and comparison groups. This phenomenon seems to originate from the fact that a criterion of the treatment group is the type of employment contract. That is, even with PSM, FPDs and non-FPDs are endogenously selected groups. Future research on IWPL must therefore consider another treatment group setting standard. Third, the dependent variable in the present study is questioned to individual workers but is related to corporate behavior. Therefore, we have attempted to control the characteristics of the company as much as possible even though KLIPS is the individual survey. However, in future research, controlling for human characteristic variables, including age, seems necessary for a more sophisticated analysis.

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Appendix

Appendix Table 1
Control Variables of Treatment and Comparison Groups

	2006		2010		2014		2018	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Less than 100	0.082	0.096	0.287	0.283	0.321	0.271	0.273	0.258
	(0.274)	(0.295)	(0.453)	(0.450)	(0.468)	(0.445)	(0.446)	(0.437)
100 or more and less than 300	0.056	0.041	0.065	0.069	0.095	0.083	0.040	0.079
	(0.230)	(0.197)	(0.247)	(0.254)	(0.294)	(0.275)	(0.196)	(0.270)
300 or more	0.863	0.863	0.648	0.648	0.583	0.646	0.687	0.663
	(0.345)	(0.344)	(0.478)	(0.478)	(0.494)	(0.478)	(0.464)	(0.473)
Management	0.004	0.019	0.012	0.007	0.012	0.012	0.003	0.013
	(0.066)	(0.138)	(0.108)	(0.085)	(0.109)	(0.109)	(0.052)	(0.115)
Expert	0.172	0.256	0.228	0.261	0.265	0.277	0.308	0.319
	(0.378)	(0.437)	(0.420)	(0.439)	(0.442)	(0.448)	(0.462)	(0.466)
Office worker	0.202	0.226	0.160	0.238	0.131	0.269	0.146	0.262
	(0.402)	(0.418)	(0.367)	(0.426)	(0.338)	(0.443)	(0.353)	(0.440)
Service worker	0.103	0.074	0.148	0.079	0.185	0.070	0.210	0.061
	(0.305)	(0.262)	(0.356)	(0.270)	(0.388)	(0.256)	(0.408)	(0.238)
Sales worker	0.107	0.055	0.098	0.054	0.071	0.057	0.093	0.052
	(0.310)	(0.228)	(0.297)	(0.226)	(0.258)	(0.233)	(0.291)	(0.221)
Skilled worker	0.219	0.291	0.180	0.284	0.146	0.250	0.095	0.234
	(0.414)	(0.454)	(0.385)	(0.451)	(0.353)	(0.433)	(0.294)	(0.423)
Unskilled worker	0.193	0.079	0.175	0.077	0.190	0.064	0.146	0.060
	(0.396)	(0.270)	(0.380)	(0.266)	(0.393)	(0.245)	(0.353)	(0.237)
Male	0.421	0.638	0.373	0.635	0.310	0.642	0.324	0.634
	(0.495)	(0.481)	(0.484)	(0.482)	(0.463)	(0.480)	(0.468)	(0.482)
Capital area	0.536	0.529	0.544	0.538	0.485	0.504	0.472	0.499
	(0.500)	(0.499)	(0.499)	(0.499)	(0.501)	(0.500)	(0.500)	(0.500)
University or higher	0.292	0.317	0.234	0.347	0.280	0.395	0.347	0.455
	(0.456)	(0.465)	(0.424)	(0.476)	(0.450)	(0.489)	(0.477)	(0.498)
Number of Obs	233	1,971	338	2,359	336	2,505	377	2,677

Note: (a) and (b) indicate FPDs and other than FPDs, respectively; standard deviations are in parentheses.

Appendix Table 2
Results for Placebo Test

		Statutory retirement allowance	Paid leave	Maternity leave	Child-care leave
Statutory benefits	2003–2005	0.030	0.027	0.008	0.005
		(0.045)	(0.044)	(0.038)	(0.034)
	2004–2006	0.087*	0.056	0.018	0.063*
		(0.044)	(0.042)	(0.039)	(0.036)
		Progressive retirement allowance	Meal benefit	Children education allowance	Private medical insurance premiums
Non-statutory benefits	2003–2005	-0.014	0.121***	0.007	0.040
		(0.032)	(0.046)	(0.034)	(0.029)
	2004–2006	-0.046	0.080*	0.042	0.058**
		(0.031)	(0.047)	(0.035)	(0.025)

Note: 1) Standard errors are in parentheses.
2) ***, **, and * represent statistical significance with 1%, 5%, and 10% levels, respectively.

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