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The Effects of Social Insurance Premium on Employment, Labor Costs, and Revenue: Evidence from Japan*

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Abstract

Expanding the coverage of employees' social insurance leads to higher social insurance premiums paid by firms, potentially affecting employment and firm revenue. We examine these effects using the reform of Japan's social insurance in 2016, which extended the social insurance coverage of part-time workers from those working at least 30 hours per week to those working 20 hours or more per week, as a quasi-natural experiment. Employing a difference-in-differences approach in which we compare firms with a higher share of part-time workers in the pre-reform year and those with a lower share, we obtain the following findings. First, firms substituted significant amounts of part-time workers with regular workers, but not with capital. Second, total labor costs including social insurance premiums paid by firms increased. Third, firms saw a significant increase in sales revenues but a reduction in profit ratios, suggesting that the increased labor costs were primarily absorbed by firms and buyers due to a partial pass-through of labor costs to output prices. Fourth, high-growth firms were more likely to substitute part-time workers with regular workers and to pass the higher labor costs through to output prices.

Keywords: Social insurance premiums, employment, substitution of labor, Japan
JEL classification: J21, J23, J38, H22, H32

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1 Introduction

Expanding the coverage of employees' social insurance potentially has various effects on employment and firm revenue. However, these effects remain not fully understood. Although a substantial body of literature has investigated the effect of payroll taxes on total employment, the evidence is mixed: while early studies found no effect on employment, some recent studies have identified a negative effect. In addition to the total number of workers, the composition of employment may also be affected: the share of workers newly covered by the insurance may decrease as firms substitute them with workers whose labor costs remain unchanged. However, empirical evidence on such a potential shift in workforce composition is still limited. Another important issue is who shoulders the increased social insurance premiums due to the expansion of coverage. If workers bear the additional premium, their net wages will decrease; if firms shoulder the burden, profits will fall; and if consumers bear it, prices will rise, which could lead to higher firm revenue as long as the price elasticity of demand is less than one.

This study seeks to deepen our understanding of these issues using the reform of Japan's social insurance in 2016, which expanded coverage to some part-time workers, as a quasi-natural experiment. Prior to the reform, employees' social insurance – including public pensions and health insurance – covered regular workers and part-time workers working at least 30 hours per week at all corporations. The reform extended coverage to part-time workers working 20 or more but less than 30 hours per week at firms with more than 500 workers. This reform may have encouraged substitution away from part-time workers working 20 to 30 hours per week toward those working 30 hours or more, toward regular workers, or even to capital. It may also have affected firms' sales revenues due to the potential pass-through of labor costs to prices.

To examine these various effects, we use firm-level data from the Basic Survey of Japanese Business Structure and Activities (BSJBSA) published by the Ministry of Economy, Trade, and Industry (METI). The BSJBSA contains information on the number of regular workers, the number of part-time workers, the average hours worked by part-time workers, total labor costs, tangible capital, and sales revenue. We first identify treated and control firms depending on whether firms had more than 500 workers or 500 or fewer workers in the observation period from FY2013 to FY2019. Next, we divide treated firms into high and low-exposure firms depending on whether the share of part-time workers was more than the maximum of the control firms (49.68%) in FY2015, i.e., before the reform, or equal to or less than that. We assume that treated firms with a higher share of part-time workers were more highly exposed to the increase in coverage. We then conduct a difference-in-differences (DID) analysis, comparing low-exposure treated and control firms. We find that, on average, the reform had no statistically significant effect on the number of workers, composition of employment, total labor costs, sales revenue, or profit-to-sales ratio. This is not surprising, given that both the low-exposure treated and control firms exhibited relatively low shares of part-time workers. Next, we

conduct a DID approach comparing high-exposure firms and low-exposure firms to obtain the following findings. First, on average, the number of part-time workers and their hours worked decreased more while the number of regular workers increased more at high-exposure firms than low-exposure firms. This result indicates that high-exposure firms substituted part-time workers working relatively long hours (presumably workers working between 20 and 30 hours) with those working relatively short hours (presumably less than 20 hours) and regular workers to a greater extent than low-exposure firms. Second, nonetheless, the total wage bills of high-exposure firms increased more than those of low-exposure treated firms, indicating that high-exposure firms were unable to fully offset the increase in labor costs due to the reform through changes in labor composition. Third, high-exposure firms' sales revenues significantly increased more than those of low-exposure firms, likely reflecting the pass-through of labor costs to output prices and implying that buyers bore part of the increase in social insurance contributions. Fourth, high-exposure firms' profit-to-sales ratios decreased significantly more than those of low-exposure firms, indicating that high-exposure firms shouldered part of the increase in social insurance contributions. Fifth, dividing firms in the high-exposure group into low- and high-growth firms, we find that high-growth firms saw a larger increase in the number of regular workers, total labor costs, and sales revenues, suggesting that high-growth firms were more likely to substitute away from part-time workers with shorter hours to part-time workers with longer hours and regular workers and to pass on the higher labor costs to prices.

This study contributes to the literature on the effects of social insurance contributions on employment and their incidence in three ways. First, we provide new evidence indicating a clear negative effect on the number of workers who were newly covered by employees' social insurance, whereas extant studies obtain mixed results on the number of workers who were covered by social insurance. Some early studies found that payroll taxes had no significant effect on employment (Gruber (1997) for Chile, Korkeamaki and Unsitalo (2009) and Huttunen et al. (2013) for Finland, and Bennmarker et al. (2009) for Sweden). In contrast, other studies have found a negative effect on employment (Kangasharju (2007) for Finland, Garsaa and Levratto (2015) for France, Collischon et al. (2021) for Germany, Saez et al. (2019) for Sweden, and Benzarti and Harju (2021a, b) for Finland). Second, we examine the substitution effect from workers whose labor costs increased due to the reform to those whose labor costs remained unchanged – a relatively underexplored area, with the exception of studies by Collischon et al. (2021) and Benzarti and Harju (2021a). Collischon et al. (2021), exploiting wage subsidy reforms in the German Minijob program, investigate substitution between subsidized and non-subsidized labor demand, finding that greater subsidization of Minijob employment crowds out non-subsidized employment. Similarly, using variation in payroll tax rates in Finland as a quasi-natural experiment, Benzarti and Harju (2021a) find that as payroll taxes increase, firms substitute away from low-skilled, routine, and manual workers. Although our data do not allow us to distinguish between part-time workers who were newly covered by employees' social insurance

and those who had been covered, our results for the average working hours of part-time workers indicate substitution from the former to the latter. Third, we present evidence indicating that firms partially passed on the increased burden of social insurance premiums to product prices, implying that consumers bore part of the burden. While some studies show that workers bear most of the incidence of payroll taxes (Gruber, 1997; Korkeamaki and Unsitalo, 2009; Bennmarker et al., 2009; and Huttunen et al., 2013), other studies show that firms bear most of it (Saez et al., 2019; and Benzarti and Harju, 2021a, 2021b). For example, examining an employer payroll tax rate cut for young workers in Sweden, Saez et al. (2019) observe no effect on net-of-tax wages of young workers, but find that firms employing many young workers received a larger tax windfall, leading to increased employment, capital, and sales. Meanwhile, Benzarti and Harju (2021a), focusing on Finland, report that payroll taxes had no effects on net-of-payroll-tax wages while they decreased employment, capital, and sales, suggesting that the reduction in sales was a consequence of reduced production due to lower input use through the cash effect or marginal cost effect of payroll taxes. Finally, Benzarti and Harju (2021b) find that although the payroll tax cuts had no effect on labor costs net of payroll taxes, employment, investment, or sales prior to the Great Recession, they had a significant positive effect on labor costs net of payroll taxes and employment at the time of the Great Recession. In contrast, our study shows that the increase in social insurance premiums had a positive effect on sales revenues. Furthermore, unlike these studies, our study distinguishes low- and high-growth firms and finds that high-growth firms saw a larger increase in sales revenues as a result of the increase in social insurance premiums, suggesting that their products were more differentiated and these firms therefore found it easier to pass on the increase in labor costs to prices.

In the broader context of labor market interventions, this study is also related to the literature on firms' responses to minimum wage policies. Research in this area has documented a range of responses, including price pass-through (Leung, 2021; Harasztosi and Lindner, 2019; Aaronson and French, 2007) and factor substitution (Aaronson et al., 2018; Aaronson and Phelan, 2019; Lordan and Neumark, 2018). Similar to these findings, our study observes both price pass-through and adjustment in input factors in response to an increase in social insurance premiums; however, the mechanisms underlying the effect of minimum wages and social insurance premiums potentially differ. For example, while a minimum wage hike may increase employment in a monopsonic labor market (Aaronson and French, 2007), higher social insurance premiums raise marginal costs and thereby decrease labor demand even in a monopsonic labor market.

The remainder of this study is organized as follows. Section 2 provides a brief overview of Japan's employees' social insurance system and presents a simple theoretical framework for understanding firms' responses to higher social insurance premiums. Next, Section 3 presents our data and empirical approach, while Section 4 reports the estimation results. Finally, Section 5 concludes.

2 Japan's employees' social insurance reform

2.1 Overview of the employees' social insurance system in Japan

In the Japanese social security system, employees' social insurance primarily consists of employees' pension and health insurance. Employees' pension insurance is administered by the central government through the Japan Pension Service (JPS). Since September 2017, premiums for this pension insurance, which are evenly shared between workers and firms, have been set at 18.3% of monthly salaries as well as bonuses. Workers covered by the pension insurance receive both basic and earnings-related pension benefits. In contrast, the provision of employees' health insurance varies according to the size and sector of the employing firm. For employees of small and medium-sized enterprises (SMEs), health insurance is provided by the Japan Health Insurance Association (JHIA), and premium rates are determined by prefecture based on local medical expenses. The average insurance premium rate across the 47 prefectures stood at 10% as of March 2025. The premiums are also equally shared between workers and firms. For employees of large firms, health insurance is managed by health insurance unions (HIUs) established by individual firms or industries. In this case, premium rates are set by each union, with an average rate of 9.31% across all unions as of March 2024, and the sharing of premiums between workers and firms is determined by the union and may not be equal. Moreover, mutual aid associations provide health insurance coverage for workers in government, public schools, and private schools.

Focusing on corporations, the employees' social insurance system has historically covered full-time workers and part-time workers who work 30 hours or more per week, but it did not extend coverage to part-time workers whose weekly hours were below this threshold.[1] Among part-time workers not covered by employees' social insurance, homemakers with spouses enrolled in the system received medical and basic pension benefits without paying social insurance premiums themselves, and firms were not required to contribute premiums for these individuals either. Other part-time workers – such as single individuals, spouses of sole proprietors, or individuals aged 60 and above – received medical and basic pension benefits if they paid national pension and health insurance premiums on their own. However, part-time workers who worked less than 30 hours per week remained ineligible for the sickness and injury benefits as well as the earnings-related pension benefits available to those insured under the employees' social insurance system.

Since around 2000, the government began discussing expanding employees' social insurance coverage to provide more generous benefits to part-time workers. To avoid a rapid increase

[1] While the employees' social insurance system is mandatory for corporations, it is not compulsory for sole proprietors except in 17 industries specified by law, or in business establishments with fewer than five employees. However, sole proprietors in industries outside the designated 17 or with fewer than five employees may elect to participate in the employees' social insurance system if both the employer and employees agree to enroll.

in costs that could negatively affect firms' performance, the reforms were implemented gradually. The 2012 reform, which was enacted in August 2012, required the employees' social insurance system to include part-time workers who (1) worked 20 or more but fewer than 30 hours per week, (2) earned at least 88,000 yen per month (about 1.06 million yen per year), (3) were not students, (4) had been employed for at least one year, and (5) worked for firms with more than 500 workers (including both full-time and part-time workers working 30 hours or more per week), with implementation beginning in October 2016.

The 2016 reform, enacted in December 2016, enabled employees' social insurance coverage for part-time workers at firms with up to 500 workers, starting in April 2017 if both the employer and employees agreed to enroll. The reform also mandated coverage for part-time workers employed by central and local governments, regardless of workforce size.

The 2020 reform, enacted in May 2020, removed the requirement of one year or more of continuous employment and expanded insurance coverage to part-time workers at firms with more than 100 workers beginning October 2022,[2] and further expanded it to part-time workers at firms with more than 50 workers in October 2024.

2.2 Theoretical analysis of the 2012 reform

Focusing on the 2012 reform, we theoretically examine changes in the employment of part-time workers in response to the reform. Table 1 shows the social insurance premium rates faced by part-time workers who satisfied conditions (1) to (5) and their employers (in the case of large firms) before and after the 2012 reform came into effect in FY2016. As can be seen, social insurance premium rates for type 1 part-time workers – homemakers whose spouses were enrolled in employees' insurance – and firms increased by a total of about 13.2 percentage points and by a total of about 14 percentage points, respectively.[3] In contrast, social insurance premium rates for type 2 part-time workers – unmarried individuals and spouses of sole proprietors – decreased by a total of about 9.3 percentage points as a result of the reform. The reason is that type 2 part-time workers who met the earnings threshold previously paid a fixed amount in social insurance premiums, which resulted in a higher social insurance premium rate before the reform.

Table 1. Social insurance premium rates for eligible part-time workers and firms (large firms) before and after the 2012 reform became effective in FY2016

	Before the reform (FY2015)	After the reform (FY2016)

[2] The 2020 reform expanded the coverage of the employees' insurance system to sole proprietors in 17 designated industries. This included the previously selected 16 industries, as well as an additional category introduced in October 2022, consisting of lawyers, certified public accountants, etc.

[3] In contrast, SMEs and their employees faced an equal increase in the social insurance premium rates.

(a) Part-time workers (type 1): Homemakers whose spouses were enrolled in employees' insurance	**0%**	Employees' pension insurance: **9.091%** Employees' health insurance provided by HIUs: **4.151%** (average of all HIUs) Total: **13.242%**
(b) Part-time workers (type 2): Single individuals and spouses of sole proprietors	National pension insurance: **17.72%** [1)] National health insurance: **4.87%** [2)] Total: **22.59%**	
(c) Firms	**0%**	Employees' pension insurance: **9.091%** Employees' health insurance provided by HIUs: **4.953%** (average of all HIUs) Total: **14.044%**

Notes:

1) Since the national pension insurance premium was set as a fixed amount of 15,590 yen in FY 2015 regardless of earnings, we define the insurance premium rate as the ratio of 15,590 yen to 88,000 yen (the monthly earnings threshold for employees' pension insurance eligibility).

2) The national health insurance premium is calculated based on the following formula:

Insurance premium = Income * Insurance premium rate + Fixed amount per capita

The insurance premium rate and fixed amount per capita are set independently by each municipality. As an example, we present the case of Ota Ward in Tokyo. Income is calculated as annual earnings minus deemed expenses and the basic deduction. We set annual earnings to 1.06 million yen, the threshold for eligibility for employees' insurance. Deemed expenses are assumed to be 650,000 yen, and the basic deduction is set at 330,000 yen, regardless of earnings. Ota Ward set the insurance premium rate and fixed amount per capita as 8.43% and 44,700 yen, respectively. For simplicity, we omit insurance premiums and the fixed amount per capita for long-term care services. Based on these parameters, the total annual health insurance premium amounts to 51,444 yen. To express this as a monthly premium rate, we divide the annual premium by 12, yielding 4,287 yen per month, and then calculate the rate as the ratio of 4,287 yen to the monthly earnings threshold of 88,000 yen.

