Labor Union Effects on Wage Dispersion: Evidence from panel data of Japanese listed companies

SAITO, Takashi
Meiji Gakuin University

MATSUURA, Tsukasa
Chuo University

OKAMOTO, Hisashi
Kobe Gakuin University

RIETI

Research Institute of Economy, Trade & Industry, IAA

Labor Union Effects on Wage Dispersion:
Evidence from panel data of Japanese listed companies[1]

Takashi SAITO[2], Meiji Gakuin University

Tsukasa MATSUURA, Chuo University

Hisashi OKAMOTO, Kobe Gakuin University

Abstract

In this study, we examined (1) whether unions can reduce wage dispersion, (2) whether the influence of unions has changed over time, and (3) whether the influence of unions differs depending on the ownership structure of firms. By combining three data sources, we created a panel dataset including data for 2004--2015. We found very small changes in union status, partly because our data set only covered a relatively short period. We used the hybrid model to address the data challenge. Our results are summarized as follows: (1) We discovered that labor unions have a role in decreasing wage dispersion based on the results of the between effect. (2) We found that the union effect gradually decreased within the sample period. (3) We discovered that there is substitutability between foreign investors and labor unions, while there is complementary between financial institutional shareholders and labor unions in terms of decreasing wage dispersion. We confirmed (1) and (3) are valid when we employed the endogenous treatment effects model to address the endogeneity problem of the union dummy. This led to the conclusion that the bargaining power of unions depends on differences in corporate governance structure.

Keywords: Corporate governance, Labor union, Wage dispersion, Institutional complementarity

JEL classification: J31, J51, G34

[2] Corresponding author : E-mail address: taksaito@eco.meijigakuin.ac.jp

1.Introduction

Recently, the influence of labor unions has reduced in most industrialized countries Data shows that the organization rate of labor unions has been consistently falling since the 1970s and union members have also been decreasing since the mid-1990s (Figure 1). Some Western studies also show that labor relations have placed more importance on human resource management on individuals rather than collective ones under labor unions (Gollan 2006; Bryson et al. 2013).

It has also been noted that wage dispersion has been increased in Japan since 1990s.While some argue that one of the underlying reasons for this is the change in age composition brought by the aging of the population, others pay attention to the influence of widening wage dispersion in the younger generation. In addition. the prevalence of performance-based payment systems since 1990s may have had a role to widen wage dispersion.

We study the influence of labor unions on wage dispersion using the panel date of Japan's listed companies. Specifically, we analyze whether labor unions can reduce wage dispersion or not, and whether the influence has changed over time. We also try to understand if labor unions have evolved over time.

As to the influence of labor unions on wages, there have been many studies. Freeman (1980) and Booth (1995) are pioneering works about the influence of labor unions on wage distribution. Some studies argue that labor unions have a role to reduce wage dispersion using the data on Western countries (Kahn and Curme 1987; Teulings and Hartog 1998; Wallerstein 1999; Blau and Kahn 1999; Franscisco et al. 2020). Farber et al.(2021) shows there is a negative correlation between income inequality and union density. As to that on the levels of wages, many studies have been conducted targeting Japanese firms (Tachibanaki and Noda 2000;Tsuru 2002; Morikawa 2010).

Although many studies have been made on the unions' effect on wages, little is known about whether it is affected by firms' heterogeneity or not. Therefore, we pay attention to firms' ownership structure. There seems to be some complementarity between ownership structure and labor relations. The Japanese employment system is characterized by lifetime employment, seniority-based payment, and enterprise labor unions. This employment system complemented the stable ownership structure of Japanese firms, which is composed of cross-shareholding with business partners and equity shares held by financial institutions. Therefore, in former days, Japan's large companies could establish managerial and investment plans from a long-term perspective thanks to the cross-shareholding and

the main bank system. Conversely, the management style emphasizing the long-term interest encouraged Japanese firms to carry out long-term human resource development programs. Aoki (1994) argues that there is institutional complementarity between ownership structure and labor relations in Japanese firms revealing the characteristics of the systems of Japanese firms largely different from those of firms in Western countries. Morishima (1991) also points out the significance of information sharing between managers and labor unions.

However, since the bubble burst, the ownership structure of Japanese firms has been dramatically changed. While many firms tried to dissolve cross-shareholding, shareholders, once they were "silent", began to actively participate in management. Such trends were also accelerated by the corporate governance reform. The extension of the influence of shareholders who strongly seek for increased profit allocation may have changed unions' influence on wage dispersion.

Unions' effects to reduce wage dispersion are revealed in previous studies. However, the extension of the influence of such shareholders in accordance with weakened bargaining power of labor unions may also have affected wage distribution as well as the levels of wages. There are reasons to account for it. First, those shareholders who emphasize short-term profits may urge managers to increase profits promoting them to stimulate employees' labor incentives by introducing more widely varying salaries. Second, such shareholders may adopt a negative attitude toward the formation of firm-specific human capital, which may lead to the cause of the widening of wage dispersion.

