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FUKAI, Taiyo
University of Tsukuba

KAWAGUCHI, Daiji
RIETI

KONDO, Ayako
RIETI

YOKOYAMA, Izumi
Hitotsubashi University

The Research Institute of Economy, Trade and Industry
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How Do Firms Attain Internal and External Flexibility of Employment?*

Taiyo Fukai
The University of Tsukuba
Daiji Kawaguchi
The University of Tokyo and RIETI
Ayako Kondo
The University of Tokyo and RIETI
Izumi Yokoyama
Hitotsubashi University

Abstract

Firms increasingly rely on workers with nonstandard contracts, but the underlying economic factors that distinguish workers on standard contracts from those on nonstandard contracts is poorly understood. We study their asymmetric employment and wage adjustments to examine whether the differences in the importance of firm-worker relation specificity between the two types of workers is a fundamental source of heterogeneity. Leveraging the exogenous shock that stems from exchange rate fluctuation and heterogeneous trade exposure between firms, we find that firms absorb temporary shocks by adjusting the number of dispatched workers from temporary help agencies and adjusting bonuses of in-house workers instead of reducing the number of in-house workers employed.

Keywords: Alternative employment arrangement, Dual labor market, Risk, Insurance
JEL codes: J23, J31, J41, J42

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1 Introduction

Firms in developed countries increasingly rely on workers with nonstandard contracts, which might include workers on temporary contracts, part-time workers, or workers hired through a temporary help agency. About half of the newly created jobs in OECD countries between the mid-1990s and the mid-2000s have been nonstandard (OECD, 2015). Nonstandard jobs are associated with low pay, fewer fringe benefits, and less employment security, and the policy that attempts to improve their labor-market situation attracts public attention. Despite intensified attention to the issue, little is known about the factor fundamentally differentiating the two types of workers.

We hypothesize that the fundamental source of the difference is the importance of the firm-worker match quality and firm-specific human capital. Our conceptual framework predicts differential employment and wage reactions to an exogenous shock between two types of workers. To test the hypothesis, we compare employment and wage adjustments of workers on standard and non-standard contracts using firm-level data from the manufacturing industry in Japan. As an exogenous variation to the firm, we construct a shift-share variable exploiting the cross-sectional variation in international trade exposure across firms and the time-series variation in foreign exchange rates.

Numerous studies examine employment adjustments to the firm's shock and reveal the importance of the adjustment cost.[1] Among these studies, Yokoyama et al. (2021) estimate the different employment adjustments between standard and nonstandard workers to exogenous shocks and find that the employment of nonstandard workers is more sensitive than that of standard workers. The current paper differs from Yokoyama et al. (2021) in exploring the different wage adjustments between permanent and fixed-term workers at the firm-level, which becomes only possible with newly constructed linked employer-employee matched data (LEED).

A strand of literature drawing on LEED studies wage adjustments in response to the firm's shock. Existing studies find that wages are affected by the shock to the firm and suggest that

[1] A classic literature examines the employment adjustment to the firm's product demand; Hamermesh (1993) reviews the literature until the 1980s. Hildreth and Ohtake (1998) is an example of a Japanese case. In a closely related context, Hosono et al. (2015) examined the impact of the 2007-2009 global financial crisis on the employment of temporary agency workers.

wages are not simply determined through a perfectly competitive labor market. An important insight from the literature is that labor market friction creates quasi-rent for a specific firm-worker match, and the firm and the worker share it (Card et al., 2018).[2] Most studies, however, limit their attention to the wage change among workers who stay with the firm, neglecting the employment adjustment (Guiso and Pistaferri, 2020). Also, extant studies pay little attention to the heterogeneous wage change by contract types. This paper contributes to this literature by investigating simultaneous adjustments of employment and wages, paying attention to its heterogeneity by types of employment contracts.[3]

To motivate our empirical study, we first lay out the theoretical discussion of the firm's behavior with two distinct labor inputs. We consider workers on standard (i.e., on full-time, permanent employment contracts) and nonstandard contracts as different inputs, reflecting the differences in their jobs within the firm. Since workers on standard contracts engage in complicated tasks requiring specific human capital, the firm incurs non-negligible hiring costs to find a well-matched worker and provide appropriate training. The firm also incurs a firing cost to terminate an indefinite contract. In contrast, workers on non-standard contracts typically perform standardized routine tasks; thus, hiring costs for them are negligible. The firing cost is also nominal because the contract period is fixed. These differences in hiring and firing costs also affect wages. For workers on standard contracts, the friction generated by hiring and firing leads to a gap between their wages paid by the current employer and their outside options. Also, the wage scheme of workers on standard contracts usually includes a profit-sharing component to share the match-specific quasi-rent. In contrast, non-regular workers' wages are determined by external labor market conditions, because other workers can easily replace them.

Our empirical analyses find that the appreciation in JPY indeed reduces the sales of exporting firms. It does not affect the employment of in-house workers, but substantially reduces the

[2]On the flip side of the coin, the firm shifts only a part of the shock to workers in the form of wage change. Therefore, firms act as insurance providers to workers (Guiso et al., 2005).

[3]In a related context, Maibom and Vejlin (2021) examine how shocks to firm performance affect the income of incumbent workers and employment, with a focus on the heterogeneity across occupations, firm size, and worker's educational background. They find that the effect on income is larger for blue-collar workers and workers in small firms. On the employment margin, blue-collar, low-educated, low-tenure workers face greater risks of unemployment, while the effect on job-to-job transitions is larger for managers and high-educated workers.

employment of dispatched workers. In terms of wages, the appreciation of JPY reduces the compensation of permanent workers of the exporting firm, but it does not affect the compensation of fixed-term workers. The adjustment in compensation for permanent workers only reflects in bonus payments, not in monthly compensation. Our empirical findings suggest that workers on standard contracts are less affected by short-term employment fluctuations and benefit from rent-sharing. In contrast, workers dispatched from temporary help agencies are subject to employment fluctuations. Dispatched and in-house fixed-term workers are excluded from rent-sharing.

Our study contributes to the literature by providing direct evidence for the micro-dual labor market (Atkinson, 1984; Cappelli and Neumark, 2001; Kalleberg, 2003). The literature argues that firms use workers on standard contracts to secure *internal flexibility* to attain flexible allocation of workers across jobs, to design an incentive scheme to induce workers' effort, and to encourage firm-specific skill accumulation in the long term. Given the specificity of the firm-employee relationship, firms do not adjust the number of such workers in response to temporary product demand shocks, but could partially shift the burden to workers in the form of wage adjustment, as suggested by the literature on rent- or risk-sharing as wage determinants (Card et al., 2018; Guiso and Pistaferri, 2020). In contrast, the firm use workers on nonstandard contracts as a buffer to the firm's demand shocks to secure the *external flexibility*. The firm arguably attains both internal and external flexibility by hiring both regular and non-regular workers. Our finding on asymmetric employment and wage adjustments is consistent with these theoretical predictions.

Our study also contributes to the literature on the adjustment of workers hired through temporary help agencies. The ultimate form of the nonstandard contract is the outsourcing of certain tasks to different firms, but studies on the employment adjustment of outsourced labor are scarce, because those workers dispatched through temporary help agencies do not appear in the administrative data of client firms, except for in a few countries such as Argentina (Drenik et al., 2023). To overcome this limitation, we exploit a unique firm-level survey in Japan that includes information on dispatched workers used in the firm to fill this gap.[4]

[4] Although our data do not allow us to examine the wages of dispatched workers, in a related context, several studies have shown that outsourced workers earn lower wages due to exclusion from firm-specific wage premia (Dube and Kaplan, 2010; Goldschmidt and Schmieder, 2017; Drenik et al., 2023) and suggest a potential link between outsourcing and rising inequality (Goldschmidt and Schmieder, 2017; Autor et al., 2020).

The rest of the paper is organized as follows. Section 2 introduces the theoretical backdrop of the micro dual labor market. Section 3 lays out the empirical model. Section 4 describes the data and implements graphical analysis. Section 5 reports the basic results. Section 6 reports the results of heterogeneity analysis and robustness check. Section 7 concludes.