We start by graphically examining changes in part-time employment in response to the 2012 reform. Since social insurance premiums differed between type 1 and type 2 part-time workers before the reform, we first describe how the level of part-time employment is determined for each type individually. Note that the following analysis applies regardless of whether the labor market is competitive or monopsonistic. Figure 1 presents a simple demand and supply model of the labor market. The horizontal axis represents the level of part-time employment, while the vertical axis indicates the wage. The upward-sloping line S_0 represents the supply of part-time labor in the absence

of social insurance premiums, while the downward-sloping line D_0 represents the demand for labor by firms in the absence of social insurance premiums. The equilibrium without insurance premiums is achieved at (E_0, W_0).

The insurance premiums for part-time workers and their employers introduced as part of the 2012 reform -- levied on wages paid by firms and represented by p_f, reduce the demand for labor, shifting the demand curve downward to D_1. For type 1 part-time workers (i.e., homemakers whose spouses are enrolled in employees' insurance), the insurance premium levied on wages received by part-time workers, p_e, reduces labor supply, shifting the supply curve upward to S_1. Given that p_f is larger than but almost equal to p_e, the shifts reduce the wage that workers receive to W_1 as long as the elasticity of labor demand is larger than that of labor supply, increase the wage that firms pay to $W_1(1 + p_f)$ unless the elasticity of demand is infinity or the elasticity of supply is zero, and reduce employment to E_1 unless the elasticity of labor demand or labor supply is zero.

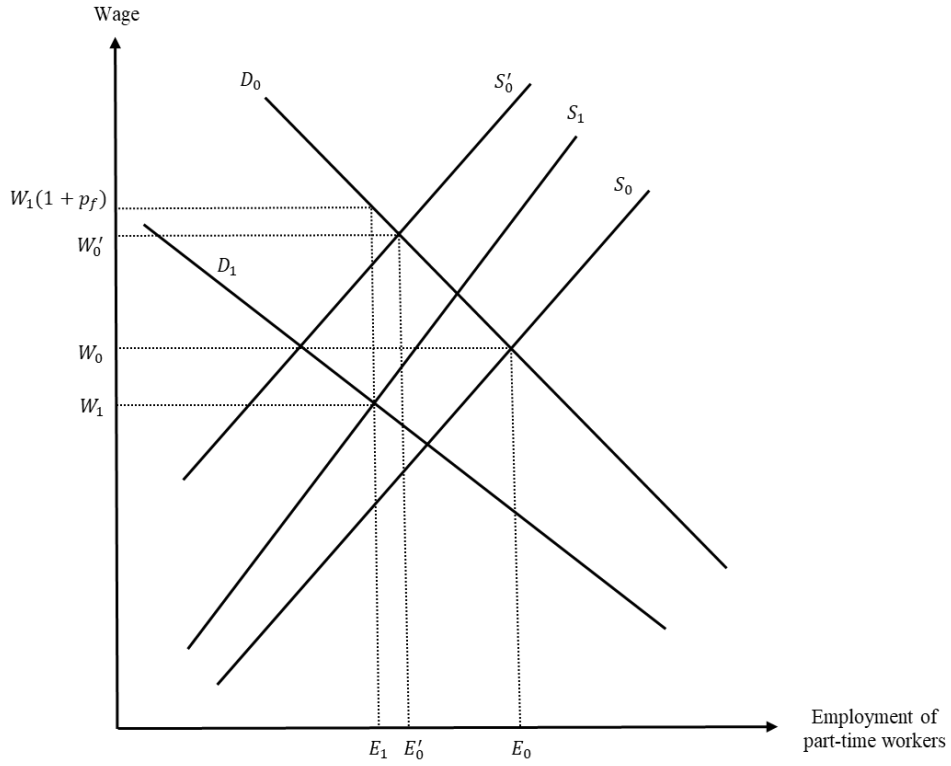
Next, in the case of type 2 part-time workers (i.e., single individuals and spouses of sole proprietors), the labor supply curve before the reform is S_0', which lies above S_0, since these workers were already subject to insurance premium p_e. The equilibrium before the reform is achieved at (E_0', W_0'). After the reform, the insurance premium rate p_f levied on wages paid by firms shifts the demand curve to D_1. Since the reform reduces the insurance premium paid by workers, p_e, the supply curve shifts downward to S_1. Given that $|\Delta p_e|$ is smaller than p_f, the shifts in the demand and supply curves reduce the wage that workers receive to W_1, increase the wage that firms pay to $W_1(1 + p_f)$ unless the elasticity of demand is infinity or the elasticity of supply is zero, and reduce employment to E_1 unless the elasticity of labor demand or labor supply is zero.

While the reform imposes insurance premiums on part-time workers and their employers, it also offers more generous benefits than before. As highlighted by Summers (1989), if insurance premiums directly finance benefits received by workers, the resulting increase in benefits can shift the labor supply curve downward. In this case, there would be no rise in the wage that firms pay and no decrease in employment. However, because Japan's social insurance system operates on a pay-as-you-go basis, the extent to which those who contribute through premiums directly enjoy the benefits is limited. As a result, we cannot expect a downward shift in labor supply, if any, sufficient to fully offset the employment-reducing effects of the insurance premiums.

In the actual market for part-time workers, labor demand for part-time workers is the sum of labor demand for type 1 and type 2 part-time workers. Similarly, the labor supply of part-time workers is the sum of the labor supply of type 1 and type 2 part-time workers. Thus, based on the preceding discussion, a reform such as the 2012 reform is expected to reduce the wage received by workers as long as the elasticity of labor demand is larger than that of labor supply, increase the wage that firms pay unless the elasticity of demand is infinity or the elasticity of supply is zero, and reduce employment unless the elasticity of labor demand or labor supply is zero. However, it is not a priori

clear whether such a reform will result in a decrease in the wage received by workers if the elasticity of labor demand is smaller than that of labor supply.

Figure 1. Effects of the 2012 reform on wages and employment of part-time workers



3 Data and empirical methods

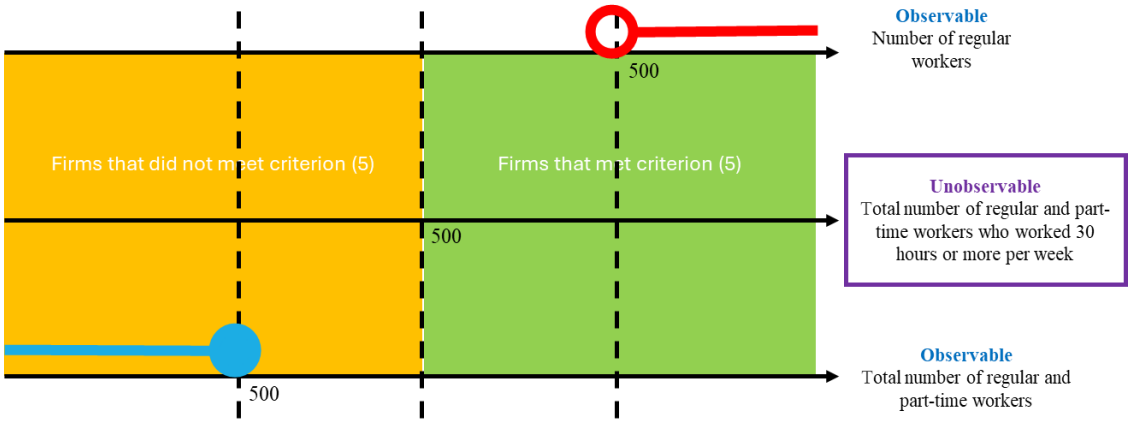
3.1 Data

To examine how changes in the insurance premium rate affect firm-level activities such as employment, capital accumulation, and production, we use the 2012 reform as a quasi-natural experiment. To identify firms affected by the 2012 reform (treated firms) and those that were not affected (control firms), we use data from the BSJBSA for FY2013 to 2019. We exclude data from the period after 2019 to avoid the confounding effects of the COVID-19 pandemic on firm activities. This survey covers firms with 50 or more workers and capital of 30 million yen or more, comprising a population of 41,991 firms in FY2023, with a response rate of 89.8%. Treated firms are defined as those that employed part-time workers newly covered by the employee insurance system under the reform, i.e., part-time workers who (1) worked between 20 and 30 hours per week, (2) earned 88,000 yen or more per month, (3) were not students, (4) had been employed for at least one year, and (5) worked for firms

with more than 500 workers (full-time workers and part-time workers working at least 30 hours per week). However, since the BSJBSA does not include information on criteria (2) through (4), we define treated and control firms based on criteria (1) and (5) only.

Starting with criterion (5), while the BSJBSA does not provide the total number of full-time and part-time workers who work 30 hours or more per week, we can identify firms that met criterion (5) using the number of regular workers (e.g., full-time workers) and part-time workers provided in the BSJBSA. Figure 2 illustrates this distinction: the green-shaded area represents firms that met criterion (5) based on the threshold (500) of the total number of full-time and part-time workers who worked 30 hours or more per week, while the orange-shaded area shows firms that did not meet criterion (5). Since we cannot observe the total number of employees meeting the 30-hour threshold, we classify firms as satisfying criterion (5) if their number of regular workers exceeded 500. Conversely, we identify firms as not meeting criterion (5) if their total number of regular and part-time workers was 500 or less. To make the difference in the number of regular workers between the treated and control groups as small as possible and to focus on firms that remained in the same group throughout the FY2013-2019 period, we restrict the treated group to firms with more than 500 but no more than 2,000 regular workers during the period, while we restrict the control group to firms with more than 200 regular workers but no more than 500 workers (both regular and part-time) throughout FY2013-2019.

Figure 2. Identification of firms that met criterion (5)



Next, regarding criterion (1), while the BSJBSA does not provide the share of part-time workers who worked between 20 and 30 hours per week, it does report total weekly working hours for part-time workers divided by 40 hours. Using this information, we can calculate the average weekly working hours for part-time workers using the following equation:

$$\frac{\text{Total weekly working hours of part-time workers}}{\text{Number of part-time workers}}.$$

To focus on firms that were likely affected by the 2012 reform when it took effect in FY2016, we further restrict the sample to firms whose part-time workers had an average weekly working time of between 20 and 30 hours in FY2015.

3.2 Empirical approach

Next, we explain our empirical approach. Specifically, we divide treated firms into high- and low-exposure firms depending on whether the share of part-time workers was more than the maximum of the control firms (49.68%) in FY2015 or equal to or less than that. We assume that treated firms with a higher share of part-time workers were more highly exposed to the increase in coverage. We then begin with the difference-in-differences (DID) analysis, comparing low-exposure treated and control firms. This is followed by the DID analysis comparing high- and low-exposure firms.

Low-exposure treatment group vs. control group

To examine how changes in the insurance premium rate affect firm-level outcomes, we first estimate the following equation:

$$Y_{it} = \alpha + \beta D_{\text{Treatment}} \times POST_t + \theta POST_t + \mu_i + \varepsilon_{it}, \qquad (1)$$

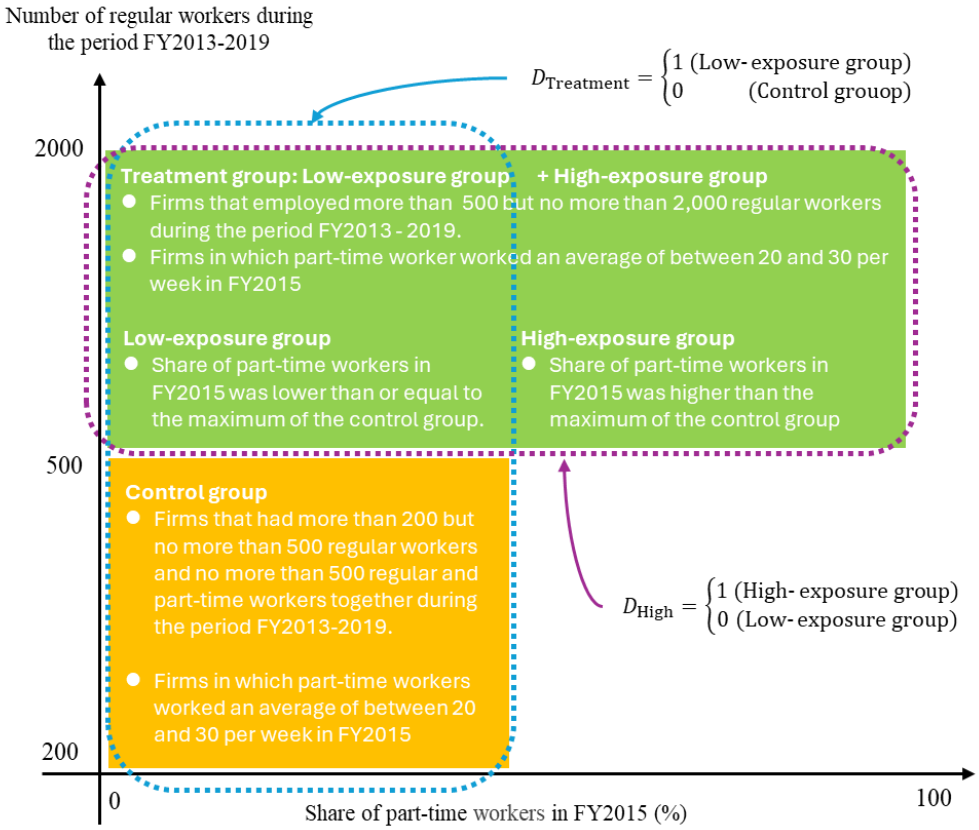
where Y_{it} represents the outcome variable for firm *i* in fiscal year *t*. We use eight outcome variables, each measured in logarithmic terms for firm *i* in fiscal year *t*: (1) average weekly working hours of part-time workers, (2) the number of part-time workers, (3) the number of regular workers, (4) total hours worked, (5) total labor costs (including firms' contributions to social insurance premiums), (6) tangible fixed assets, (7) sales revenue, and (8) the ratio of operating profit in fiscal year *t* to sales in the base fiscal year (2015).[4] The treatment indicator, $D_{\text{Treatment}}$, is a binary variable equal to one if a firm is classified as treated by the 2012 reform, and zero otherwise. Specifically, as outlined in Section 3 and illustrated in Figure 3, treated firms are those employing more than 500 but no more than 2,000 regular workers during the period FY2013-2019 and whose part-time workers on average worked between 20 and 30 hours per week in FY2015. The control group consists of firms that employed more than 200 regular workers but no more than 500 workers (both regular and part-time) during the period FY2013-2019 and whose part-time workers on average worked between 20 and 30 hours per week in

[4] Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40.

FY2015.