Overall, in firms where there are many shareholders who emphasize short-term profits, there is a possibility that unions' effects to reduce wage dispersion is suppressed. Therefore, we study unions' effects on wage distribution taking into the differences in ownership structure.

The following parameters were set for this study. First, we examined whether union effects to reduce wage dispersion depending on ownership structure focusing on the interactions between ownership structure and unions. To our knowledge, there has been little research on this issue. Second, we paid attention to the change in union effects over time to make it possible to discuss the change in the bargaining power of labor unions. Third, we constructed and used panel data for Japan's large firms. This enabled us to control for firms' heterogeneity.

The rest of this paper is organized as follows: Section two provides an overview of the previous studies. Section three includes the hypotheses, data, and the empirical strategy. Section four presents the results. Section five summarizes our analysis and discusses the limitations of the findings.

2. Previous Studies

Freeman's (1980) study revealed the unions' decreasing effects on wage dispersion. It argued that unions prefer smaller wage dispersion in firms because to maintain unity among union members. Booth (1995) demonstrated that unions reduce wage dispersion by decreasing the rate of return, education, and tenure. Using firm-level data, Tachibanaki and Noda (2000) discussed that the unions' effect was confirmed only for women. Hara and Kawaguchi (2008) analyzed wage dispersion between union members and non-union members by employing Cotton-Neumark decomposition. Suzuki (2020) studied unions' influence on wage distribution by utilizing Oaxaca-Blinder decomposition. She revealed that wage variance among age groups has been decreasing in recent years regardless of union status.

Most studies conducted since the first decade of the 2000s claimed that unions' influence on wage dispersion has been decreasing because managers have placed more importance on direct negotiations with employees than through labor unions. Kaufman and Taras (2000) and Kaufman and Taras (2010) stated that managers created non-union employee committees to prevent unions from being formed. Bryson et al. (2013) pointed out that in Britain, negotiations on employment conditions have shifted from unions or non-union employee committees to direct communication between the manager and employees.

For studies on unions in Japan, Tsuru (2002) argued that non-unionization of labor relations was preferred. Morikawa (2010) contended that unions did not raise wages more than productivity for Japan's labor markets. Noda and Hirano (2013) stated that while unionized firms were likely to resist downsizing before 1997, they became more open with downsizing after 1997. Abe and Shimizutani (2007), focusing on the relationship between corporate governance and employment conditions, argued that outside managers were likely to execute layoffs or early retirement programs. Matsuura and Noda (2013) revealed that unions' influence on the job separation rate is significantly different for family-owned companies. Okamoto and Matsuura (2020) discovered that employees with higher financial institution stock ownership ratios and foreign stock ownership ratios received higher wages.

The studies confirm that unions have a role in decreasing wage dispersion. However, the lower number of union organization rates and union members indicate that they now play a lesser role in wage dispersion. This trend has been observed in Japan and in Western countries.

Moreover, by using the survey on wage structure from 1991 to 2012 by the Ministry of Health,

Labour and Welfare, Akesaka and Miyoshi (2018) broke down employees' wage dispersion in Japan into within-firm and between-firm. They showed that a variance increase in establishment fixed effects results in an increase in the between-firm dispersion. In contrast, we examine the factors involved in firm fixed effects and how it affects unions and corporate governance.

3. Hypotheses, Data, and Empirical Strategy

3.1. Hypotheses

We examine the unions' influence on wage dispersion in firms from three perspectives:

First, we explore whether unions can reduce wage dispersion after controlling for covariates in the following empirical analysis. Figure 3 displays the trends in wage differences for employees at the age of 30 in unionized and non-union firms. The first chart shows the wage gap between unionized and non-union firms using the highest and lowest wages. The second chart shows the wage gap between unionized and non-union firms using the highest and average wages, while the last chart uses the average and lowest wages. The figure shows that the overall wage dispersion is smaller in unionized firms. This validates the theory of Freeman (1980) for Japanese firms.

Hypothesis 1. Unions can reduce wage dispersion.

Second, we examine whether unions' influence on reducing wage dispersion has significantly weakened in recent years. We study whether the unions' influence on wage reduction has changed in recent years. Figure 3 shows that the overall differences in wage dispersion between unionized and non-union firms have been decreasing, and this may be due to the lesser influence of unions. Unions may urge management to avoid implementing a performance-based compensation system in order to reduce wage dispersion. However, unions would be unable to do this if their influence on wage dispersion has diminished.

Hypothesis 2. Unions' influence on reducing wage dispersion has weakened in recent years.