2 Conceptual Framework

2.1 Relationship between product demand and the exchange rate

Suppose that the product market is differentiated and each firm is monopolistically competitive, facing a downward sloping demand curve of its product. Furthermore, there are two markets: domestic and international. Let p, e, and EXP denote the product's price in the domestic currency, the exchange rate of the domestic currency, and the share of the international market in the firm's total sales. Then, the total demand for firm i's product in period t is written as the sum of the domestic and international demand:

$$D_i(p_{it} : EXP_{i0}, e_t) = (1 - EXP_{i0})D_i^d(p_{it}) + EXP_{i0} \times D_i^f(p_{it}e_t) \tag{1}$$

where D_i^d is the domestic demand, D_i^f is the foreign demand, p_{it}, and EXP_{i0} is the firm i's permanent nature of export share. The demand function in each market is decreasing in the price, i.e., $D'^d < 0$ and $D'^f < 0$. Since $\frac{dD(p_{it}:EXP_{i0},e_t)}{de_t} = EXP_i \times p_t \times D'^f(p_{it}e_t) < 0$ as long as $EXP_{i0} > 0$, the appreciation of the domestic currency shifts the demand curve to the left, and the decrease in the product demand is larger for a firm with larger export share EXP_{i0}.

2.2 Different Adjustment Costs by Worker Type

The firm hires two groups of workers on standard and nonstandard contracts, respectively. We consider them as different inputs in the production function, given the substantial differences in the tasks they perform. Workers on standard contracts are assigned complicated jobs, and as described below, the employer incurs additional hiring costs to hire them and their wages can deviate from their outside market wages.

There are several reasons behind the hiring and firing costs of workers on standard contracts. First, the match quality between the worker and the job affects productivity; therefore, the employer may need to pay costs in searching for well-fitted workers. Second, since regular workers' tasks require specific skills and background knowledge, the employer may incur some training costs. To avoid the hiring cost in the future, the firm has an incentive to hoard workers in the temporary recession. In addition, employment protection laws may impose non-negligible firing costs.

These hiring and firing costs make it costly to adjust the number of regular workers in response to temporary shocks. To see this point, let us construct a very simple model. For simplicity, we introduce a fixed "adjustment cost," h, of hiring or firing an additional worker. Let w_r denote a regular worker's wage, and then the total cost of hiring L_{rt} regular workers in period t can be written as

$$C(L_{rt}) = w_r L_{rt} + h \times |L_{rt} - L_{r,t-1}|. \tag{2}$$

The marginal cost of an additional regular worker is w_r at the point where $L_{rt} = L_{r,t-1}$, $w_r + h$ if $L_{rt} > L_{r,t-1}$, and $w_r - h$ if $L_{rt} < L_{r,t-1}$. That is, the marginal cost of regular workers jumps at the previous period's level of employment. Therefore, if the marginal product of the worker on a standard contract is between $w_r - h$ and $w_r + h$, a firm that aims to maximize its profit in period t would choose $L_{rt} = L_{r,t-1}$ as the current period's input of regular workers.

In reality, the adjustment cost is particularly important when shocks to the marginal product are temporary. The change in the exchange rate, the shock to the product market we are going to examine, is arguably temporary, and thus firms may not change the number of regular workers in response to exchange rate shocks.

In contrast to workers on standard contracts, workers on nonstandard contracts perform standardized routine tasks. Since it is easy to find replacements for them, the hiring cost for the firm is negligible. Also, from the worker's point of view, they can easily move to another employer if the firm pays less than the market wage. Thus, the wages of workers on nonstandard contracts are presumably determined by external labor market conditions.

In our data, workers on nonstandard contracts are further divided into dispatched workers,

who are employed by temporary help agencies, and other workers on nonstandard contracts, who are directly employed with fixed-term contracts. Their adjustment costs are slightly different, reflecting the difference in the typical contract periods. The contract between temp agencies and firms can be used to adjust the number of dispatched workers. Non-renewal of the contract at its end does not incur any cost. Since the majority of contracts are within three months,[5] the adjustment can be made relatively quickly. Regarding the directly employed workers, there is no legal cost of not renewing the fixed-term contract when the term ends, but it is almost as hard to terminate the contract in the middle as to displace workers on indefinite contracts. Since the typical contract length is one year or longer,[6] their employment adjustment may be slower than that of dispatched workers.

2.3 Rent-sharing between the firm and regular workers

Regular workers are assigned complicated jobs, in which specific skills and background knowledge affect productivity. This generates the hiring costs described above, and this friction allows the gap between w_r and the worker's reservation wage to persist. This gap can be interpreted as the quasi-rent arising from the match quality between the job and the worker and the returns to the job-specific human capital investment. Furthermore, as reviewed in Card et al. (2018), many empirical studies have shown a positive correlation between firms' profitability and the wages of their employees. This correlation is interpreted as rent-sharing between the employer and employees.

In addition, several different, not mutually exclusive theories explain why firms have the incentive to set w_r strictly greater than the worker's reservation wage, including the efficiency wage to prevent shirking (Shapiro and Stiglitz, 1984) and the fair wage-effort hypothesis (Akerlof and Yellen, 1990). In line with such theories, a profit-sharing bonus is often used as an incentive scheme for regular workers. That is, the employer tries to give its employees incentives to invest in their human capital, or increase work effort, by sharing the returns on their investment or effort.[7] This

[5] General Survey on Dispatched Workers 2017, Ministry of Health, Labour and Welfare.

[6] According to Employment Status Survey 2017, 38% of fixed-term employees answered that their employment contract is strictly longer than 6 months and shorter or equal to 1 year, and 22% answered strictly longer than one year. Since contracts for seven months or ten months are rare, the majority of "strictly longer than 6 months and shorter or equal to 1 year" is likely to be exact one year.

[7] Fitzroy and Kraft (1987) finds a positive correlation between profit-sharing and productivity, and Wilson and Peel

is particularly plausible when firm-specific skills and knowledge are an important factor of productivity.

The existing studies on the Japanese labor market demonstrated that the share of bonuses to total compensation is high compared to other countries (Nakamura and Nakamura, 1991; Nakamura and Hübler, 1998; Hart and Kawasaki, 1999; Kato, 2016; Kawaguchi et al., 2017; Kodama and Yokoyama, 2018). For example, Nakamura and Hübler (1998) show that the ratios of bonus to regular pay in the 1980s were 0.317, 0.121, and 0.194 for Japan, Germany, and the U.S., respectively.

The Japanese bonus amount is flexibly adjusted because the workers recognize that the amount can fluctuate depending on the firm's performance (Hashimoto, 1979; Kawaguchi and Ohtake, 2007; Kawaguchi et al., 2017; Kodama and Yokoyama, 2018). Hashimoto (1979) shows that increased profitability leads to higher bonus-earning ratios, consistent with productivity motivations for profit-sharing (Blasi et al., 1996). Hashimoto (1979) also found that workers with longer tenure tend to receive a higher proportion of their compensation in the form of bonuses. This implies that during periods of economic hardship, the firm adjusts bonuses in a flexible manner to retain employees who possess skills specific to the firm.

3 Empirical Model

This section introduces an empirical model to estimate how a fluctuation in the exchange rate affects the change in various outcomes of a firm and its employees, such as total sales, the total number of employees, wages, and bonuses. We pay particular attention to the heterogeneity of impacts by the types of employment contracts. We focus on exporters rather than importers, because the exchange rate directly affects sales in JPY through changing the product price for exporters, but it only indirectly affects the sales of importers through production cost reduction. How much of the cost reduction of importers is shifted to the product price depends on the firm's markup behavior, and thus the effect of appreciation on sales of importers is not straightforward. That said, a significant fraction of firms is involved in both exports and imports, and thus to elicit the impact of

(1991) show that profit-sharing reduces absenteeism and quits. Furthermore, Blasi et al. (1996) provides supportive evidence for productivity-related motivations for profit-sharing.

the exchange rate fluctuation on exporters, we control for the effects that come from the importing side.

Following the literature (Campa and Goldberg, 2001; Nucci and Pozzolo, 2010; Yokoyama et al., 2021), our empirical model allows the impacts of exchange rate fluctuations to vary with the firm's trade exposure. Specifically, the empirical model to estimate these impacts according to the fluctuation of the exchange rate is specified as follows.

$$\Delta \ln Y_{it} = \beta_0 + \beta_1 Exp_{i0} \times \Delta \ln E_t + \beta_2 Imp_{i0} \times \Delta \ln E_t + Year\ dummies_t + \Delta v_{it} \tag{3}$$

where Y_{it} denotes one of the outcome variables, such as total sales and the number employees of firm i in year t, and $\Delta \ln Y_{it} = lnY_{it} - lnY_{it-1}$. The variable Exp_{i0} is the mean of the share of export sales in the pre-sample period. Similarly, Imp_{i0} is the share of imported inputs among the total operating costs in the same period. The term $\Delta \ln E_t$ is the exchange rate change between year $t-1$ and t, where an increase means the appreciation of JPY. This first difference of the exchange rate is considered to be a shock that is hard to predict (Rossi, 2013). Since neither Exp_{i0} nor Imp_{i0} is time invariant within a firm, they are dropped from the first-difference Equation (3). Also, note that we do not need to include $\Delta \ln E_t$ because it is absorbed in the year fixed effects.