However, it turns out that the average share of part-time workers in the treatment group defined as above is much higher than that of the control group (27% vs. 10%). We therefore divide the treatment group defined in Section 3.1 into two subgroups: a *low-exposure group*, consisting of firms whose share of part-time workers is less than or equal to the maximum observed in the control group in FY2015 (i.e., 49.68%), and a *high-exposure group*, consisting of firms whose share of part-time workers is higher than the maximum observed in the control group in FY2015. We assume that treated firms with a higher share of part-time workers were more highly exposed to the increase in coverage. We then exclude firms in the high-exposure group when constructing $D_{\text{Treatment}}$. Consequently, $D_{\text{Treatment}}$ takes one if a firm belonged to the low-exposure group, and zero if it belonged to the control group. $POST_t$ is a dummy variable that takes one for FY2016-2019, and zero for FY2013-2015. μ_i and ε_{it} represent the firm fixed effect and the error term for firm i in fiscal year t, respectively. The coefficient β captures the average DID effect in the post-reform period (FY2016-2019).

Figure 3. Definitions of the treatment and high exposure dummies



Next, we examine the year-by-year DID effects by estimating the following equation:

$$Y_{it} = \alpha + \sum_t \beta_t D_{\text{Treatment}} \times Year_t + \sum_t \theta_t Year_t + \mu_i + \varepsilon_{it} \qquad (2).$$

All variables, apart from $Year_t$, are the same as those in Equation (1). $Year_t$ is a dummy variable that takes one if *t* is FY *t*, and zero otherwise. β_t represents the DID effect in FY t when $t \geq 2016$ and the pre-trend (if present) when $t \leq 2014$.

High-exposure group vs. low-exposure group

Next, we examine to what extent the effects of the reform depend on the degree of exposure to the reform as measured by the share of part-time workers. Specifically, limiting the sample to treated firms, we estimate the following equation:

$$Y_{it} = \alpha + \beta D_{\text{High}} \times POST_t + \theta POST_t + \mu_i + \varepsilon_{it} \qquad (3),$$

where D_{High} takes one if a firm belonged to the high-exposure group, and zero if it belonged to the low-exposure group. Thus, our comparison focuses on the high- and low-exposure groups within the same firm size category (shown in Figure 3). The low-exposure group consists of treated firms that were likely less affected by the reform due to a relatively lower share of part-time workers, i.e., potentially a lower share of employees newly covered by the employees' insurance. In contrast, the high-exposure group consists of treated firms likely more strongly affected by the reform due to a higher share of part-time workers. It should be noted that firm-level responses in part-time employment may be smaller than the market-level response illustrated in Figure 1 when the share of part-time workers is relatively low.

We further examine the year-by-year effects by estimating Equation (2), replacing $D_{\text{Treatment}}$ with D_{High}.

Heterogeneous effects among high-exposure firms

We further examine the heterogeneous DID effects of high exposure to the reform depending on firms' sales growth. High-growth firms may have stronger incentives and greater capacity to adjust their labor composition and pass labor costs through to product prices. Specifically, we estimate the following equation:

$$Y_{it} = \alpha + \beta D_{\text{High}} \times POST_t + \gamma D_{Growth} \times POST_t + \delta D_{Growth} \times D_{\text{High}} \times POST_t + \theta POST_t + \mu_i + \varepsilon_{it} \qquad (4),$$

where D_{Growth} takes one if a firm's sales growth rate was above the median in FY2015 for all treated firms, the year before the reform, and zero otherwise. The coefficient δ denotes the difference in DID effects between high- and low-growth firms.

We further examine year-by-year effects by estimating the following equation:

$$Y_{it} = \alpha + \sum_t \beta_t D_{\text{High}} \times Year_t + \sum_t \gamma_t D_{\text{Grwoth}} \times Year_t + \sum_t \delta_t D_{\text{Grwoth}} \times D_{High} \times Year_t + \sum_t \theta_t Year_t + \mu_i + \varepsilon_{it} \qquad (5),$$

where δ_t denotes the difference in DID effects between high- and low-growth firms in FY t when $t \geq 2016$ and the pre-trend (if present) when $t \leq 2014$.[5]

3.3 Descriptive statistics

Table 1(a) shows the descriptive statistics for the treatment dummy variables and the share of part-time workers in FY2015 for the three groups shown in Figure 3. The treatment dummy variable labelled $D_{Treatment}$ is used to compare the control and low-exposure groups, while the high-exposure dummy variable labelled D_{High} is used to capture differences between the low- and high-exposure groups. The average share of part-time workers is nearly identical between the control and low-exposure groups, while the high-exposure group has a much larger average share than the low-exposure group.

Table 1(b) reports descriptive statistics for the eight outcome variables over FY2013-2019 for the three groups. Comparing the control and low-exposure groups, the mean value of the average working hours of part-time workers for the low-exposure group is slightly shorter than that for the control group, while the mean values of the other outcome variables for the low-exposure group are larger than those for the control group. Since firms in the low-exposure group are larger than those in the control group by definition in terms of the number of regular workers, it is natural that firms in the low-exposure group are larger than the control group in terms of the mean values of employment of

[5] Another source of heterogeneous effects may lie in differences across industries, especially between those with a high and low share of part-time workers. Specifically, three industries – retail, accommodation and food services, and personal services and entertainment – exhibit substantially higher average shares of part-time workers (about 76%, 77%, and 74%) than other sectors in the high-exposure group. Given such differences, we examined the heterogeneous DID effects of high exposure to the reform between these three industries on the one hand and other industries on the other. The estimation results using equations (4) and (5) and replacing the high-growth dummy with a dummy for firms in the three industries indicate that there are almost no differences in the effects between the three industries and other industries except with regard to the average working hours of part-time workers and the profit-to-sales ratio (not reported).

part-time workers, total hours worked, labor costs, capital, and sales revenue as well.

Next, comparing the low- and high-exposure groups, the mean value of average working hours of part-time workers and the profit-to-sales ratio are lower in the high-exposure group than in the low-exposure group, while the mean values of the other outcome variables are higher in the high-exposure group. These statistics in Table 1 for the two groups suggest that a higher share of part-time workers is likely to be associated with higher levels of part-time and regular employment, total hours worked, labor costs, capital, and sales revenue.

Table 1. Descriptive statistics

(a) Treatment dummy variables and share of part-time workers in FY2015: Mean values

	Control group	Low-exposure treatment group	High-exposure treatment group
$D_{\text{Treatment}}$	0	1	
	(0.00)	(0.00)	
D_{High}		0	1
		(0.00)	(0.00)
Share of part-time workers	0.10	0.11	0.74
	(0.10)	(0.11)	(0.11)
Number of observations	564	382	127

(b) Outcome variables for FY2013-2019: Mean values

	Control group	Low-exposure treatment group	High-exposure treatment group
Average weekly working hours of part-time workers	28.10	27.60	24.57
	(5.65)	(5.41)	(4.05)
Number of part-time workers	39	147	3736
	(41)	(236)	(3425)
Number of regular workers	298	895	962
	(66)	(335)	(329)
Total hours worked	325	994	3227
	(69)	(391)	(2288)

Total labor costs (Million yen)	1655	5463	9681
	(593)	(2795)	(6271)
Tangible fixed assets (Million yen)	3505	12273	20512
	(4031)	(19860)	(26585)
Sales revenue (Million yen)	17205	57879	89953
	(21548)	(72537)	(73741)
Profit-to-sales ratio	0.040	0.042	0.031
	(0.048)	(0.049)	(0.036)
Number of observations	3948	2674	889

Notes: Standard deviations are shown in parentheses. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year *t* divided by sales revenue in the base year (FY2015). The number of observations for tangible fixed assets is 3,947 for the control group and 882 for the high-exposure group. The number of observations for the profit-to-sales ratio is 3,935 for the control group, 2,651 for the low-exposure group, and 875 for the high-exposure group.

4. Estimation results

4.1 Low-exposure treatment group vs. control group

Table 2 reports the average DID estimates of the treatment effect over the post-reform period from 2016 to 2019. These estimates represent the changes in the average outcome variables before and after the reform for the treatment group (i.e., the low-exposure group) relative to the corresponding changes for the control group. The results indicate that, on average, the reform had no statistically significant effect on the outcome variables during the period.

Table 2. DID estimates of the effects of low exposure to the reform over the post-reform period

	Dependent variable:			
	(1)	(2)	(3)	(4)
	Average weekly working hours of part-time workers	Number of part-time workers	Number of regular workers	Total hours worked
POST	0.042 ***	0.177 ***	0.029 ***	0.041 ***
	(0.009)	(0.024)	(0.004)	(0.004)
$D_{\text{Treatment}}$*POST	-0.006	-0.006	-0.009	-0.007
	(0.014)	(0.044)	(0.007)	(0.008)

Constant	3.281	***	3.421	***	6.089	***	6.175	***
	(0.004)		(0.012)		(0.002)		(0.002)	
Firm fixed effects	Yes		Yes		Yes		Yes	
R-squared (Within)	0.0092		0.0268		0.027		0.0556	
Number of obs.	6,622		6,622		6,622		6,622	

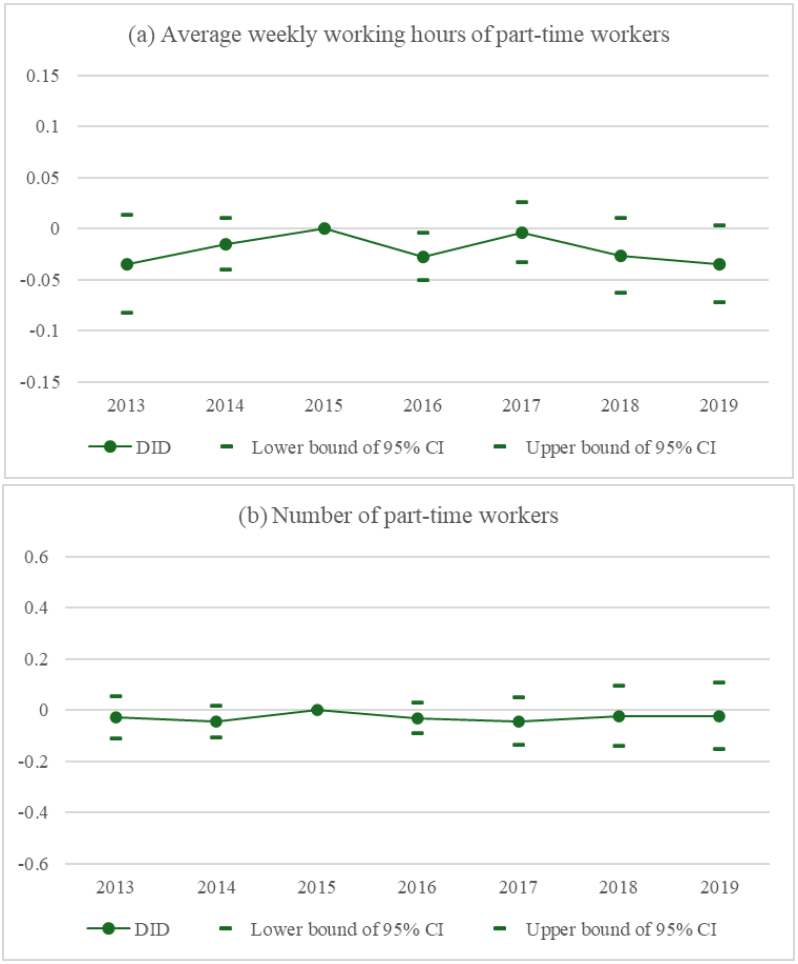
	Dependent variable:							
	(5)		(6)		(7)		(8)	
	Total labor costs		Tangible fixed assets		Sales revenue		Profit-to-sales ratio	
POST	0.064	***	0.090	***	0.048	***	0.006	***
	(0.007)		(0.013)		(0.006)		(0.001)	
$D_{\text{Treatment}}$*POST	-0.007		-0.017		0.0001		-0.001	
	(0.011)		(0.022)		(0.010)		(0.002)	
Constant	7.775	***	7.831	***	9.806	***	0.038	***
	(0.003)		(0.006)		(0.003)		(0.001)	
Firm fixed effects	Yes		Yes		Yes		Yes	
R-squared (Within)	0.0457		0.0273		0.0494		0.013	
Number of obs.	6,622		6,621		6,622		6,586	

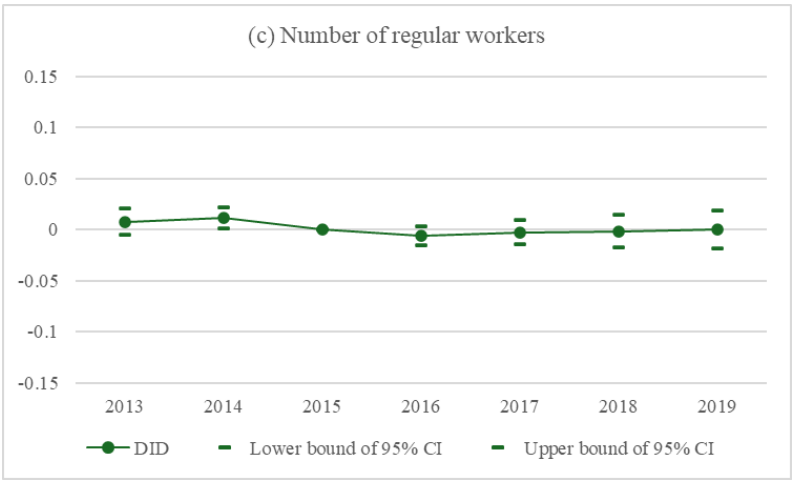
Notes: All dependent variables are in logarithmic form. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year *t* divided by sales revenue in the base year (FY2015). POST is a dummy variable that takes one for FY2016 to 2019, and zero for FY2013 to 2015. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors clustered at the firm level are shown in parentheses.