Third, we examine whether unions' influence differs depending on the corporate governance structure of firms. Specifically, we explore whether the corporate ownership structure and enterprise

union has a complementary or a substitution effect with respect to the reducing wage dispersion.

Hall and Soskice (2001) suggests a categorization of capitalism in to two types: Liberal Market Economies (LMEs) exemplified by the USA/UK and Coordinated Market Economies (CMEs) such as Japan/Germany. Firms in LMEs emphasize a short-term perspective, striving to maximizing shareholders' profit. In contrast, firms in CMEs prioritize a long-term perspective and consider a diverse range of stakeholders including their employees, the creditors, the suppliers and the customers, and so on. Similarly, shareholders in CMEs typically adopt a "silent" or patient approach to their invested firm, prioritizing non-financial interests such as long-term relationship over the short-term financial interests emphasized by the shareholders in LMEs.

Consequently, shareholders in LMEs may encourage managers to boost employee incentives by introducing more dispersed wage structure within employees who have same characteristics such as a pay-for-performance wage system, while shareholders in CMEs may align with the objectives of enterprise unions, such as reducing wage dispersion among their members.

Nakamura (2023) focused on the three types of shareholders: (1) Main banks and other relationship – oriented lenders, (2) business corporations with cross-shareholdings, and (3) foreign investors, then pointed out that (1) and (2) place a premium on long-term business relationships while (3) has the sole purpose of maximizing the share price. Additionally, Nakamura (2023) mentioned that (1) and (2) are only one component of "financial institutions" and "other domestic corporations (non-financial institutions)" in the shareholder composition data from each firm's annual security report whereas (3) corresponds almost one-to-one to "overseas corporations." We therefore employ the foreign stock ownership ratio as a proxy variable to gauge the influence of shareholders from LMEs.

While we intend to employ the financial institutional stock ownership ratios a proxy variable to measure the influence of shareholders from CMEs, it is essential to note that "Financial institutions" includes trust banks, city banks, regional banks, insurance companies, and other financial institutions. Certain types of financial institutions, such as investment trust fund and trust account shareholders may not possess the characteristics aligning with type (1) shareholders. Although our data used in the regression analysis lacks a breakdown, we can obtain the "Investment trust fund stock ownership ratio," allowing us to subtract it from the financial institutions stock owner ship ratio mitigating the influence of shareholders other than the CMEs to some extent.

Our investigation aims to determine the influence of foreign investors weakens the union's effect

in reducing wage dispersion (substitution effect) and whether the influence of financial institutional shareholders enhances union's effect in reducing wage dispersion (complementary effect).

Hypothesis 3. Ownership structure affects union's reducing wage dispersion effects.

3.2. Data

Our analysis combines the following three firm-level panel datasets: (1) "CSR Data" compiled by Toyo Keizai Shinpo, (2) financial data brought by Nikkei NEEDS Financial QUEST, and (3) union data by Nikkei NEEDS. While (2) and (3) cover all listed firms in Japan, (1) only contains data on firms' targeted CSR data questionnaire. In addition, there are cases where respondent firms have not answered the question on which we have produced variables. For CSR Data, we used data from 2004 to 2015. For the variables used for measuring wage dispersion, we used (1) the gap between the highest and the lowest wages (LNWD1), (2) the gap between the highest and the average wages (LNWD2), and (3) the gap between the average and the lowest wages (LNWD3) within a firm.

These variables were calculated based on monthly wages[1] of employees on the main career track (Sogo-shoku) who graduated from universities. It is exceptionally rare to obtain panel data on wage differentials specific to each company and it provides highly valuable information for econometricians. This holds true even if the highest and lowest[2] wages may include extreme case. The wage gaps were computed in log after dividing the former by the latter. For example, if the highest wage amounts to six hundred thousand yen and the lowest is two hundred thousand yen, the ratio is two and the logarithm of two is 1.0986.

Using the wages of employees at the age of 30 is reasonable for identifying the effects of unions on wage dispersion. Wage dispersion is likely low for employees in their twenties because in Japan's listed firms, most of the regular employees are hired en masse after graduation. In this situation, it is difficult to identify whether the decreasing wage dispersion is influenced by the union or is due to

---

[1] It should be noted that the average wage may be based on the model wage in the firm. The wages include position-related allowances and family allowances but do not include overtime allowances, bonuses, and similar payments. Additionally, location-specific allowances and housing allowances, which are only provided to specific individuals, are also not included.

[2] We excluded the lowest wage data from our sample due to the reasons such as taking leave during the survey period reported by the firm.

limited dispersion in knowledge or skills affecting the wages of the younger workforce. On the other hand, some employees in late thirties lose union membership because they accepted managerial positions. As a result, it becomes difficult to identify whether wage dispersion is due to the decrease in union influence or because of some employees leaving the unions to accept managerial positions[3]. Hence, we deem it proper to use wages of employees at the age of 30.