Since the appreciation of JPY is likely to decrease the total sales of exporting firms through an increase in the product price, we expect β_1 to be negative. As stated above, $Imp_{i0}\Delta \ln E_t$ is treated as a control variable in Equation (3).

4 Data

4.1 Data construction and descriptive statistics

We construct a firm-level panel data set by merging two sources. The first data set is the Basic Survey of Japanese Business Structure and Activities (BSJBSA) by the Ministry of Economy, Trade and Industry, a panel survey of all firms in Japan that meet the minimum size criteria. This data set contains information on the number of employees by the contract types, and international trade exposure. The second data set is the Basic Survey of Wage Structure (BSWS) by the Ministry

Health, Labour and Welfare, which consists of a random sample of payroll records from randomly sampled establishments. From this data source, we construct establishment-level average wages and hours worked by workers' characteristics, including the type of employment contract. Then we merge these two data sets with the firm ID using the firm-establishment crosswalk from the Economic Census for Business Frame by the Ministry of Internal Affairs and Communications. We assume that the workers in the establishments sampled in the BSWS represent all workers in the firm. We restrict our sample to firms that are in the manufacturing sector, and our analysis sample includes 6,519 observations from 2,374 firms covering the period between 2006 and 2017, which is unbalanced panel data.

The key variable in our analysis is the shift-share variable defined by the trade exposure and the changes in the exchange rate. We calculate each firm's export and import share using the BSJBSA; export share is the proportion of direct export sales in total sales, and import share is the proportion of purchases from direct imports in total cost. We calculate the average value of export share and import share for each firm from 1998 to 2005 to avoid the share variables being affected by the exchange rate fluctuation. The share variable is used in conjunction with the shift variable, the fluctuation in the exchange rate. For the exchange rate, we use the Real Broad Effective Exchange Rate for Japan (REER) from the Bank of International Settlement, from which we calculate a moving average over the last 12 months.[8] Since the accounting period differs across firms, the REER for the last month of the accounting period is merged. This adjustment ensures that the periods of exchange rate measurement and firms' activity measurement overlap.

We create several outcome variables on sales and employment of the workers on heterogeneous contracts. First, from the BSJBSA, we create variables for the changes in total sales and the total number of employees. We further construct employment variables by the type of employment contract: directly employed (regular and part-time) and indirectly employed. From the BSWS, we construct the mean work hours and wages at the firm level by type of contract and age.

Table 1 reports descriptive statistics for our constructed data set for variables created from the BSJBSA. Column 1 shows that the mean total employment is 466 including all industries. Column

[8]The data are downloaded from FRED of St. Louis FED.

2 shows that restricting the sample to the manufacturing sector reduces the average number of employees to 399. Column 3 shows that, after matching the BSJBSA to the BSWS, the average number of employees becomes 1,377. To be included in the matched sample, an establishment should appear in the BSWS in two consecutive years to construct the first difference variable, and larger establishments are more likely to be sampled in two consecutive years, because BSWS over-samples larger establishments. The larger firm size of the analysis sample is a natural consequence of the survey design. The BSWS includes the annual bonus amount of the previous year. We create the first differenced variable of two consecutive years and merge them to the primary data set with one-year lag. This operation requires the firms should appear in BSWS in three consecutive years to construct the bonus variable.

Table 2 reports descriptive statistics for the matched data set for variables created from the BSWS. The sample sizes differ slightly by variables because we drop firms that do not have workers that correspond to the type of contract or age of the employer and firms that do not have bonuses or other benefits (The sample size is summarized in Appendix Table A1).

We first provide an overview of the descriptive statistics of all firms reported in Column (1) of Table 2. The hours worked by permanent employees are approximately 10% longer than those of temporary employees, and monthly salaries are about 65% higher than those of temporary employees. Monthly wages increase as workers age among permanent workers but not among temporary workers. The annual bonuses of all workers are about 3.4 times higher than their monthly earnings. Put differently, about 22% (3.4/15.4) of yearly compensation is paid as a bonus. The fraction is only 8% among temporary workers, reflecting that the bonus is less critical for temporary workers. The steeper monthly salary-age profile and the higher fraction of bonus payment among permanent workers than among temporary workers are consistent with the notion that firm-specific human capital is more crucial among permanent workers than among temporary workers.

We next compare the characteristics of exporting and non-exporting firms by comparing Columns (2) and (3). In terms of hours worked, workers in exporting firms work only about 2% less than those in non-exporting firms. In contrast, the monthly salary of workers in exporting firms is

about 25% higher than their non-exporting counterparts, and the wage differential is more substantial among permanent workers than among temporary workers. Among permanent workers, monthly wages show that exporters have a steeper age-wage profile compared to non-exporters. The wage differential between exporters and non-exporters is even more pronounced in the bonus; the bonus of exporters is about 61% higher than that of non-exporters. Looking at the importance of bonus from a different angle, 25% of annual compensation is in the form of bonus payment among exporters, whereas it is 20% among non-exporters. Steeper age-wage profile and higher fraction of bonus in total compensation among permanent workers among exporters are consistent with the notion that firm-specific human capital is more pronounced among exporters than non-exporters. A consensus of trade literature is that exporters tend to have higher TFP than non-exporters to cover the fixed cost of trade. The descriptive evidence suggests that the firm-specific human capital can partially explain the high TFP of exporters. As we will see later, exporters reduce the bonus payment when hit by the negative shock induced by JPY appreciation. Thus, paying a high fraction of annual compensation as a bonus can be understood as a precautionary behavior of exporting firms.

4.2 Trade exposure and exchange rate fluctuation

We now review the sources of exogenous variation: heterogeneous trade exposure and the exchange rate fluctuation. Figure 1 illustrates the dispersion of export share calculated from the observations between 1998 and 2005. We identify the export share for 2,374 distinct firms, and 59.3% of them are non-exporters. Figure 1 illustrates the distribution of the export share of the remaining 40.7% of exporting firms, with many companies having an export share of 10% or less and a few firms exporting a significant percentage among their total sales. The non-exporting firms serve as a control group, and the considerable heterogeneity in export share implies that the effect of exchange rate fluctuations may differ even among the exporting firms.

Figure 2 illustrates the exchange rate fluctuations over our sample period, standardized with 2010 as 100. As is evident from Figure 2 , the exchange rate experienced substantial increases and decreases during the sample period. In particular, the yen depreciated during the global financial

crisis of 2008, whereas it has appreciated since 2013, the period of Abenomics. The relatively light negative damage from the global financial crisis that made the JPY a safe asset is allegedly the source of the appreciation of the JPY in 2008. The source of JPY depreciation, however, is allegedly the expected appointment of the dovish governor of the Bank of Japan. Arguably, this substantial change in the exchange rate is caused by monetary but not real shocks. The combination of the variation in the export share shown in Figure 1 and this fluctuation in the exchange rate during the sample period constitutes the variation in the shift-share variable that serves as a source of identification in our analysis.

The presumption of our argument is that the appreciation of JPY decreases the export of Japanese firms. Table A2 in the Appendix robustly confirms this relationship both in the BSJBSA and in the analysis samples. The specification with firm fixed effect based on the analysis sample indicates that 10 percent appreciation of JPY decreases the firm's export by 2.3 percent.

4.3 Graphical analysis of the impact of exchange rate fluctuation on employment and wages

Before conducting the econometric analysis, we provide graphical illustrations on the impact of exchange rate fluctuations on employment and wages using sensitive outcome variables.

As employment, we focus on the number of dispatched workers because previous studies showed that their employment is sensitive to exogenous shocks (Hosono et al., 2015; Yokoyama et al., 2021). Figure 3 illustrates the REER time series and the number of dispatched workers per firm by export status. This figure indicates that the appreciation of JPY after the Great Recession in 2008 is associated with a sharp drop in the number of dispatched workers. On the other hand, the depreciation of JPY is followed by a gradual increase in the number of dispatched workers. These patterns are more pronounced among exporting firms, indicating the use of dispatched workers as an employment adjustment margin, but they are not yet definitive in causality.