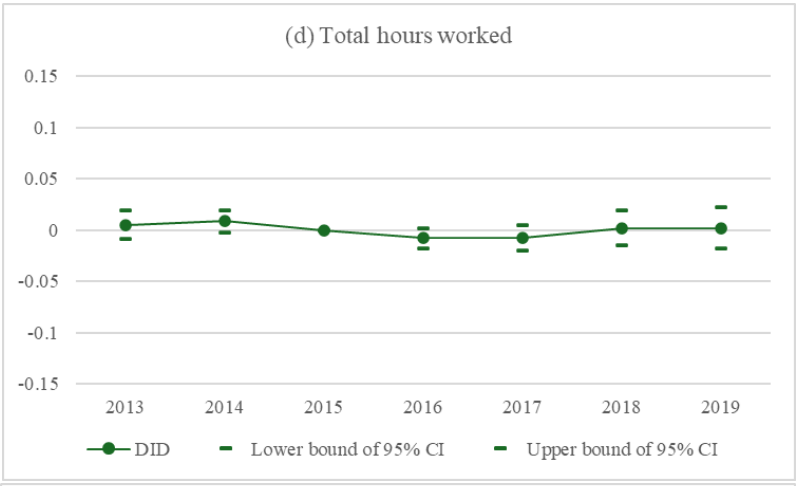
Panels (a) to (h) of Figure 4 show the year-by-year DID estimates of the treatment effect and pre-trend. These capture the differences in the average outcome variables between the base year (FY2015) and each preceding and subsequent fiscal year for the treatment group, relative to those for the control group. The results indicate an absence of pre-trends across all variables. Furthermore, Panel (a) shows a negative and significant effect on average weekly hours for part-time workers one year after the reform, implying that treated firms reduced average weekly working hours relative to control firms. By contrast, Panels (b) through (g) show no statistically significant effects on the number of part-time workers (Panel (b)), the number of regular workers (Panel (c)), total hours worked (Panel (d)), total labor costs (Panel (e)), tangible fixed assets (Panel (f)), or sales revenue (Panel (g)). The

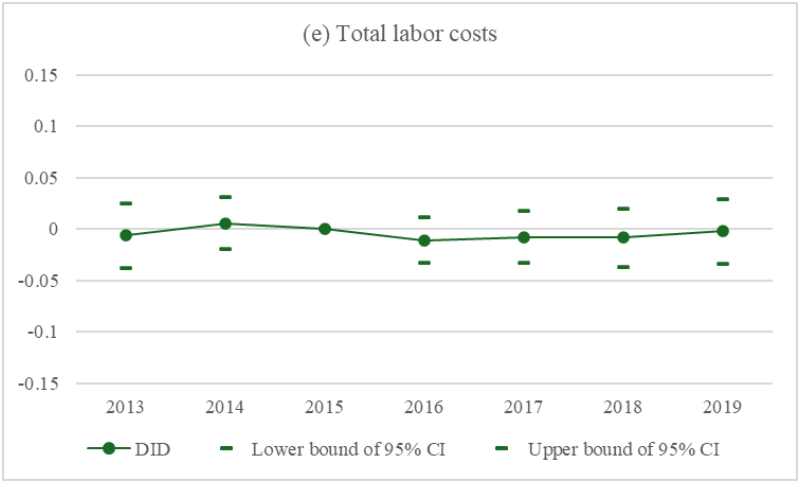
only exception is a significant effect on the profit-to-sales ratio (Panel (h)) in FY2018. The generally insignificant effects may be due to the relatively low exposure of the treatment group: the average share of part-time workers was 11% (Table 1), and only a small proportion of these workers became newly covered by employees' social insurance. These findings motivate a comparison of the DID effects between the high- and low-exposure groups.

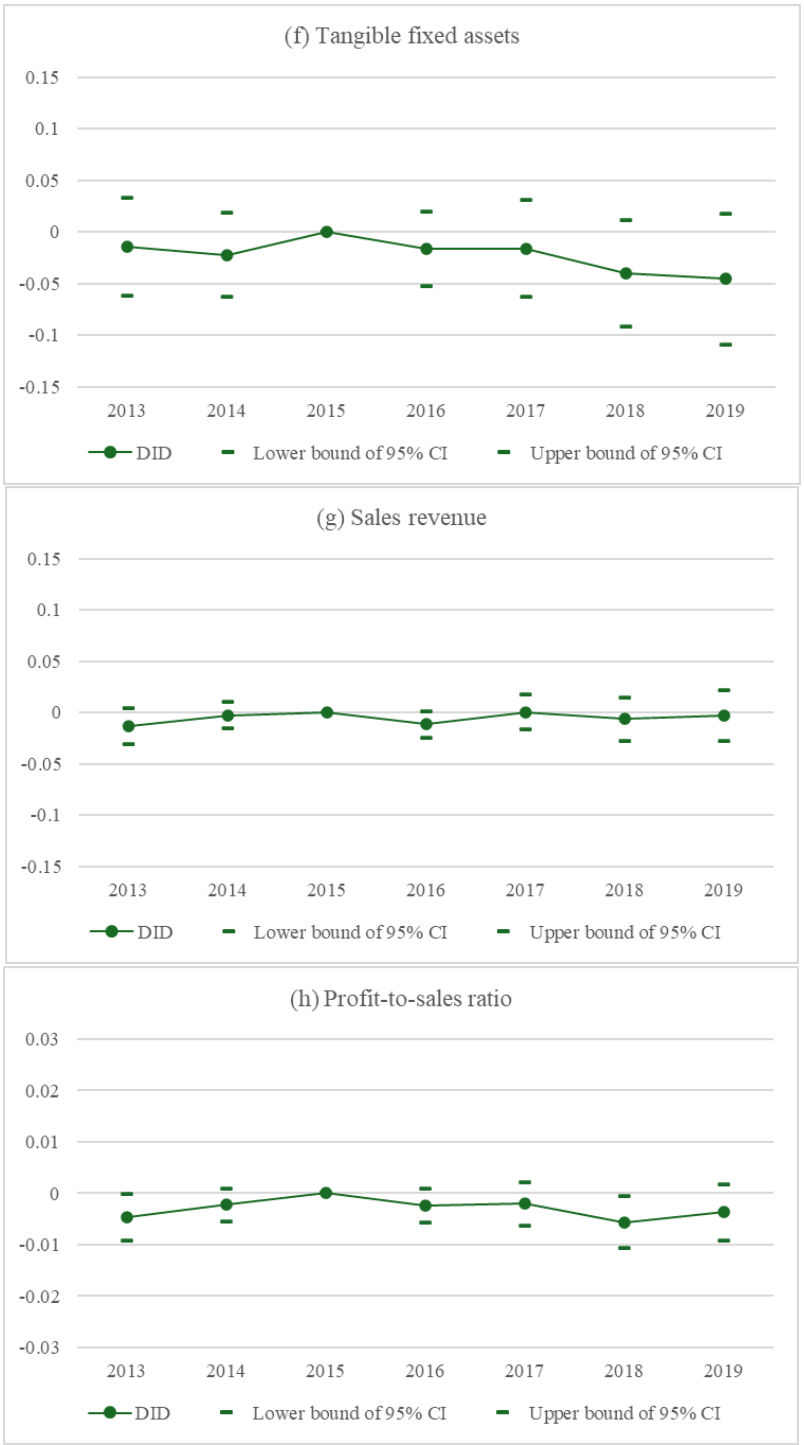
Figure 4. Year-by-year DID estimates of treatment effects and pre-trends




(c) Number of regular workers
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID
Lower bound of 95% CI
Upper bound of 95% CI


(d) Total hours worked
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID
Lower bound of 95% CI
Upper bound of 95% CI


(e) Total labor costs
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID
Lower bound of 95% CI
Upper bound of 95% CI



Notes: All outcome variables are in logarithmic form. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year *t* divided by sales revenue in the base year (FY2015). Each panel displays the lower and upper bounds of the 95% confidence intervals (CI) for the DID estimates.

4.2 High-exposure group vs. low-exposure group

Table 3 shows the average DID estimates of high exposure to the reform over the post-reform period (FY2016-2019). These estimates capture the changes in the average outcome variables before and after the reform for the high-exposure group, relative to those for the low-exposure group. The results indicate, first, that the reform had a negative and significant effect on the number of part-time workers and a positive and significant effect on the number of regular workers, indicating that high-exposure firms substituted part-time workers with regular workers. Second, the reform had a positive and significant effect on firms' total wage bills including contributions to social insurance premiums. Third, the reform had a negative and significant effect on the profit-to-sales ratio; on the other hand, although the coefficient on sales revenue is positive, it is not significant. The second and third results indicate that high-exposure firms did not significantly pass increased labor costs on to output prices, resulting instead in reduced profits.

Table 3. DID estimates of the effects of high exposure to the reform over the post-reform period

	Dependent variable:			
	(1)	(2)	(3)	(4)
	Average weekly working hours of part-time workers	Number of part-time workers	Number of regular workers	Total hours worked
POST	0.035 ***	0.171 ***	0.019 ***	0.034 ***
	(0.011)	(0.036)	(0.006)	(0.006)
D_{High}*POST	-0.019	-0.088 **	0.032 **	0.029
	(0.034)	(0.042)	(0.014)	(0.017)
Constant	3.246 ***	4.999 ***	6.740 ***	7.081 ***
	(0.007)	(0.016)	(0.003)	(0.004)
Firm fixed effects	Yes	Yes	Yes	Yes
R-squared (Within)	0.0049	0.0232	0.0311	0.041
Number of obs.	3,563	3,563	3,563	3,563

	Dependent variable:			
	(5)	(6)	(7)	(8)
	Total labor costs	Tangible fixed assets	Sales revenue	Profit-to-sales ratio
POST	0.056 ***	0.072 ***	0.049 ***	0.005 ***

	(0.008)		(0.018)		(0.008)		(0.002)	
D_{High}*POST	0.041	**	0.014		0.018		-0.004	*
	(0.016)		(0.029)		(0.014)		(0.002)	
Constant	8.590	***	8.633	***	10.655	***	0.037	***
	(0.004)		(0.008)		(0.004)		(0.001)	
Firm fixed effects	Yes		Yes		Yes		Yes	
R-squared (Within)	0.0554		0.0261		0.0673		0.0094	
Number of obs.	3,563		3,556		3,563		3,526	

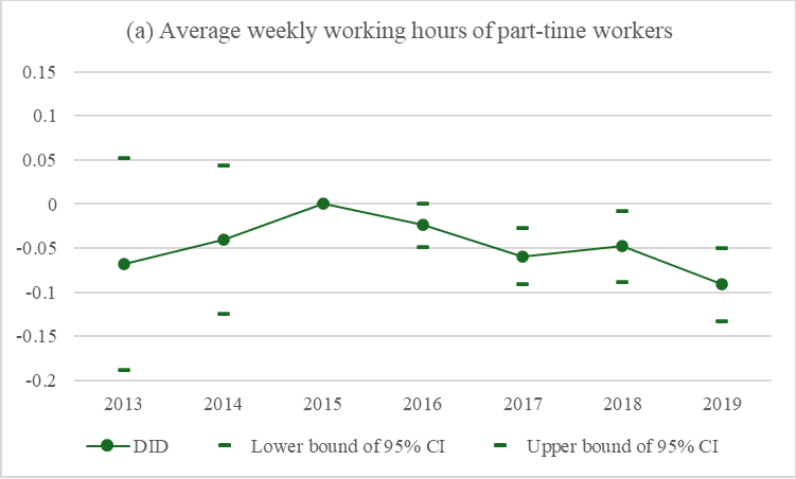
Notes: All dependent variables are in logarithmic form. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year *t* divided by sales revenue in the base year (FY2015). POST is a dummy variable that takes one for FY2016 to 2019, and zero for FY2013 to 2015. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors clustered at the firm level are shown in parentheses.

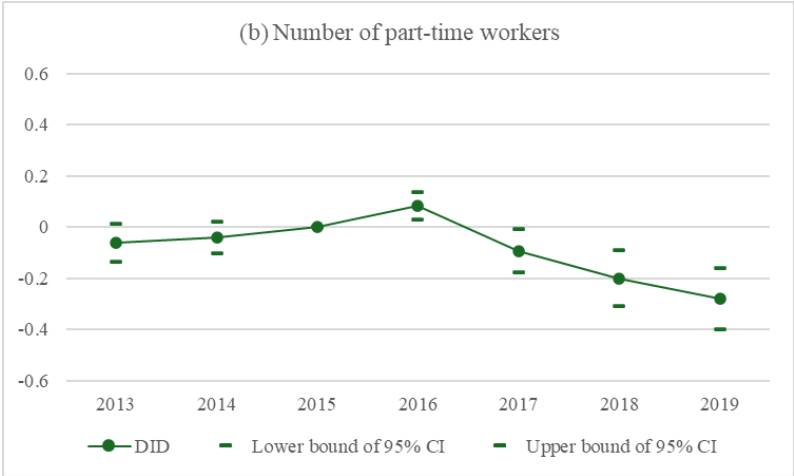
Panels (a) to (h) of Figure 5 present the year-by-year DID estimates of high exposure to the reform and pre-trends. These estimates represent the differences in average outcome variables between the base year (FY2015) and each preceding and subsequent fiscal year for the high-exposure group, relative to the low-exposure group. The results indicate that there was no pre-trend for any outcome variable, except for total hours worked in FY2013. Panels (a) and (b) show that the effects on average weekly hours worked by part-time workers and the number of part-time workers were negative and significant in the second year (i.e., FY2017) and subsequent years after the reform.[6] Panel (a) suggests that high-exposure firms tried to substitute part-time workers working between 20 and 30 hours per week with part-time workers working less than 20 hours per week to avoid incurring the costs of social insurance contributions. Panel (b) indicates that high-exposure firms, relative to low-exposure firms, decreased the number of part-time workers after the reform. In contrast, Panel (c) shows that the effect on the number of regular workers was positive and significant in the second year and subsequent years after the reform, indicating that high-exposure firms increased the number of regular workers more than low-exposure firms. These findings indicate that, in response to the increased cost of employing part-time workers, high-exposure firms tended to substitute part-time workers with regular workers. Next, Panel (d) shows that the effect on total hours worked was positive in the first year after the reform (i.e., in FY2016), indicating that while total hours worked at high-exposure firms increased in FY2016 relative to low-exposure firms, there were no further relative

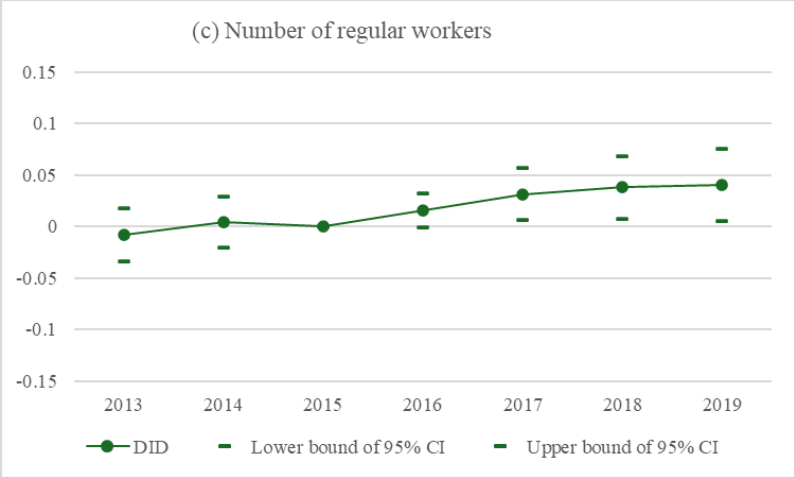
[6] Since the reform law was enforced in October 2016 and we use data as of the end of fiscal years (e.g., March 2018 for FY2017), we regard FY2016 as the first year, FY2017 as the second year, etc., here and below.