Next, we illustrate how the fluctuation of the exchange rate affects wages. Among the wage components, for example, we choose bonuses because bonuses are known to reflect firm performance (Hashimoto, 1979; Freeman and Weitzman, 1987; Kawaguchi and Ohtake, 2007). Figure

4 draws the time series of the REER and the average amount of bonuses by export status. This figure shows that the REER of JPY and the bonus are negatively associated with exporting firms, whereas the correlation does not exist among non-exporters. These patterns are consistent with the notion that exporting firms share their windfall profit due to JPY depreciation with their workers by paying higher bonuses.

5 Empirical Results

5.1 Impacts on Sales and Total Employment

Table 3 shows the estimated impact of the exchange rate fluctuation on the log difference in total sales and the number of total employees, both taken from the BSJBSA. The first column shows that the appreciation of JPY reduces the total sales of exporters; A 10% appreciation of JPY reduces total sales by 0.699% for firms that export 10% of total sales. The estimated coefficient is statistically significant at the 1% level. The finding that appreciation reduces exporter sales is consistent with the findings of Ito et al. (2016) and Yokoyama et al. (2021).

The second column in Table 3 reports the effect on the change in the number of employees. The appreciation of JPY decreases the employment of exporters, although this effect is not statistically significant. Furthermore, the magnitude of the employment response is much smaller than the size of the sales response. The lack of employment adjustment to the temporary shock caused by the exchange rate fluctuation implies the non-negligible adjustment cost of employment, at least in the short run.

Note that the majority of employees in the firms in our data are regular workers on standard contracts. Thus, the above results reflect mainly the difficulty in adjusting the number of regular workers. Examining the change in regular employees, reported in Column (3), reassures this. The adjustment costs for workers on non-standard contracts may be smaller; Thus, we scrutinize the adjustments of workers on nonstandard employment contracts in the following analysis.

5.2 Impact on Employment by Employment Contract Types

We examine employment adjustments among nonstandard contract workers, paying close attention to their heterogeneity. As explained in Section 5.1, workers on nonstandard contracts are either directly employed or on indirect employment schemes. The cost of adjusting the workforce can vary depending on the type of employment scheme used. For direct employment of part-time workers, the adjustment cost can be higher compared to the indirect employment scheme of dispatched workers. This difference in cost can be attributed to the difference in the typical contract length between the two schemes. In-house part-time workers typically have a contract length of one year, while dispatched workers have a contract length of three months. Table 4 presents separate estimates of the impact of exchange rate fluctuations on the employment of part-time and dispatched workers.

The estimation results reported in Table 4 show the stark contrast of adjustments between directly employed and indirectly employed workers. To capture the changes in the number of each type of workers, we define three dependent variables. *Increase* is defined as $I(y_{it} - y_{it-1} > 0)$, *Decrease* is defined as $I(y_{it} - y_{it-1} < 0)$, and we use $\ln(y_{it}) - \ln(y_{it-1})$ for firms that hire the worker in the category in both years.

The first three columns report the estimation results for in-house part-time workers. The appreciation of JPY does not affect the employment of part-time workers among exporters. In contrast, we find significant negative impacts on the employment of dispatched workers among exporters. Column (4) shows that an appreciation of JPY reduces the probability of increasing the number of dispatched workers within an exporting firm at the 1% significance level. A 10% appreciation of JPY reduces the probability of increasing the number of dispatched workers by 1.96% for a firm that exports 10% of its total sales. Column (5) indicates that an appreciation of JPY also increases the probability of decreasing the number of dispatched workers. Column (6) shows that the appreciation of JPY reduces the number of dispatched workers of the firms that hire them both $t-1$ and t, and the estimate is statistically significant at the 10% level. These results illustrate that firms adjust dispatched workers in response to exchange rate fluctuations at both the extensive and intensive margins, reassuring that the association reported in Figure 3 is due to causality.

Given these results, we interpret the insignificant effect on the total employment presented in Table 3 as follows. Since the fraction of dispatched workers is relatively small in most firms (Mean=0.072, SD=0.156), the negative impact on their employment is masked by the insignificant impact on the employment of regular workers and part-time workers, both of whom belong to direct employment schemes and are the majority in most firms.

5.3 Impacts on Hours Worked

This subsection examines the impact of exchange rate changes on hours worked. The working hours per worker is another important adjustment margin in addition to employment. Hours worked is available only from payroll records of the BSWS, which covers in-house workers only. In-house workers in the BSWS include both permanent and fixed-term contract workers, so we focus on the difference between them.

Table 5 Column (1) shows that the appreciation of JPY decreases the hours worked among all workers, but the estimated impact is small and not statistically significant. The estimates imply that a 10% appreciation of JPY decreases the hours worked of workers belonging to a firm that exports 10% of total sales by only 0.04%, which is negligible. Dividing the analysis sample by the length of employment contract does not change the results, as reported in Columns (2) and (3).

Together with the results of Table 4, the quantitative adjustments are thought to be made mainly through changes in employment of dispatched workers. Previous studies on the Japanese economy based on time series analysis identified the work hour adjustment as an important labor-hoarding instrument (e.g., Hamada and Kurosaka (1984)). Although our results differ from previous studies, it is worth noting that our estimates suggest a decrease in work hours for workers in exporting firms when the JPY appreciates, although this finding is not statistically significant. At least, Our results are qualitatively consistent with the claims made by previous studies.

5.4 Impacts on Wages and Bonuses

We next investigate the impacts of exchange rate fluctuation on wages and bonuses, utilizing the BSWS.

Columns (1) - (3) in Table 6 tabulate the effect of exchange rate fluctuation on monthly wages. Column (1) reports the result for pooling all in-house workers, Column (2) for permanent workers, and Column (3) for temporary workers. Although all the estimated coefficients for the exporters are negative, suggesting that the appreciation of JPY reduces the monthly wages, all are imprecisely estimated, and thus none of the estimates are statistically significant. Therefore, we cannot say anything definitive about the impact of the exchange rate on monthly wages. This result is natural given that monthly wages are rigid and difficult to change in response to temporary shocks.

The last three columns in Table 6 report the regression results that use bonus amount as the dependent variable. Column (4) shows that the appreciation of JPY substantially reduces the bonus amount of exporting firms. The estimated impact is about seven times as large as the impact on monthly wages. The sub-sample analysis reported in Columns (5) - (6) shows that the negative impact is statistically significant only among permanent workers. This is largely because bonuses are less important among temporary workers. The findings conform to the received wisdom in the literature that the bonus payment of Japanese firms is a form of profit sharing among workers with firm-specific skills (Hashimoto, 1979; Freeman and Weitzman, 1987).

The BSWS does not allow us to examine the wage impacts on workers in the indirect employment scheme, namely, the dispatched workers hired through a temporary help agency. However, it is worth discussing the possible impact on them. Those workers are typically on short-term contacts with a temporary help agency, and most contract periods are three months or less.[9] Moreover, the workers are hired by a temporary help agency instead of the firm for which the worker works. Given the short-term and indirect nature of their contracts, firm-level shock or quasi-rent is less likely to be shifted to workers. Instead, their wages are likely to be determined by the local labor market. In the end, fluctuations in exchange rates do not seem to impact the wages of workers hired through temporary help agencies.

The analysis presented in this section highlights significant differences in employment and wage adjustments among different types of workers. The firm reacts to the temporary shock by changing the employment of workers hired from temporary help agencies, but it does not modify

[9] General Survey on Dispatched Workers 2017, Ministry of Health, Labour and Welfare.

the employment of in-house workers. This suggests that the company employs temporary workers to secure external flexibility, while regular workers are kept employed to maintain firm-specific matches. The wage analysis indicates that the firm manages to cope with the temporary shock by adjusting the wages of in-house regular workers, especially at the bonus payment margins.

6 Additional Empirical Results

6.1 Heterogeneous effects across different age groups

This section explores potential heterogeneity in the impact of exchange rate fluctuations across different age groups. Since the number of temporary workers per firm is not large enough to conduct an analysis by age group, the results presented in this section focus on permanent workers.