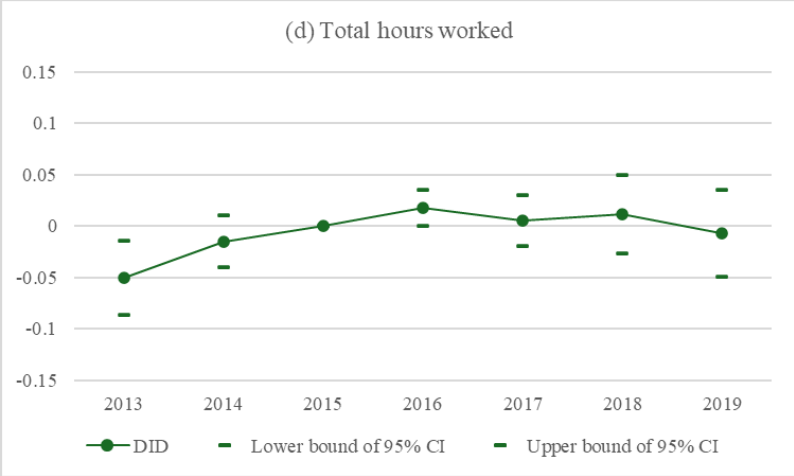
changes in the period FY2017-2019.Panel (f) shows that estimates for the effects on tangible assets are positive but not significant, suggesting that high-exposure firms did not tend to substitute part-time workers with tangible fixed assets. Panel (e) indicates that the effect on total labor costs including firms' contributions to social insurance premiums was positive and significant in the second year after the reform (i.e., FY2017). This suggests that high-exposure firms experienced an increase in total labor costs due both to the new social insurance obligations for part-time workers and to a rise in the number of regular workers in that year. Panel (g) shows that the effect on sales revenue was significantly positive in the first year after the reform (i.e., FY2016). One possible explanation is that the increase in total hours worked that year contributed to higher production volume. Another possibility is that firms passed part of the higher labor costs on to buyers through higher prices. Harasztosi and Lindner (2019) interpret a similar finding for Hungary – a rise in sales revenue following a minimum wage hike – as evidence that firms passed increased wage costs on to consumers. The positive effect on sales revenue in this study can plausibly be explained by either or both mechanisms. However, since the observed increases in total hours worked (1.79%) and tangible fixed assets (1.24%) in FY2016 account for only part of the increase in sales revenues (2.03%), it is likely that some portion of the effect reflects price pass-through. Panel (h) shows that the effect on the profit-to-sales ratio was negative and significant in the second year after the reform (i.e., FY2017), suggesting that high-exposure firms were only partially able to pass increased labor costs on to output prices.

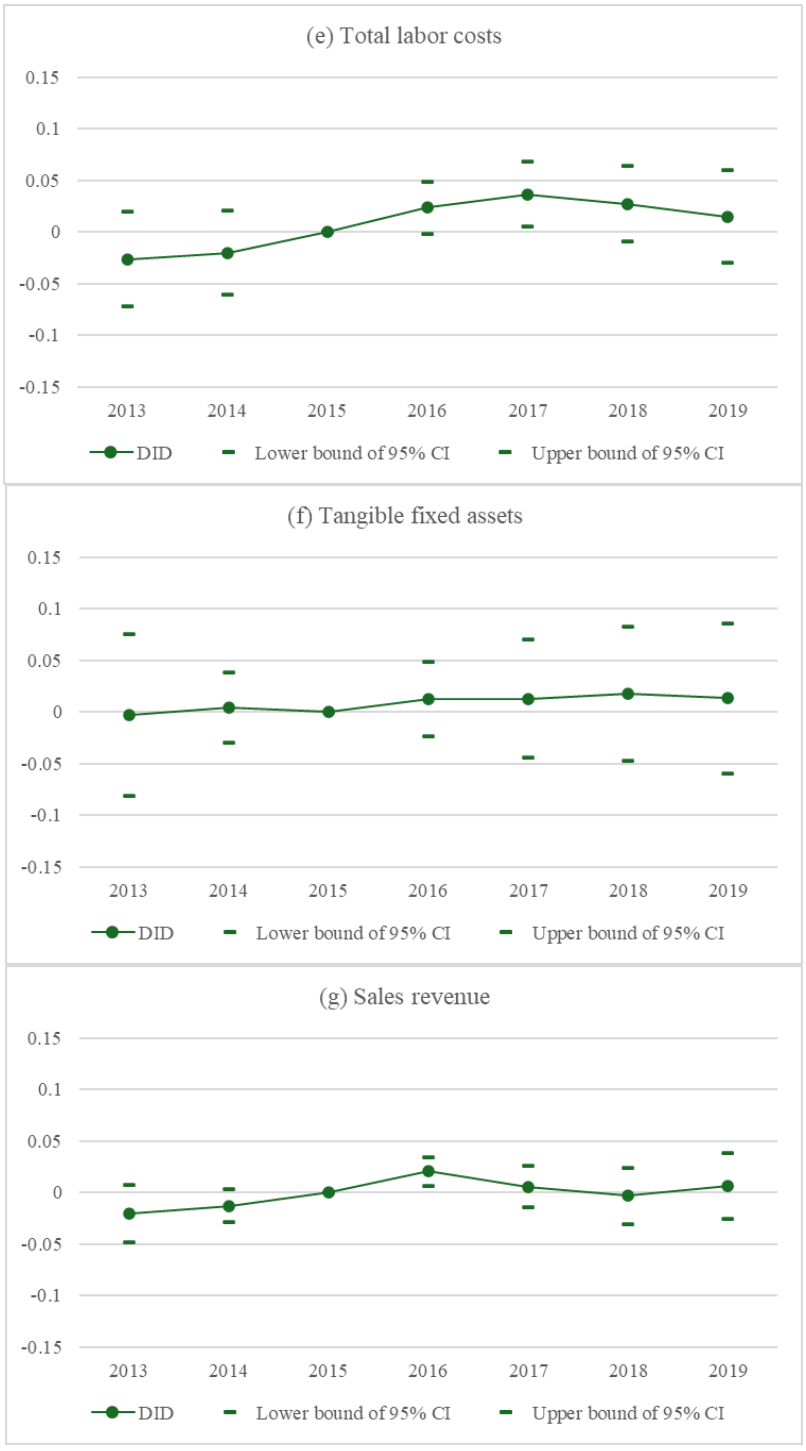
Figure 5. Year-by-year DID estimates of high exposure to the reform and pre-trends

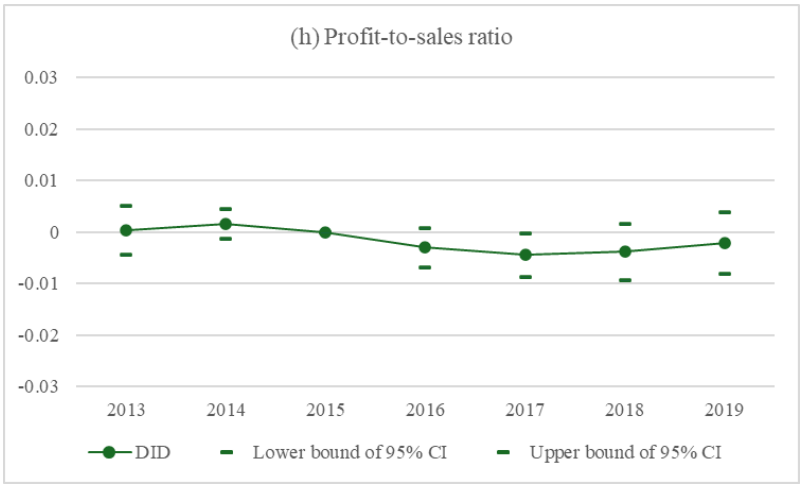



(b) Number of part-time workers
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
2013
2014
2015
2016
2017
2018
2019
DID
Lower bound of 95% CI
Upper bound of 95% CI


(c) Number of regular workers
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID
Lower bound of 95% CI
Upper bound of 95% CI


(d) Total hours worked
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID
Lower bound of 95% CI
Upper bound of 95% CI


(e) Total labor costs
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID
Lower bound of 95% CI
Upper bound of 95% CI
(f) Tangible fixed assets
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID
Lower bound of 95% CI
Upper bound of 95% CI
(g) Sales revenue
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID
Lower bound of 95% CI
Upper bound of 95% CI



Notes: All outcome variables are in logarithmic form. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year *t* divided by sales revenue in the base year (FY2015). Each panel displays the lower and upper bounds of the 95% confidence intervals (CI) for the DID estimates.

4.3 High- vs. low-growth firms among high-exposure firms

Table 4 presents the differences in average DID estimates of high exposure to the reform between high- and low-growth firms. The results indicate that, compared to their low-growth counterparts, high-growth firms experienced larger increases in the number of regular workers, total wage bills, and sales revenue, while no significant differences were observed for the other outcome variables. These findings suggest that high-growth firms were more likely to substitute part-time workers with regular workers and to pass increased labor costs through to prices.

Table 4: Differences in average DID effects of high exposure between high- and low-growth firms

	Dependent variable:			
	(1)	(2)	(3)	(4)
	Average weekly working hours of part-time workers	Number of part-time workers	Number of regular workers	Total hours worked
POST	0.032 **	0.158 ***	0.002	0.015 *
	(0.016)	(0.049)	(0.008)	(0.009)
D_{High}*POST	-0.033	-0.107 *	-0.007	0.007
	(0.033)	(0.059)	(0.018)	(0.021)
D_{Growth}*POST	0.008	0.033	0.043 ***	0.047 ***

	(0.022)		(0.072)		(0.011)		(0.012)	
D_{High}*D_{Growth}*POST	0.027		0.031		0.070	***	0.035	
	(0.067)		(0.084)		(0.025)		(0.034)	
Constant	3.246	***	4.999	***	6.740	***	7.081	***
	(0.007)		(0.016)		(0.003)		(0.004)	
Firm fixed effects	Yes		Yes		Yes		Yes	
R-squared (Within)	0.0053		0.0236		0.0678		0.059	
Number of obs.	3,563		3,563		3,563		3,563	

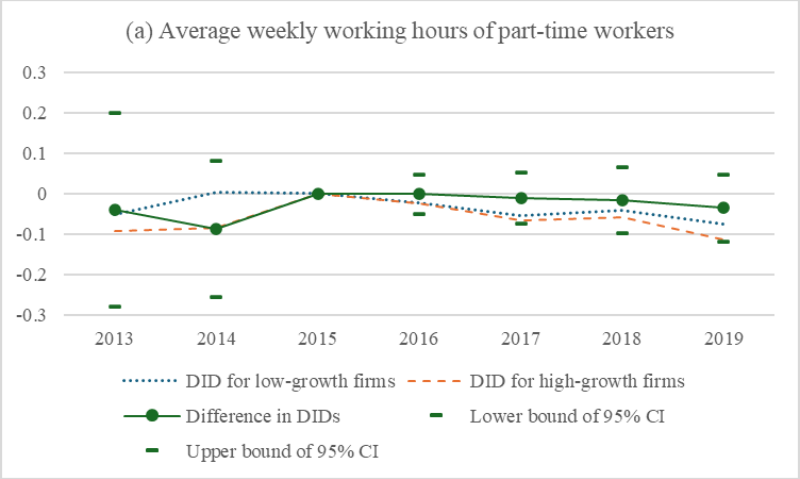
	Dependent variable:							
	(5)		(6)		(7)		(8)	
	Total labor costs		Tangible fixed assets		Sales revenue		Profit-to-sales ratio	
POST	0.041	***	0.016		0.011		0.001	
	(0.012)		(0.023)		(0.010)		(0.002)	
D_{High}*POST	-0.001		0.026		-0.017		-0.003	
	(0.020)		(0.033)		(0.016)		(0.003)	
D_{Growth}*POST	0.038	**	0.142	***	0.095	***	0.008	***
	(0.015)		(0.035)		(0.014)		(0.003)	
D_{High}*D_{Growth}*POST	0.077	**	-0.054		0.052	**	-0.003	
	(0.030)		(0.057)		(0.023)		(0.005)	
Constant	8.590	***	8.633	***	10.655	***	0.037	***
	(0.004)		(0.008)		(0.003)		(0.001)	
Firm fixed effects	Yes		Yes		Yes		Yes	
R-squared (Within)	0.0679		0.0447		0.1363		0.0176	
Number of obs.	3,563		3,556		3,563		3,526	

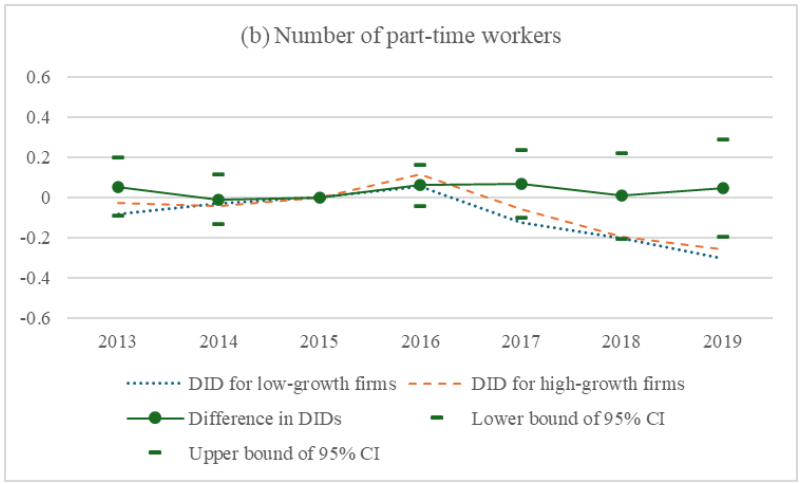
Notes: All dependent variables are in logarithmic form. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year *t* divided by sales revenue in the base year (FY2015). POST is a dummy variable that takes one for FY2016 to 2019, and zero for FY2013 to 2015. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors clustered at the firm level are shown in parentheses.

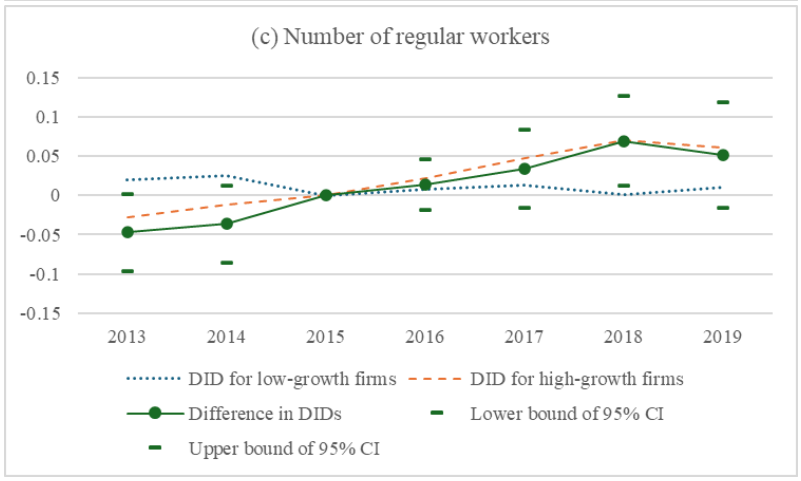
Panels (a) to (h) of Figure 6 show the differences in the year-by-year DID estimates of high exposure to the reform between high- and low-growth firms. Panels (a) and (b) indicate that there were

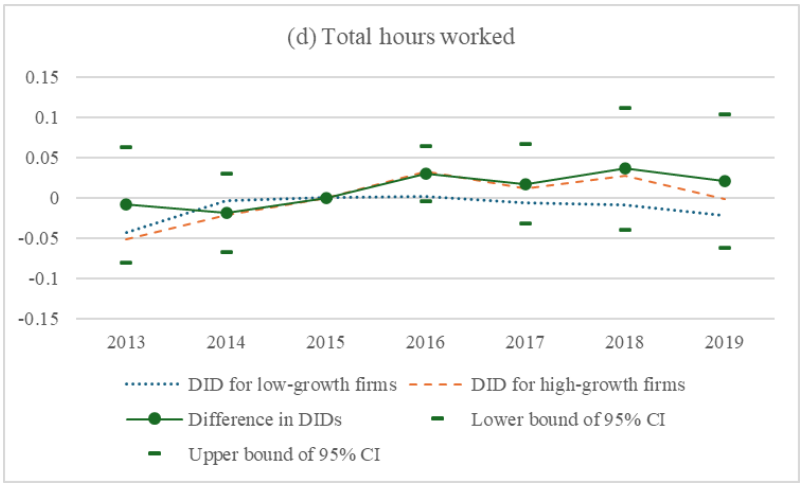
no significant differences in the year-by-year DID effects of high exposure between high- and low-growth firms with respect to average weekly working hours and the number of part-time workers throughout the period, although for both groups the effects on these outcome variables were negative and significant from the second year after the reform onward (not shown in Figure 6). In contrast, Panels (c), (e), and (g) show that the year-by-year DID effects of high exposure for high-growth firms were significantly larger than those for low-growth firms with respect to the number of regular workers in 2018, total wage bills in 2019, and sales revenue in 2017-2019. Moreover, there were no pre-trends for these variables. On balance, these results indicate that high-growth firms had stronger incentives and greater capacity to adjust their workforce composition and pass on higher labor costs to product prices than low-growth firms. Panel (h) shows that there was no significant difference in the year-by-year DID effects between high- and low-growth firms with respect to the profit-to-sales ratio during the post-reform period. However, the effect on this outcome variable in the second year after the reform is negative and significant for low-growth firms, while the effects are negative but insignificant for high-growth firms (not shown in Figure 6). These results suggest that low-growth firms' profit-to-sales ratios fell after the reform due to a decline in their sales revenues reflecting the reduction in their part-time workforce. In contrast, the profit-to-sales ratios of high-growth firms hardly declined as they were able to pass on part of the increase in labor costs to prices and raise their sales revenues.