Table 7 reports the regression results of the change in average hours worked on the exchange rate fluctuation to assess the importance of the adjustment of hours. As shown in Table 5, when all age groups are pooled, the effect on hours worked is insignificant for both permanent and temporary workers. Table 7 further confirms that the estimated impact is precisely estimated and close to zero for all age groups among permanent workers.

The first three columns of Table 8 report the impact of exchange rate fluctuation on monthly wages. These results show that the appreciation of JPY does not affect the monthly wages of any age group in a statistically significant way. The results confirm the findings from Table 6 that firms do not use a monthly wage margin to absorb temporary shocks caused by exchange rate fluctuations.

The last three columns of Table 8 report the impact on bonus payments. In contrast to the zero-effects on hours worked and monthly wages, the estimation results indicate that the appreciation of JPY reduces bonus payments for all age groups. Furthermore, the impact for workers age 45-59 is about 30% larger than that for workers age 18-35 or 36-44, though the difference between the estimated coefficients is not statistically significant.

Although there are other potential explanations, the larger adjustment among senior workers than among junior ones is consistent with the hypothesis that the firm hoards senior workers,

who presumably hold more intense firm-specific human capital or better match quality. The tasks done by regular workers require firm-specific human capital, and thus entail a considerable adjustment cost. Hence, the firm may hoard workers whose match quality is demonstrated to be good. Since both the firm and workers learn their match quality gradually, workers with long tenure should have, on average, better firm-worker match quality (Abraham and Farber, 1987; Altonji and Shakotko, 1987). Also, workers accumulate firm-specific human capital through on-the-job training. Therefore, firms have an incentive to hoard such workers by varying their bonuses. Since age and tenure are positively correlated, we observe a larger adjustment on senior workers' bonuses.

6.2 Potential Endogeneity of Exchange Rate

A potential threat to our identification strategy is the endogeneity of the exchange rate. The error term of the estimated equations can be correlated with the exchange rate (and its interaction terms with international exposure) through several channels. For example, specific local economies are known for heavy dependence on a specific industry, including the Chubu area's dependence on the automobile industry. Given this, monetary policy authorities can react to the current performance of specific industries considering its impact on local economies, which can eventually affect the exchange rate. Alternatively, a technological shock to an industry may be large enough to affect the exchange rate. If the exchange rate is endogenous, it is likely that the industry-year-level shock is correlated with the exchange rate. Thus, we address this concern by replicating the results reported in Tables 3 - 6 by including industry-year fixed effects. Now, our identification is to exploit within industry variation of trade exposure.

The estimation results, including industry-year fixed effects, are reported in Tables A5 - A8 in Appendix. The estimation results do not change substantially by including industry-year fixed effects, implying the robustness of our results based on the specification without industry-year fixed effects. A notable exception is the results of bonus payment reported in Tables A8. The coefficients on the interaction terms of export exposure and changes in log export for all and regular workers attenuate by approximately one-third, with slightly inflated standard errors. Attenuated coeffi-

cients with inflated standard errors make the estimated coefficients statistically insignificant. The change in the results suggests that the co-movement of exchange rates and bonus payments among exporters is partially driven by industry-level temporal shocks. This is in line with the received wisdom in the literature that claims that the bonus payment of Japanese firms is motivated by the rent sharing between employers and employees Hashimoto (1979); Freeman and Weitzman (1987). In the bonus negotiation between the employer and employees, the macroeconomic environment, including exchange rate and export performance, is often referred to as an exogenous determinant of the firm's performance. Thus, after removing the industry-year-specific effect, the relationship between the exchange rate and bonus payment weakens among exporters.

7 Conclusion

This paper examines how a shock to the firm propagates to the employment and wages of in-house regular and non-regular workers, and the dispatched workers from temporary help agencies. The empirical result indicates that the firm adjusts the employment of dispatched workers and the wages of in-house regular workers to the shock, which is consistent with the theory that the two types of workers have different adjustment costs, reflecting the difference in the importance of the employer-employee match. The finding bolsters the argument that regular and non-regular workers are involved in different tasks in the firm.

Given the indirect evidence that regular and non-regular workers are involved in different tasks characterized by the firm-specificity, the increase in the number of non-regular workers implies that the firm has become able to separate non-firm-specific tasks from firm-specific tasks and cut out the non-firm specific tasks to non-regular workers. Specifying the technological or institutional change that enables the firm to do so will shed light on why we observe the increase in non-regular employment. Such an investigation is left for further research.

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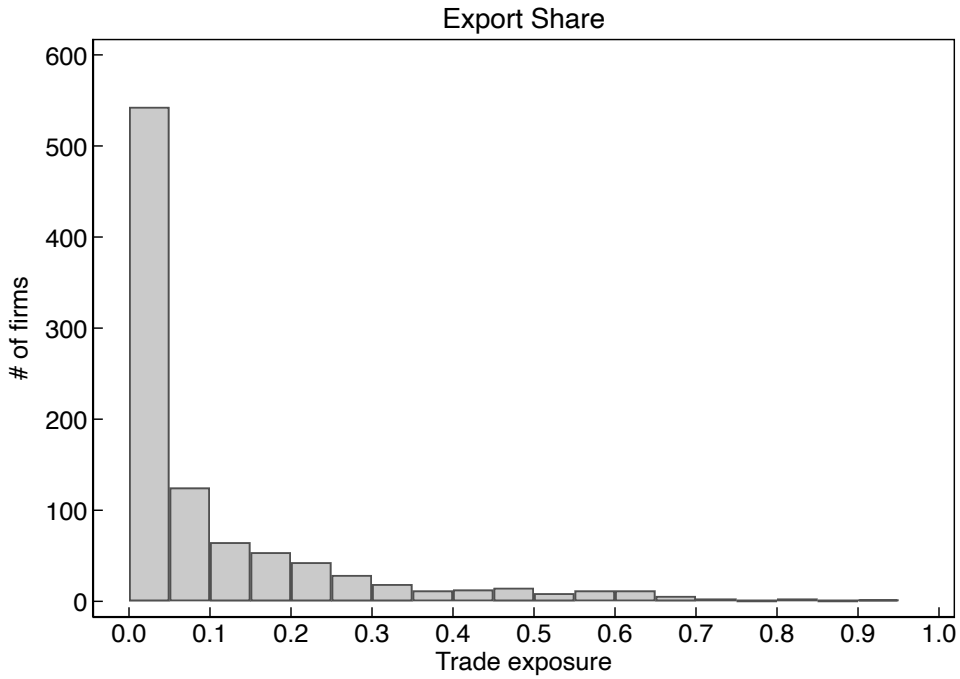

Figure 1: Distribution of Export Share for Exporting Firms

Source: Basic Survey of Japanese Business Structure and Activities by the Ministry of Economy, Trade and Industry. Note: Export share is defined as the ratio of the amount of export sales to total sales. For trade information, we compiled the average over the 1998-2005 period for 2,374 firms. Mean = 0.045, SD = 0.118. The share of firms with zero export is 59.3% (N=1,407).

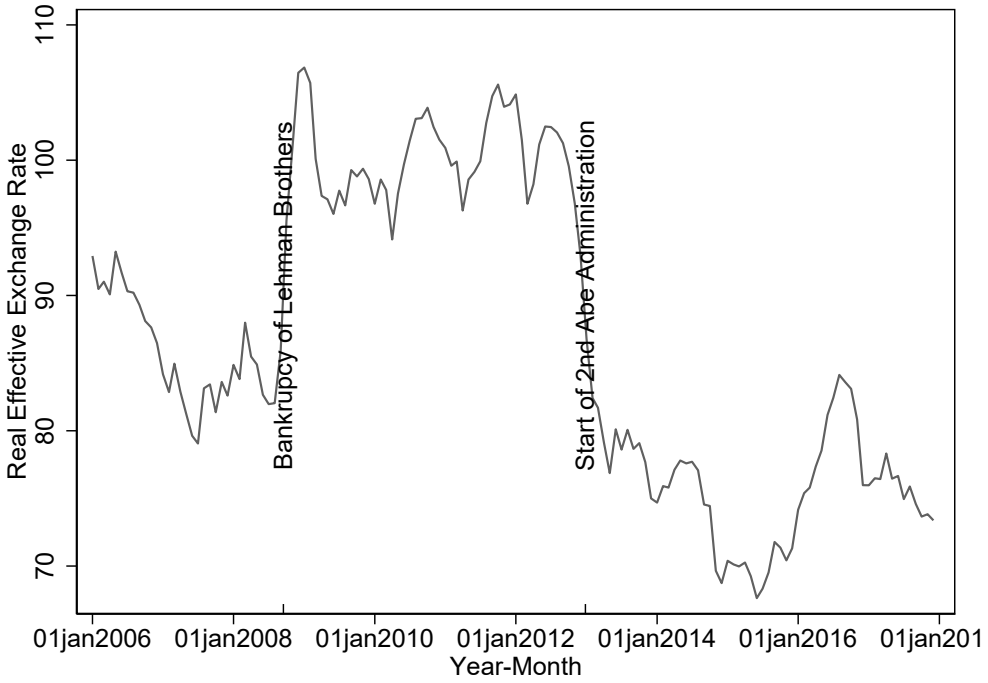

Figure 2: Time Series of Real Effective Exchange Rate of JPY

Source: Bank of International Settlement.