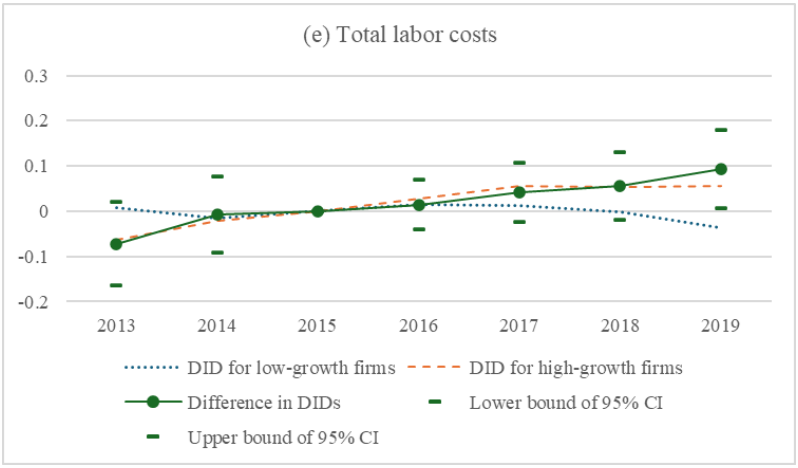
Figure 6. Differences in the year-by-year DID effects of high exposure between high- and low-growth firms

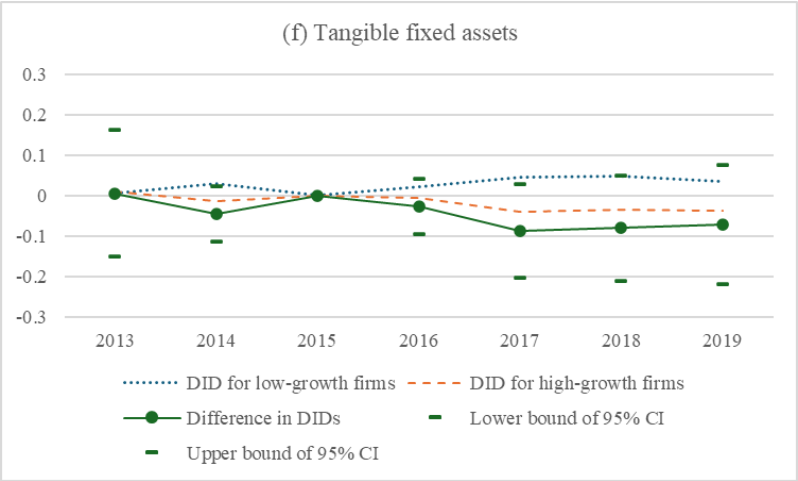


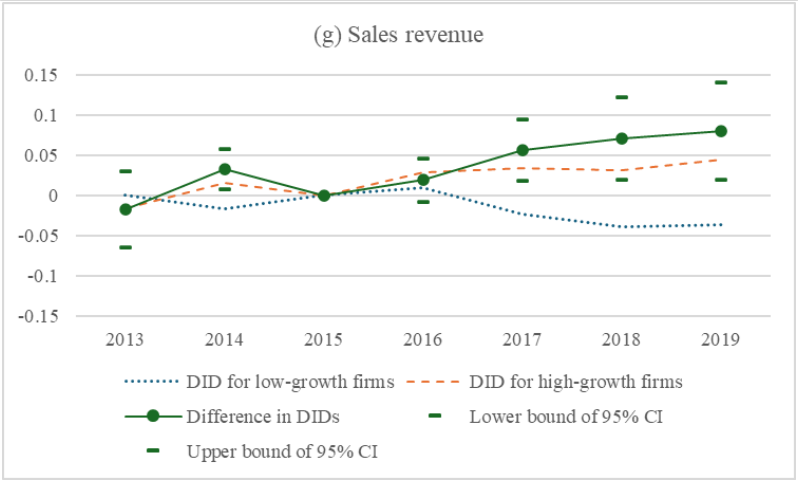

(b) Number of part-time workers
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
2013
2014
2015
2016
2017
2018
2019
DID for low-growth firms
DID for high-growth firms
Difference in DIDs
Lower bound of 95% CI
Upper bound of 95% CI

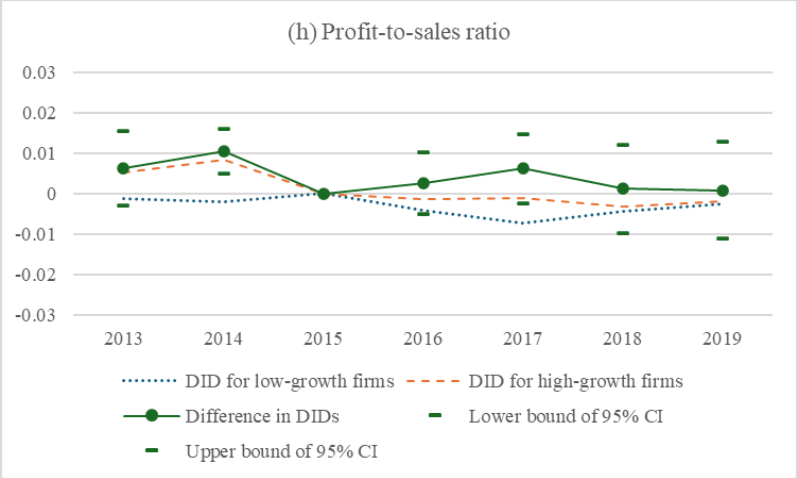

(c) Number of regular workers
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID for low-growth firms
DID for high-growth firms
Difference in DIDs
Lower bound of 95% CI
Upper bound of 95% CI


(d) Total hours worked
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID for low-growth firms
DID for high-growth firms
Difference in DIDs
Lower bound of 95% CI
Upper bound of 95% CI


(e) Total labor costs
0.3
0.2
0.1
0
-0.1
-0.2
2013
2014
2015
2016
2017
2018
2019
DID for low-growth firms
DID for high-growth firms
Difference in DIDs
Lower bound of 95% CI
Upper bound of 95% CI


(f) Tangible fixed assets
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
2013
2014
2015
2016
2017
2018
2019
DID for low-growth firms
DID for high-growth firms
Difference in DIDs
Lower bound of 95% CI
Upper bound of 95% CI


(g) Sales revenue
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2013
2014
2015
2016
2017
2018
2019
DID for low-growth firms
DID for high-growth firms
Difference in DIDs
Lower bound of 95% CI
Upper bound of 95% CI



Notes: All outcome variables are in logarithmic form. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year *t* divided by sales revenue in the base year (FY2015). Each panel displays the lower and upper bounds of the 95% confidence intervals (CI) for the DID estimates.

4.4 Discussion

Thus far, we have conducted the DID analyses based on the assumption that firms did not respond before the reform came into effect in FY2016. This assumption appears to be valid given that the year-by-year DID results show no evidence of pre-trends. However, a remaining concern is the possibility that firms began responding to the reform after it was enacted in 2012 rather than waiting until it came into effect in FY2016. If this was the case, our results in Sections 4.1 to 4.3 would underestimate firms' responses. To address this possibility, we conduct two additional DID analyses using BSJBSA data for the period FY2009-2015 and regarding FY2012 as the treatment year: one comparing the low-exposure treated group and the control group, and one comparing the high-exposure group and the low-exposure group. Our findings are as follows. First, low-exposure firms decreased the average working hours of part-time workers as compared to control firms even before the reform came into effect. Second, high-exposure firms also reduced average weekly working hours of part-time workers and partially substituted part-time workers with regular workers before the reform took effect. These findings suggest that our results in Sections 4.1 and 4.2 underestimate the true effects on part-time working hours and substitution of part-time workers with regular workers. That is, the results in Sections 4.1 and 4.2 should be considered conservative. However, we find no evidence that low-exposure treated firms substituted part-time workers with regular workers or that their total labor costs and sales revenues increased before the reform took effect, or that high-exposure firms passed higher labor costs on to output prices before the reform came into effect. These results are provided in the Appendix.

5 Conclusions

In this study, we used the 2016 extension of Japan's social insurance coverage to part-time workers working between 20 and 30 hours a week as a quasi-natural experiment to examine how the increase in social insurance premiums affected employment and firm revenue. Employing a difference-in-differences approach, we compare firms with a relatively high share of part-time workers in the year before the reform (the high-exposure group) to those with a lower share (the low-exposure group), and obtain the following findings. First, firms significantly substituted part-time workers with longer working hours with part-time workers with shorter hours and regular workers, but not with capital. Second, firms' total labor costs including social insurance premiums increased. Third, while firms' sales revenues increased significantly, their profit ratios fell, suggesting that they were unable to fully pass the increased labor costs through to output prices. Consequently, both buyers and firms absorbed part of the increased labor costs. Fourth, high-growth firms were more likely than low-growth firms to substitute part-time workers with regular workers and to pass increased labor costs through to prices.

These findings contribute to the literature on the effects of social insurance contributions on employment and their incidence by providing clear evidence on employment. They offer insights into substitution between newly covered part-time workers and other workers and highlight the heterogeneity in outcomes depending on sales growth. Nonetheless, this analysis has several limitations. In particular, we have no information on whether workers are regular or part-time workers or on the hours worked for individual workers, which limits the scope of our analysis. Access to employer-employee matched data would allow for a more detailed understanding of firm and worker responses to the reform.

Acknowledgements

This study was conducted as part of the Project "Firm Dynamics, Industry, and the Macroeconomy" at the Research Institute of Economy, Trade and Industry (RIETI). The analysis makes use of data from the Basic Survey of Japanese Business Structure and Activities conducted by the Ministry of Economy, Trade and Industry (METI). The authors are grateful to Eiichi Tomiura, Daisuke Miyakawa, and Discussion Paper Seminar participants at RIETI for their valuable comments and suggestions.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data availability statement

With the exception of the data from the Ministry of Economy, Trade and Industry (METI)'s Basic Survey of Japanese Business Structure and Activities, which we accessed under the permission of METI, the data supporting the findings of this study are available from the corresponding author upon reasonable request.

Appendix

A Additional empirical results

Using the BSJBSA for FY2009-2015, we examine whether firms' behavior changed after the 2012 reform was enacted in FY2012 and before it took effect in FY2016. To this end, we redefine $D_{\text{Treatment}}$, D_{High}, and $POST_t$ in equations (1) to (3) as follows.

$D_{\text{Treatment}}$ is a treatment dummy variable that takes one if a firm belonged to the low-exposure group, and zero if it belonged to the control group. The control group consists of firms that employed more than 200 but no more than 500 workers (both regular and part-time) during the period FY2009-2015, that had employees who worked between 20 and 30 hours per week on average in FY2011 (the year before the reform was enacted), and that had a share of part-time workers less than or equal to 49.68% (the maximum for the control group in FY2015). The low-exposure group consists of firms that employed more than 500 but no more than 2,000 regular workers during the period FY2009-2015, that had employees that worked between 20 and 30 hours per week on average in FY2011, and that had a share of part-time workers of less than or 49.68%.

D_{High} is a dummy variable representing high exposure to the reform and takes one if a firm belonged to the high-exposure group and zero if it belonged to the low-exposure group. The high-exposure group consists of firms that employed more than 500 but no more than 2,000 regular workers during the period FY2009-2015, that had employees who on average worked 20 or more but less than 30 hours per week in FY2011, and that had a share of part-time workers of more than 49.68%. $POST_t$ is a dummy variable that takes one for FY2012-2015 (the post-enactment period), and zero for FY2009-2011 (the pre-enactment period).

A1 Low-exposure group vs. control group

Table A1 shows the average DID estimates of the treatment effect during the post-enactment/pre-enforcement period from 2012 to 2015. These estimates represent the differences in the average outcome variables before and after the reform enactment for the treatment group (i.e., the low-

exposure group) relative to those for the control group. The results indicate that, on average, the reform enactment did not have a significant effect on the outcome variables over this period, except for the number of part-time workers. Specifically, the reform enactment had a positive and significant effect on the number of part-time workers, indicating that treated firms increased the number of part-time workers during the post-enactment/pre-enforcement period.

Table A1. Average DID effects of treatment during the post-enactment period

	Dependent variable:			
	(1)	(2)	(3)	(4)
	Average weekly working hours of part-time workers	Number of part-time workers	Number of regular workers	Total hours worked
POST	0.014	-0.029	0.001	-0.001
	(0.011)	(0.028)	(0.005)	(0.005)
$D_{\text{Treatment}}$*POST	-0.019	0.144 ***	0.000	0.009
	(0.020)	(0.048)	(0.009)	(0.009)
Constant	3.296 ***	3.384 ***	6.115 ***	6.197 ***
	(0.005)	(0.013)	(0.002)	(0.002)
Firm fixed effects	Yes	Yes	Yes	Yes
R-squared (Within)	0.0006	0.0070	0.0000	0.0011
Number of obs.	4,452	4,452	4,452	4,452

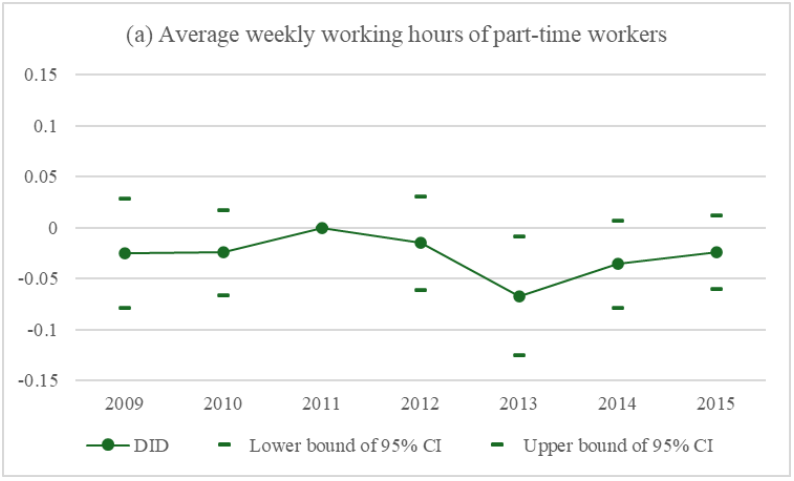
	Dependent variable:			
	(5)	(6)	(7)	(8)
	Total labor costs	Tangible fixed assets	Sales revenue	Profit-to-sales ratio
POST	0.036 ***	0.019	0.064 ***	0.009 ***
	(0.012)	(0.017)	(0.009)	(0.002)
$D_{\text{Treatment}}$*POST	0.006	-0.008	0.0053	0.000
	(0.017)	(0.027)	(0.013)	(0.003)
Constant	7.762 ***	7.926 ***	9.787 ***	0.031 ***
	(0.005)	(0.008)	(0.004)	(0.001)
Firm fixed effects	Yes	Yes	Yes	Yes
R-squared (Within)	0.0113	0.0009	0.0655	0.0257
Number of obs.	4,452	4,448	4,452	4,446

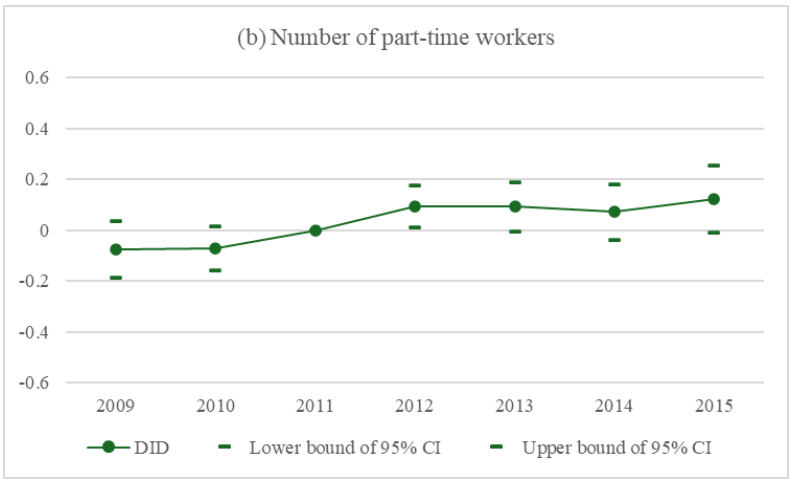
Notes: All dependent variables are in logarithmic form. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year t divided by sales revenue in the base year (FY2011). POST is a dummy variable that takes one for FY2012 to 2015, and zero for FY2009 to 2011. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors clustered at the firm level are shown in parentheses.

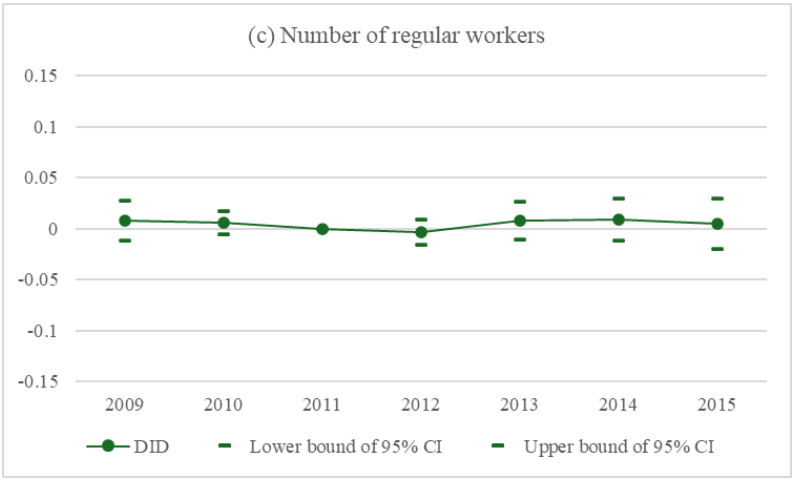
Panels (a) to (h) of Figure A1 present the year-by-year DID estimates of the treatment effect and pre-trends. The estimates represent the differences in the average outcome variables between the base year (FY2011) and each preceding and subsequent fiscal year for the treatment group relative to the control group. The results indicate that there were no pre-trends in any of the outcome variables. Furthermore, Panels (a) and (f) show that the effects on the average weekly hours worked by part-time workers and on tangible fixed assets were negative and significant in the second and the first year after the reform, respectively (i.e., FY2013 and FY2012) during the post-enactment/pre-enforcement period.[7] On the other hand, Panel (b) shows that the effect on the number of part-time employees was positive and significant in the first year after the enactment (FY2012). The remaining panels show no significant effects on the number of regular workers (Panel (c)), total hours worked (Panel (d)), total labor costs (Panel (e)), sales revenue (Panel (g)), or profit-to-sales ratio (Panel (h)). Panel (a) suggests that treated firms reduced the average weekly working hours of part-time workers before the reform was enacted to avoid the new social insurance contributions. Together, Panels (a) and (b) suggest that treated firms offset the decrease in average working hours with an increase in the number of part-time workers. Furthermore, Panels (b) and (f) indicate that treated firms substituted tangible fixed assets with part-time workers. However, there is no evidence suggesting that treated firms substituted part-time workers with regular workers or that their total labor costs and sales revenues increased before the reform came into effect.

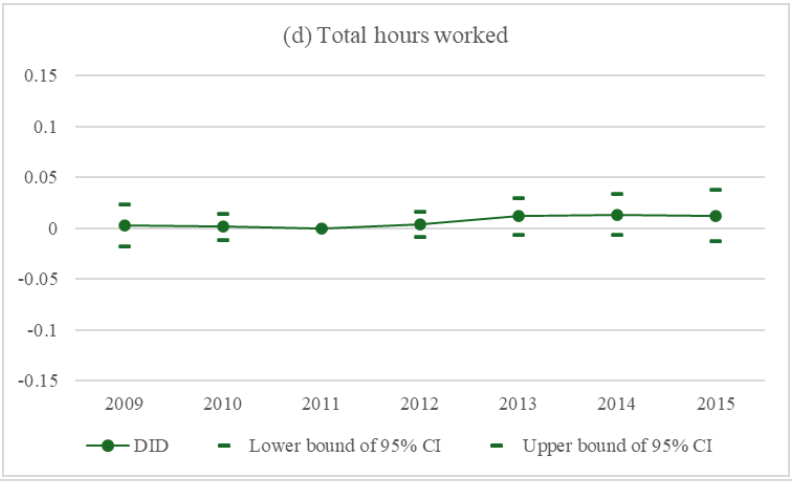
Figure A1. Year-by-year DID estimates of treatment effects and pre-trends

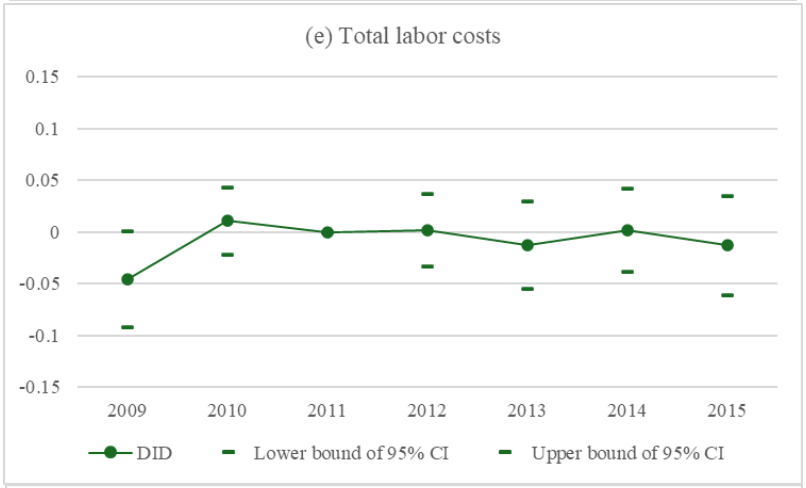
[7] Since the reform act was enacted in August 2012 and we use data as of the end of fiscal years (e.g., March 2013 for FY2012), we regard the DID estimates as of FY2012 as the first year after the enactment of the reform and so on in this Appendix.

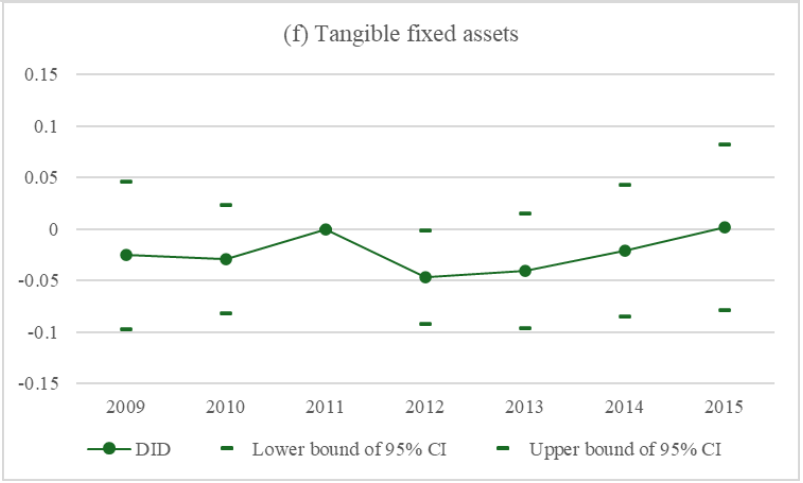

(a) Average weekly working hours of part-time workers
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI

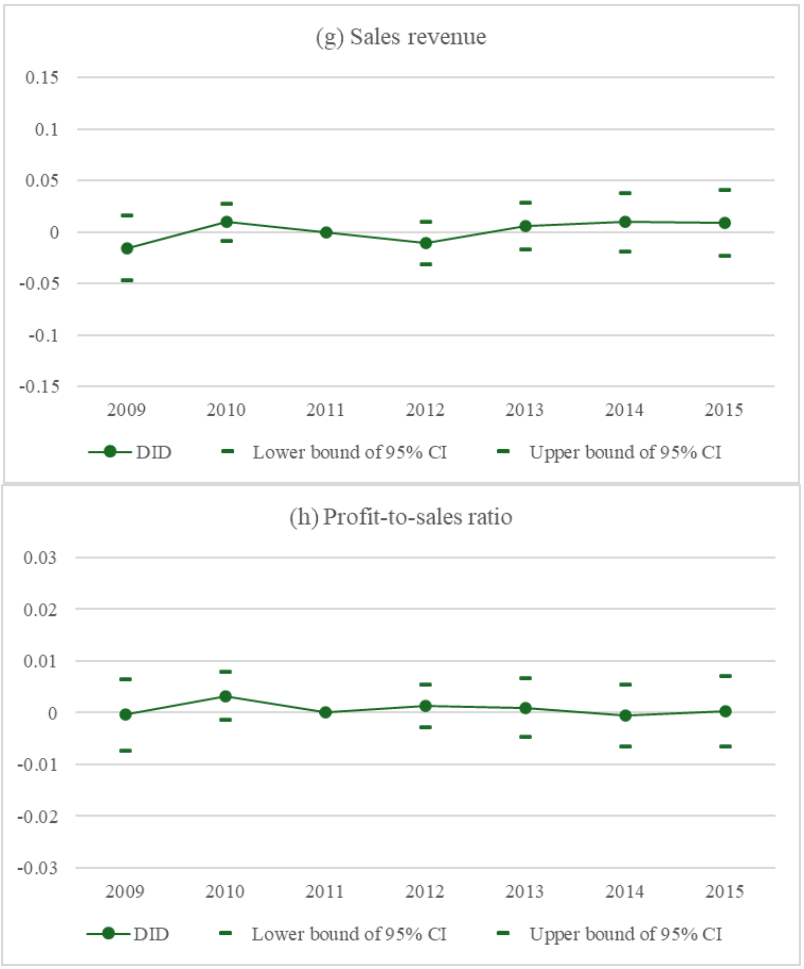

(b) Number of part-time workers
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI


(c) Number of regular workers
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI


(d) Total hours worked
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI


(e) Total labor costs
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI


(f) Tangible fixed assets
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI



Notes: All outcome variables are in logarithmic form. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year *t* divided by sales revenue in the base year (FY2011). Each panel displays the lower and upper bounds of the 95% confidence intervals (CI) for the DID estimates.

A2 High-exposure group vs. low-exposure group

Table A2 shows the average DID effects of the enactment of the reform on high-exposure firms during the post-enactment/pre-enforcement period from FY2012 to 2015. These effects represent the differences in the average outcome variables before and after the reform enactment for the high-exposure group relative to those for the low-exposure group. The results indicate that the reform enactment had a positive and significant effect on tangible fixed assets and a negative and significant effect on the profit-to-sales ratio, while it had no significant effect on the other outcome variables.