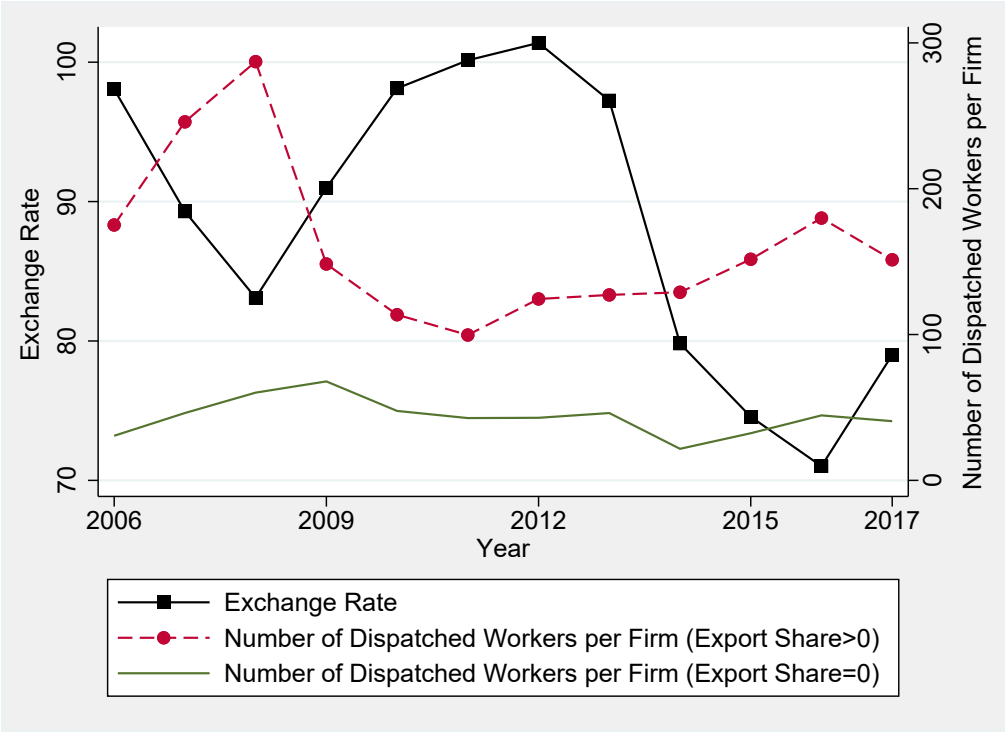

Figure 3: Exchange Rate and the Number of Dispatched Workers per Firm

Note: The average exchange rate (REER) during the sample period (2006-2017) is 88.68, while the average number of dispatched workers per firm during the same period is 164.03. We report the number of dispatched workers for exporting firms and non-exporting firms (3,579 firms that had zero export share as of 2005, which is the previous year of the sample period), separately.

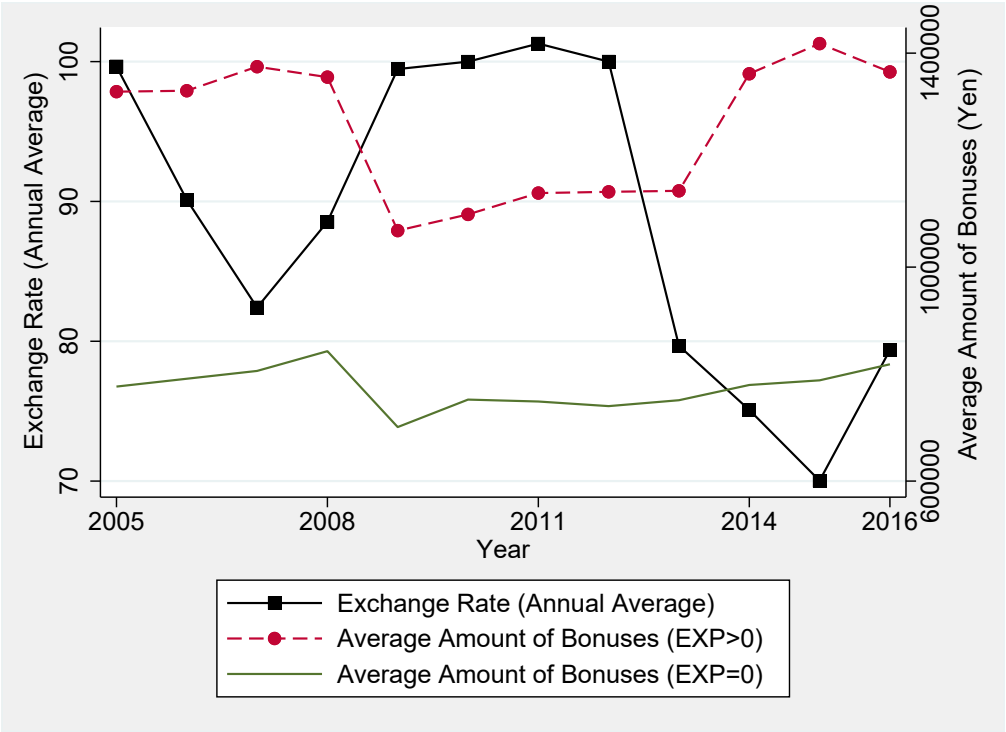

Figure 4: Exchange Rate and the Average Bonus per Worker

Note: The average exchange rate (REER) during the sample period (2006-2017) is 88.68, while the mean annual bonus amount during the same period is 106.03k JPY.

Table 1: Descriptive Statistics of Firm Characteristics by Sample Construction

	BSJBSA		Matched with BSWS		
	All Firms	Manufacture	Matched Sample		
			All	EXP $>$ 0	EXP = 0
	(1)	(2)	(3)	(4)	(5)
Sales (1mil. JPY)	23,301	22,116	90,258	157,278	40,082
	[161,534]	[155,734]	[387,008]	[528,328]	[217,023]
Total Employees	466	399	1,377	2,306	682
	[1,894]	[1598]	[4,298]	[5,741]	[2,550]
Direct Employment					
Total Regular	334	361	1,318	2,243	625
	[1,294]	[1,550]	[4,231]	[5,694]	[2,435]
Total Parttime	132	39	60	63	57
	[1,190]	[211]	[331]	[210]	[399]
Indirect Employment					
Total Dispatched	21	26	93	155	46
	[145]	[136]	[391]	[489]	[287]
N	354,558	156,300	6,519	2,791	3,728
# of Firms	46,291	19,733	2,374	1,407	967

Note: BSJBSA stands for Basic Survey of Japanese Business Structure and Activities by the Ministry of Economy, Trade and Industry. BSWS stands for Basic Survey of Wage Structure by the Ministry of Health, Labor, and Welfare. Standard deviations are reported in brackets. The export shares, denoted as "EXP", take the form of fractions, which make their range from 0 to 1. The export share is the mean of the export share of each year from 1998 to 2005.

Table 2: Descriptive Statistics of Hours Worked and Salary

	ALL (1)	EXP > 0 (2)	EXP $= 0$ (3)	Diff. (2) - (3)
Monthly hours worked				
All	176.8	174.6	178.5	-3.9***
	[19.0]	[17.6]	[19.9]	(0.5)
Permanent	178.6	175.8	180.6	-4.8***
	[19.0]	[17.6]	[19.7]	(0.5)
Temporary	163.9	160.0	167.1	-7.1***
	[31.9]	[29.9]	[33.1]	(1.0)
Monthly salary (10k JPY)				
All	31.3	35.1	28.4	6.8***
	[8.4]	[8.3]	[7.3]	(0.2)
Permanent	32.6	36.3	29.8	6.5***
	[8.3]	[8.2]	[7.2]	(0.2)
Age 18-35	26.2	28.1	24.7	3.4***
	[5.5]	[5.3]	[5.1]	(0.1)
Age 36-44	33.6	37.0	31.0	6.1***
	[8.5]	[8.1]	[7.9]	(0.2)
Age 45-59	39.0	44.0	35.1	8.9***
	[11.5]	[11.1]	[10.3]	(0.3)
Temporary	19.4	21.0	18.1	2.8***
	[9.1]	[10.8]	[7.2]	(0.3)
Age 18-35	19.3	20.8	18.4	2.4***
	[6.9]	[8.0]	[5.9]	(0.3)
Age 36-44	18.5	19.9	17.5	2.4***
	[8.2]	[9.7]	[6.7]	(0.3)
Age 45-59	19.3	21.2	17.9	3.3***
	[11.7]	[13.8]	[9.6]	(0.4)
Annual bonus (10k JPY)				
All	106.3	134.0	83.1	51.0***
	[69.9]	[69.5]	[61.1]	
Permanent	114.8	142.0	92.0	50.1***
	[71.9]	[72.4]	[62.9]	(2.3)
Age 18-35	76.7	90.1	65.5	24.6***
	[39.4]	[37.9]	[37.0]	(1.3)
Age 36-44	120.1	146.5	97.6	48.9***
	[73.7]	[74.8]	[64.8]	(2.4)
Age 45-59	153.2	191.6	120.6	71.0***
	[103.7]	[106.4]	[89.2]	(3.3)
Temporary	23.8	16.3	31.8	15.3***
	[39.2]	[23.9]	[49.6]	(1.7)

Note: Standard deviations are reported in brackets and standard errors are reported in parentheses. The sample is limited to our matched sample. The export shares, denoted as "EXP", take the form of fractions, which make their range from 0 to 1. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$. The sample sizes to calculate the statistics of each variable are different and are reported in Table A1.

Table 3: Impact on Firms' Sales and Total Employment

Dependent Variable	$\Delta \ln(Total\ Sales)$ (1)	$\Delta \ln(\#\ of\ Employees)$ (2)	$\Delta \ln(\#\ of\ Reg.Employees)$
$EXP \times \Delta \ln(E)$	-0.699***	-0.055	-0.084
	(0.229)	(0.091)	(0.108)
$IMP \times \Delta \ln(E)$	-0.044	-0.137	0.047
	(0.308)	(0.166)	(0.216)
Mean of EXP	0.056	0.056	0.056
Mean of IMP	0.019	0.019	0.019
R-squared	0.116	0.004	0.003
Observations	6,519	6,519	6,519
# of Firms	2,374	2,374	2,374

Note: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year fixed effects are included in the regressions. The variables come from the BSJBSA. The import and export shares take the form of fractions, which make their range from 0 to 1. These results are obtained from the BSJBSA. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table 4: Impact of the Exchange-rate Fluctuation on Employment of Part-time and Dispatched Workers

Type of Employment	*Direct Employment*			*Indirect Employment*		
Worker Type	*Part-time Workers*			*Dispatched Workers*		
Dependent Variable	$Increase$ (1)	$Decrease$ (2)	$\Delta \ln(\#\ of\ Employees)$ (3)	$Increase$ (4)	$Decrease$ (5)	$\Delta \ln(\#\ of\ Employees)$ (6)
$EXP \times \Delta \ln(E)$	0.401	-0.229	0.184	-1.996***	0.961***	-1.360*
	(0.443)	(0.430)	(0.712)	(0.457)	(0.332)	(0.769)
$IMP \times \Delta \ln(E)$	-1.708	0.693	-3.044	-0.006	-0.273	4.188**
	(1.217)	(1.228)	(2.184)	(1.003)	(0.980)	(2.045)
Mean of EXP	0.056	0.056	0.060	0.056	0.056	0.070
Mean of IMP	0.019	0.019	0.020	0.019	0.019	0.021
R-squared	0.002	0.004	0.008	0.029	0.035	0.081
Observations	6,519	6,519	4,174	6,519	6,519	3,301
# of Firms	2,374	2,374	1,674	2,374	2,374	1,352

Note: Notes: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year fixed effects are included in the regressions. The import and export shares take the form of fractions, which make their range from 0 to 1. 'Increase' is a dummy variable indicating firms that increased the number of each type of workers during the last year. 'Decrease' is a dummy variable indicating firms that decreased the number of each type of workers during the last year. These results are obtained from the BSJBSA. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$.

Table 5: Impact of Exchange-rate Fluctuation on Hours Worked by Worker Type

Worker Type	All	Permanent	Fixed-term
Dependent Variable		$\Delta \ln(Hours)$	
	(1)	(2)	(3)
$EXP \times \Delta \ln(E)$	-0.044	-0.034	-0.102
	(0.080)	(0.080)	(0.228)
$IMP \times \Delta \ln(E)$	0.015	0.109	-0.198
	(0.198)	(0.201)	(0.568)
Mean of EXP	0.056	0.056	0.055
Mean of IMP	0.019	0.019	0.018
R-squared	0.094	0.103	0.035
Observations	6,519	6,492	3,238
# of Firms	2,374	2,367	1,303

Note: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year fixed effects are included in the regressions. The import and export shares take the form of fractions, which make their range from 0 to 1. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table 6: Impact of the Exchange-rate Fluctuation on Wages and Bonuses by Worker Type

Wage Category	*Monthly Wage*			*Yearly Bonus*		
Worker Type	All	Permanent	Temporary	All	Permanent	Temporary
Dependent Variable		$\Delta \ln(Wage)$			$\Delta \ln(Bonus)$	
	(1)	(2)	(3)	(4)	(5)	(6)
$EXP \times \Delta \ln(E)$	-0.095	-0.093	-0.088	-0.713**	-0.737**	-1.349
	(0.067)	(0.066)	(0.527)	(0.335)	(0.332)	(1.697)
$IMP \times \Delta \ln(E)$	-0.071	-0.024	-0.994	-0.848	-0.956	0.818
	(0.185)	(0.184)	(0.974)	(0.994)	(0.986)	(5.274)
Mean of EXP	0.056	0.056	0.055	0.069	0.069	0.067
Mean of IMP	0.019	0.019	0.018	0.021	0.021	0.018
R-squared	0.063	0.073	0.019	0.066	0.066	0.014
Observations	6,519	6,492	3,238	3,496	3,496	1,380
# of Firms	2,374	2,367	1,303	809	809	406

Note: Notes: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year fixed effects are included in the regressions. The import and export shares take the form of fractions, which make their range from 0 to 1. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table 7: Impact of the Exchange-rate Fluctuation on Work Hours Among Permanent Workers by Age

Age category	18–35	36–44	45–59
Dependent Variable	$\Delta \ln(Hours)$		
	(1)	(2)	(3)
$EXP \times \Delta \ln(E)$	0.006	-0.035	-0.089
	(0.092)	(0.102)	(0.079)
$IMP \times \Delta \ln(E)$	0.077	-0.164	0.300*
	(0.239)	(0.284)	(0.172)
Mean of EXP	0.057	0.057	0.057
Mean of IMP	0.019	0.019	0.019
R-squared	0.090	0.070	0.068
Observations	6,419	6,384	6,419
# of Firms	2,349	2,336	2,349

Note: Notes: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year fixed effects are included in the regressions. The import and export shares take the form of fractions, which make their range from 0 to 1. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$.