Table A2. Average DID effects of reform enactment on high exposure firms during the post-enactment/pre-enforcement period

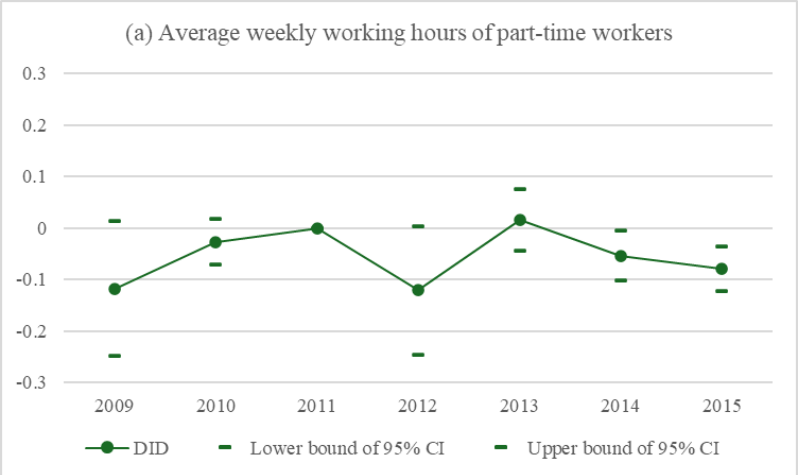
	Dependent variable:			
	(1)	(2)	(3)	(4)
	Average weekly working hours of part-time workers	Number of part-time workers	Number of regular workers	Total hours worked
POST	-0.005	0.115 ***	0.001	0.008
	(0.017)	(0.039)	(0.008)	(0.008)
D_{High}*POST	-0.011	-0.060	0.024	0.033
	(0.034)	(0.050)	(0.015)	(0.022)
Constant	3.264 ***	5.191 ***	6.767 ***	7.158 ***
	(0.008)	(0.017)	(0.004)	(0.005)
Firm fixed effects	Yes	Yes	Yes	Yes
R-squared (Within)	0.0003	0.0137	0.0050	0.0093
Number of obs.	2,541	2,541	2,541	2,541

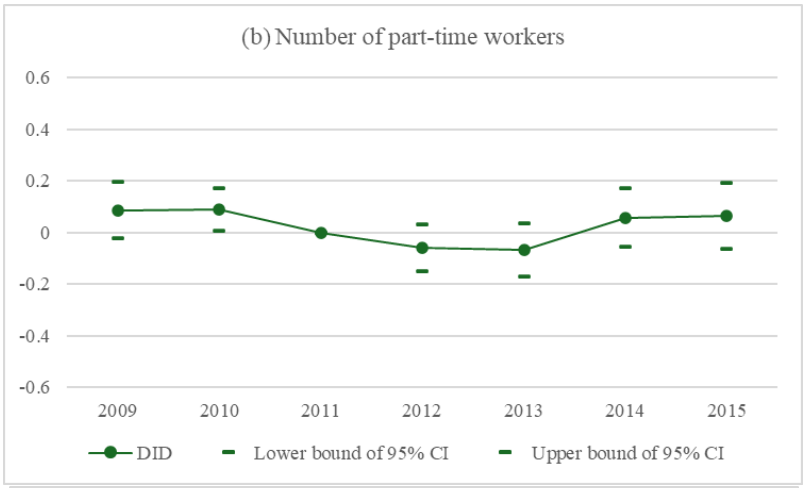
	Dependent variable:			
	(5)	(6)	(7)	(8)
	Total labor costs	Tangible fixed assets	Sales revenue	Profit-to-sales ratio
POST	0.042 ***	0.011	0.069 ***	0.008 ***
	(0.012)	(0.022)	(0.010)	(0.002)
D_{High}*POST	0.029	0.061 *	0.005	-0.005 **
	(0.022)	(0.033)	(0.016)	(0.002)
Constant	8.612 ***	8.747 ***	10.682 ***	0.033 ***
	(0.006)	(0.010)	(0.004)	(0.001)
Firm fixed effects	Yes	Yes	Yes	Yes
R-squared (Within)	0.0230	0.0073	0.0842	0.0222
Number of obs.	2,541	2,541	2,541	2,522

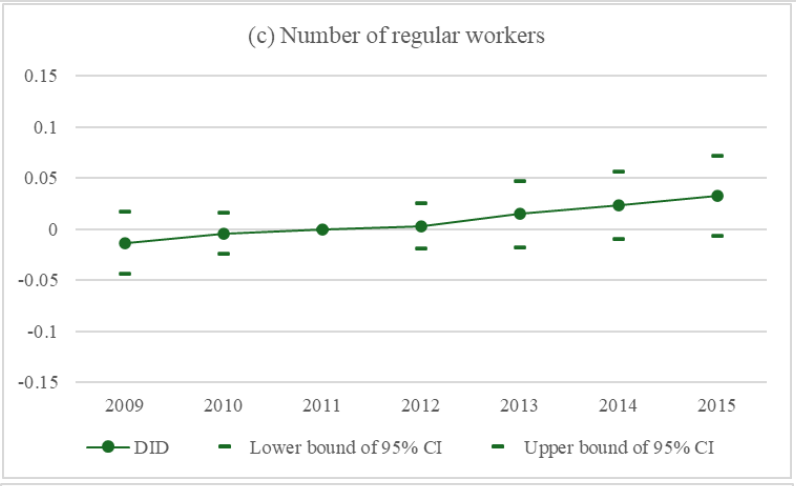
Notes: All dependent variables are in logarithmic form. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year t divided by sales revenue in the base year (FY2011). POST is a dummy variable that takes one for FY2012 to 2015, and zero for FY2009 to 2011. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors clustered at the firm level are shown in parentheses.

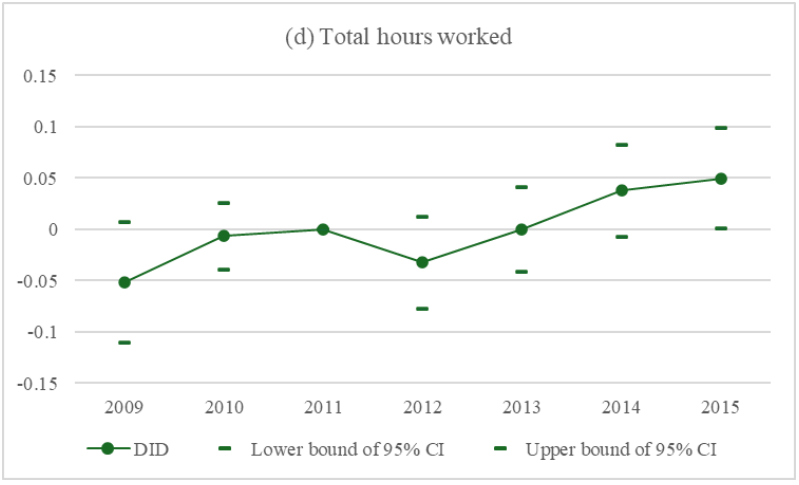
Panels (a) to (h) of Figure A2 present the year-by-year DID effects of the enactment of the reform on high exposure firms and pre-trends. The estimates represent the differences in the average outcome variables between the base year (FY2011) and each preceding and subsequent fiscal year for the high-exposure group relative to the low-exposure group. The results indicate that there were no pre-trends in any of the outcome variables. Panel (a) shows that the effect on average weekly hours worked by part-time workers was negative and significant in the third and fourth year after the reform was enacted (FY2014 and 2015), suggesting that high-exposure firms reduced the average hours worked by part-time workers before the reform took effect in order to avoid the new social insurance premiums. Panels (d) and (e) show that the effects on total hours worked and total labor costs were positive in the fourth year after the enactment of the reform (FY 2015), indicating that the increase in total labor costs reflected an increase in total hours worked. Taken together, panels (a) and (d) suggest that high-exposure firms responded to the enactment of the reform by decreasing the average hours worked by part-time workers and by increasing the total number of regular workers and part-time workers, indicating that they partially substituted part-time workers with regular workers before the reform took effect. Panel (f) shows that the effect on tangible fixed assets was positive and significant in the first and second years after the enactment of the reform (FY 2012 and 2013). Panel (h) shows that the effect on profit-to-sales ratios was negative and significant in the second and third years after the reform enactment (FY 2013 and 2014). Taken together, Panels (f) and (h) imply that the decline in profit-to-sales ratios in FY2013-2014 can be attributed to an increase in tangible fixed assets (i.e., capital costs) over the same period, although the reasons for the increase in tangible fixed assets are unclear. However, there is no evidence that high-exposure firms passed the higher labor costs on to output prices before the reform took effect, since no increase in their sales revenues is observed (Panel (g)).

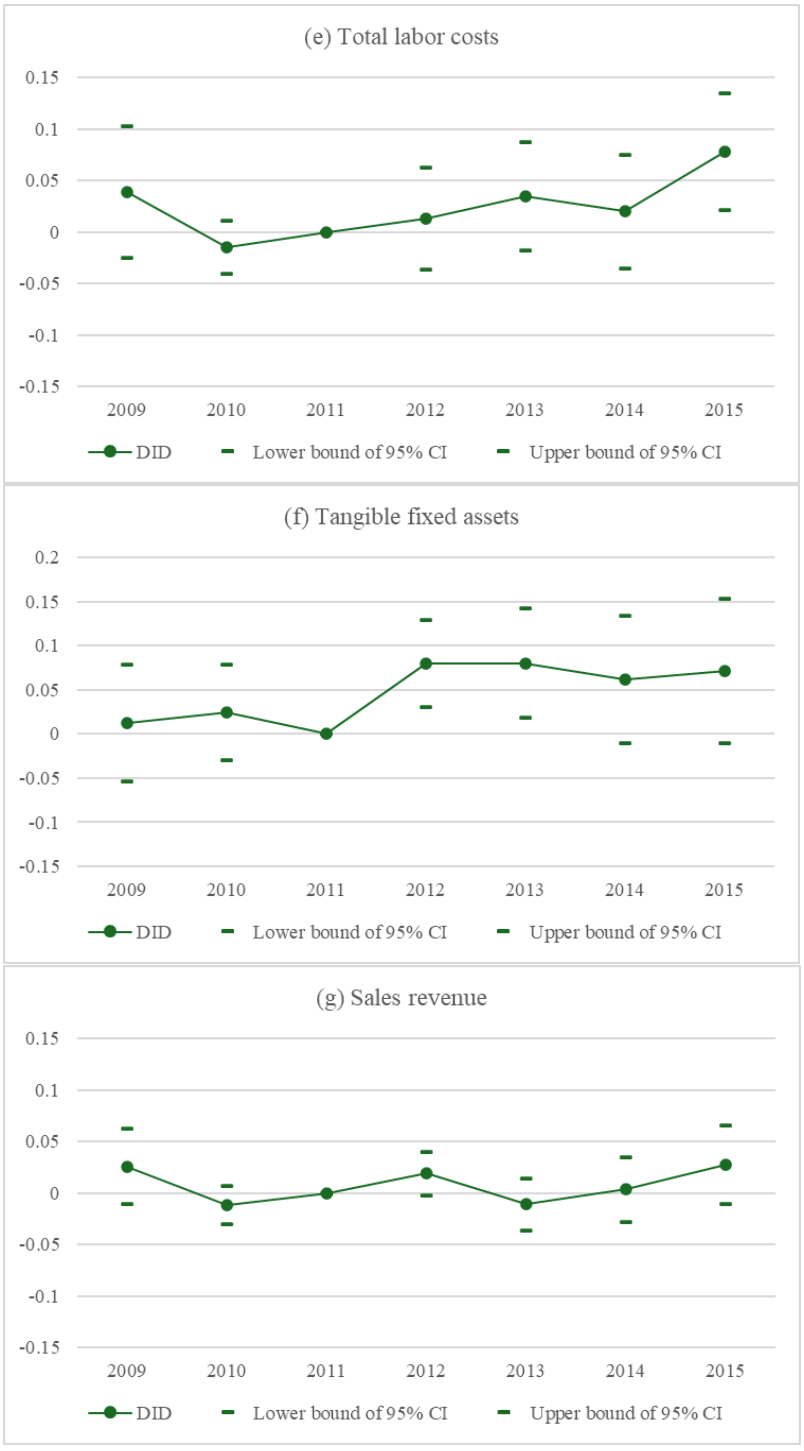
Figure A2. Year-by-year DID effects of reform enactment on high-exposure firms and pre-trends

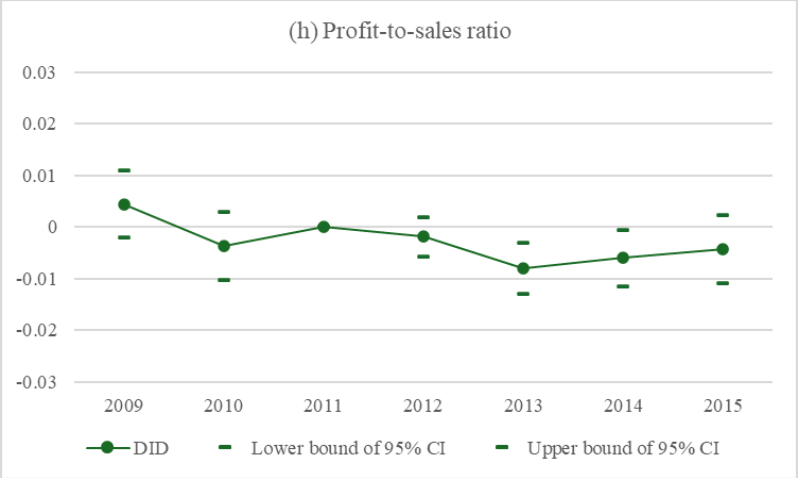



(b) Number of part-time workers
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI


(c) Number of regular workers
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI


(d) Total hours worked
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI


(e) Total labor costs
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI
(f) Tangible fixed assets
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI
(g) Sales revenue
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
2009
2010
2011
2012
2013
2014
2015
DID
Lower bound of 95% CI
Upper bound of 95% CI



Notes: All outcome variables are in logarithmic form. Total hours worked are calculated as the sum of the number of regular workers and the total weekly working hours of part-time workers divided by 40. Total labor costs include employers' contributions to social insurance premiums. The profit-to-sales ratio is defined as operating profit in each fiscal year *t* divided by sales revenue in the base year (FY2011). Each panel displays the lower and upper bounds of the 95% confidence intervals (CI) for the DID estimates.

References

Aaronson, D., and E. French, 2007, "Product market evidence on the employment effects of the minimum wage," *Journal of Labor Economics*, 25(1) 167–200.

Aaronson, D., and B. J. Phelan, 2019, "Wage shocks and the technological substitution of low-wage jobs," *The Economic Journal*, *129*, 1–34.

Aaronson, D., E. French, I. Sorkin, and T. To, 2018, "Industry dynamics and the minimum wage: A putty-clay approach," *International Economic Review*, *59*, 51–84.

Bennmarker, H., E. Mellander, and B. Ockert, 2009, "Do regional payroll tax reductions boost employment?" *Labour Economics*, 16, 480–489.

Benzarti, Y., and J. Harju, 2021a, "Using payroll tax variation to unpack the black box of firm-level production," *Journal of the European Economic Association* 19(5), 2737–2764.

Benzarti, Y., and J. Harju, 2021b, "Can payroll tax cuts help firms during recession?" *Journal of Public Economics*, 200, 104472.

Collischon, M., K. Cygan-Rehm, and R. T. Riphahn, 2021, "Employment effects of payroll tax xubsidies," *Small Business Economics*, 57, 1201–1219.

Garsaa, A., and N. Levratto, 2015, "Do labor tax rebates facilitate firm growth? An empirical study on French establishments in the manufacturing industry, 2004–2011," *Small Business Economics*, 45, 613–641.

Gruber, J., 1997, "The incidence of payroll taxation: Evidence from Chile," *Journal of Labor*

Economics, 15(S3), S72–S101.

Harasztosi, P., and A. Lindner, 2019, "Who pays for the minimum wage?" *American Economic Review*, 109, 2693–2727.

Huttunen, K., J. Pirttila, and R. Unsitalo, 2013, "The employment effects of low-wage subsidies," *Journal of Public Economics*, 97, 49-60.

Kangasharju, A., 2007, "Do wage subsidies increase employment in subsidized firms?" *Economica* 74, 51–67.

Korkeamaki, O., and R. Unsitalo, 2009, "Employment and wage effects of a payroll-tax cut: Evidence from a regional experiment," *International Tax and Public Finance*, 16, 753–772.

Leung, J.H., 2021, "Minimum wage and real wage inequality: Evidence from pass-through to retail prices," *The Review of Economics and Statistics*, 10 2021, *103*, 754–769.

Lordan, G., and D. Neumark, 2018, "People versus machines: The impact of minimum wages on automatable jobs," *Labour Economics*, *52*, 40–53.

Saez, E., B. Schoefer, and D. Seim, 2019, "Payroll taxes, firm behavior, and rent sharing: Evidence from a young workers' tax cut in Sweden," *American Economic Review*, 109(5), 1717–1763.

Summers, L., 1989, "Some simple economics of mandated benefits," *American Economic Review*, 79(2), 177–183.