Table 8: Impact of the Exchange-rate Fluctuation on Wages and Bonuses Among Permanent Workers by Age

Wage Category	*Monthly Wage*			*Yearly Bonus*		
Age category	18–35	36–44	45–59	18–35	36–44	45–59
Dependent Variable	$\Delta \ln(Wage)$			$\Delta \ln(Bonus)$		
	(1)	(2)	(3)	(4)	(5)	(6)
$EXP \times \Delta \ln(E)$	-0.094	-0.100	-0.062	-0.633*	-0.607*	-0.796**
	(0.099)	(0.111)	(0.110)	(0.380)	(0.325)	(0.342)
$IMP \times \Delta \ln(E)$	0.002	-0.434*	0.336	-0.276	-0.240	-0.490
	(0.212)	(0.263)	(0.232)	(1.295)	(0.943)	(0.995)
Mean of EXP	0.057	0.057	0.057	0.069	0.070	0.069
Mean of IMP	0.019	0.019	0.019	0.021	0.021	0.021
R-squared	0.057	0.041	0.018	0.045	0.060	0.058
Observations	6,419	6,384	6,421	3,448	3,430	3,456
# of Firms	2,349	2,336	2,350	802	802	806

Note: Notes: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year fixed effects are included in the regressions. The import and export shares take the form of fractions, which make their range from 0 to 1. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Appendix

Table A1: Sample Size of Hours Worked and Salary

	ALL N	EXP > 0 N	EXP $= 0$ N
Monthly hours worked			
All	6,519	2,791	3,728
Permanent	6,510	2,788	3,722
Temporary	3,792	1,693	2,099
Monthly salary (10k JPY)			
All	6,519	2,791	3,728
Permanent	6,510	2,788	3,722
Age 18-35	6,462	2,773	3,689
Age 36-44	6,450	2,776	3,674
Age 45-59	6,473	2,787	3,686
Temporary	3,792	1,693	2,099
Age 18-35	2,583	1,057	1,526
Age 36-44	2,306	971	1,335
Age 45-59	2,770	1,186	1,584
Annual bonus (10k JPY)			
All	3,496	1,597	1,899
Permanent	3,496	1,597	1,899
Age 18-35	3,470	1,588	1,882
Age 36-44	3,465	1,591	1,874
Age 45-59	3,476	1,596	1,880
Temporary	2,121	1,020	1,101

Note: The sample is limited to our matched sample.

Table A2: Firms' Sales and Real Exchange Effective Rate

Dependent Variable	$\ln(Total\ Sales)$	
	(1)	(2)
$\ln(E)$	-0.202**	-0.230**
	(0.090)	(0.113)
Firm FE	Y	Y
R-squared	0.986	0.989
Observations	13,846	9,756
# of Firms	3,315	2,374
Sample	Full	Analysis

Note: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. The sample Full refers to all firms, and Analysis represents our analysis sample, where the data are continuously observed. Year fixed effects are included in the regressions. The variables come from the BSJBSA. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table A3: Firms' Export and Real Exchange Effective Rate

Dependent Variable	Amount of Export	
	(1)	(2)
$\ln(E)$	-0.443	-1.197*
	(0.790)	(0.709)
Firm FE	Y	Y
Observations	6,115	4,261
# of Firms	1,359	960
# of dropped observations	7,731	5,495
Sample	Full	Analysis

Note: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. The sample Full refers to all firms, and Analysis represents our analysis sample, where the data are continuously observed. Year fixed effects are included in the regressions. The variables come from the BSJBSA. Extimations are performed by Poisson pseudo-maximum likelihood regressions. We used the Stata command *ppmlhdfe* developed by Correia et al. (2020). $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table A4: Impact on Firms' Sales and Total Employment Using Full BSJBA Sample

Dependent Variable	$\Delta \ln(Total\ Sales)$ (1)	$\Delta \ln(\#\ of\ Employees)$ (2)	$\Delta \ln(\#\ of\ Reg.Employees)$ (3)
$EXP \times \Delta \ln(E)$	-0.812***	-0.077*	-0.086
	(0.094)	(0.042)	(0.045)
$IMP \times \Delta \ln(E)$	-0.211	0.115	0.186
	(0.150)	(0.073)	(0.077)
Mean of EXP	0.036	0.036	0.036
Mean of IMP	0.015	0.015	0.015
R-squared	0.103	0.006	0.003
Observations	114,814	114,814	114,813
# of Firms	12,601	12,601	12,601

Note: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year fixed effects are included in the regressions. The variables come from the BSJBSA. The import and export shares take the form of fractions, which make their range from 0 to 1. These results are obtained from the BSJBSA. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table A5: Impact on Firms' Sales and Total Employment

Dependent Variable	$\Delta \ln(Total\ Sales)$ (1)	$\Delta \ln(\#\ of\ Employees)$ (2)	$\Delta \ln(\#\ of\ Reg.Employees)$ (3)
$EXP \times \Delta \ln(E)$	-0.571**	-0.009	-0.036
	(0.251)	(0.101)	(0.119)
$IMP \times \Delta \ln(E)$	-0.259	-0.255	-0.072
	(0.353)	(0.195)	(0.250)
Mean of EXP	0.056	0.056	0.056
Mean of IMP	0.019	0.019	0.019
R-squared	0.217	0.071	0.054
Observations	6,519	6,519	6,519
# of Firms	2,374	2,374	2,374

Note: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year-Industry fixed effects are included in the regressions. The variables come from the BSJBSA. The import and export shares take the form of fractions, which make their range from 0 to 1. These results are obtained from the BSJBSA. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table A6: Impact of the Exchange-rate Fluctuation on Employment of Part-time and Dispatched Workers

Type of Employment	*Direct Employment*			*Indirect Employment*		
Worker Type	*Part-time Workers*			*Dispatched Workers*		
Dependent Variable	$Increase$	$Decrease$	$\Delta \ln(\#\ of\ Employees)$	$Increase$	$Decrease$	$\Delta \ln(\#\ of\ Employees)$
	(1)	(2)	(3)	(4)	(5)	(6)
$EXP \times \Delta \ln(E)$	0.372	-0.380	0.045	-1.694***	0.970***	-0.289
	(0.483)	(0.474)	(0.808)	(0.531)	(0.368)	(0.945)
$IMP \times \Delta \ln(E)$	-2.061	0.721	-3.354	0.792	-0.424	2.575
	(1.427)	(1.367)	(2.490)	(1.070)	(1.098)	(2.156)
Mean of EXP	0.056	0.056	0.060	0.056	0.056	0.070
Mean of IMP	0.019	0.019	0.020	0.019	0.019	0.021
R-squared	0.054	0.056	0.085	0.100	0.105	0.181
Observations	6,519	6,519	4,174	6,519	6,519	3,301
# of Firms	2,374	2,374	1,674	2,374	2,374	1,352

Note: Notes: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year-Industry fixed effects are included in the regressions. The import and export shares take the form of fractions, which make their range from 0 to 1. 'Increase' is a dummy variable indicating firms that increased the number of each type of workers during the last year. 'Decrease' is a dummy variable indicating firms that decreased the number of each type of workers during the last year. These results are obtained from the BSJBSA. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$.

Table A7: Impact of Exchange-rate Fluctuation on Hours Worked by Worker Type

Worker Type	All	Permanent	Fixed-term
Dependent Variable		$\Delta \ln(Hours)$	
	(1)	(2)	(3)
$EXP \times \Delta \ln(E)$	0.004	0.001	-0.101
	(0.090)	(0.090)	(0.271)
$IMP \times \Delta \ln(E)$	-0.034	0.081	-0.090
	(0.213)	(0.216)	(0.691)
Mean of EXP	0.056	0.056	0.055
Mean of IMP	0.019	0.019	0.018
R-squared	0.159	0.167	0.112
Observations	6,519	6,492	3,238
# of Firms	2,374	2,367	1,303

Note: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year-Industry fixed effects are included in the regressions. The import and export shares take the form of fractions, which make their range from 0 to 1. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table A8: Impact of the Exchange-rate Fluctuation on Wages and Bonuses by Worker Type

Wage Category	*Monthly Wage*			*Yearly Bonus*		
Worker Type	All	Permanent	Temporary	All	Permanent	Temporary
Dependent Variable	$\Delta \ln(Wage)$			$\Delta \ln(Bonus)$		
	(1)	(2)	(3)	(4)	(5)	(6)
$EXP \times \Delta \ln(E)$	-0.019	-0.051	0.087	-0.424	-0.433	-1.549
	(0.081)	(0.081)	(0.580)	(0.386)	(0.385)	(2.139)
$IMP \times \Delta \ln(E)$	-0.091	-0.032	-1.057	-1.148	-1.162	1.683
	(0.191)	(0.194)	(1.099)	(1.044)	(1.044)	(4.661)
Mean of EXP	0.056	0.056	0.055	0.069	0.069	0.067
Mean of IMP	0.019	0.019	0.018	0.021	0.021	0.018
R-squared	0.121	0.128	0.090	0.151	0.148	0.174
Observations	6,519	6,492	3,238	3,496	3,496	1,380
# of Firms	2,374	2,367	1,303	809	809	406

Note: Notes: Standard errors robust against firm-level clustering are reported in parentheses. The sample is limited to the manufacturing industry. Year-Industry fixed effects are included in the regressions. The import and export shares take the form of fractions, which make their range from 0 to 1. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$