For explanatory variables, we used the union status dummy (UNION), which takes 1 if a respondent firm has at least one union within it. We also use the foreign stock ownership ratio (FOREIGN) and the financial institutional stock ownership ratio (FINANCIAL) to represent corporate governance structure.

Other control variables include the log of the number of employees (LnEMP) as a proxy variable for the characteristics of firms, years of operation(OYEAR) , dummy variables for industries classified based on Nikkei's middle classification, the log of average yearly wages among employees (LnAWAGE) as a proxy variable for the characteristics of average employees, the ratio of employees over 50 to total employees (OVER50), and the ratio of female employees to total employees (FEMALE). While our overall strategy to control for macroeconomic shocks commonly affecting firms is to employ dummy variables, we introduced a time trend to specify the recent change in unions' effects to reduce wage dispersion. The estimated sample size was 3755-3856 and the number of firms was 784-785.

We eliminated firms with inaccurate responses (for example, the cases in which the lower wage exceeds the higher wage, firms answering yearly wages in place of monthly wages, and firms answering the wage of long-term absentees in place of the lowest wages from our sample). In addition, we only used firms that gave at least one correct answer concerning the three measures for wage dispersion and with complete values for explanatory variables.

Table 1 displays descriptive statistics. The percentage of unionized firms in the sample was 73.5%. While both the highest and the lowest wages at the age of 30 are higher for non-union firms, the lowest wage is slightly higher for unionized firms. Wage dispersion was higher for non-union firms for all three measurements. As for shareholding ratios, both the foreign stock ownership and the

---

[3] Analyzing unions' effect on wages, Tachibanaki and Noda(2000) also uses only wages for employees in their thirties since most of the supervisory employees in their forties are supposed to quite union.

financial institutional stock ownership ratios are higher for unionized firms. The number of employees and (logged) average yearly wages are higher for unionized firms. The number of years of operation and the ratio of employees over fifty years old are higher for unionized firms. Lastly, the ratio of female employees to total employees is higher for non-union firms.

Table 2 shows the breakdown of firms by industry. There is a substantial difference between unionized and non-unionized firms. While manufacturing firms account for 70% of the total for unionized firms, they do a little more than 30 % for non-union firms. Table 3 displays the current trends in the ratio of unionized firms. The ratio remained stable at approximately 75%. Table 4 displays the ratio and trends in union status of firms. From 2004 to 2015, the ratio remained stable at approximately 75%. Within the sample period, nineteen firms transitioned from "Non-union" to "Union" while six firms transitioned from "Union" to "Non-union". Overall, there were only 25 transitions out of 3864 firms in the sample.

One challenge with this analysis is the difficulty in correctly estimating coefficients for the fixed variables for each individual, such as a union status dummy, when the fixed-effect model is estimated. We tackle this problem later using the hybrid model.

3.3. Empirical strategy

In the previous section, we explained three hypotheses to be tested in this study.

For the first hypothesis, we estimate a baseline model.

$$LNWD_{it} = \beta_{10} + \beta_{11}Union_{it} + (Control) + u_{it} \qquad (1)$$

Since there are three types of measurables, there will be three estimated results for a single equation. UNION is a dummy variable that takes the value of 1 if a firm has at least one union, and 0 otherwise; We used an indicator variable for corporate governance (GOV), as well as the foreign stock ownership ratio (FOREIGN) and the financial institutional stock ownership ratio (FINANCIAL). We added the control variables defined in Section 3.2, including year and industry dummies. If the estimated coefficient is negative, it indicates that unions' influence reduces wage dispersion in a firm.

For the second hypothesis, we used the model incorporating a time trend dummy (YEAR) and the interaction term between YEAR and UNION.

$$LNWD_{it} = \beta_{20} + \beta_{21}UNION_{it} + \beta_{22}GOV_{it} + \beta_{23}YEAR_t + \beta_{24}UNION_{it} \times YEAR_t$$
$$+(Control) + u_{it} \qquad (2)$$

If the estimated coefficients of UNION and the interaction term between UNION and YEAR are negative and positive respectively, it indicates that unions' influence on decreasing wage dispersion has weakened year by year.

For the third hypothesis, we used a model that includes indicator variables for corporate governance (GOV), UNION, and the interaction terms between both variables.

$$LNWD_{it} = \beta_{30} + \beta_{31}UNION_{it} + \beta_{32}GOV_{it} + \beta_{33}UNION_{it} \times GOV_{it} + (Control) + u_{it} \qquad (3)$$

The control variables were the same as those employed in Equation (1). For firms with labor unions, the combined impact of unions and shareholders on wage dispersion is represented by $(\beta_{31} + (\beta_{32} + \beta_{33}) \times GOV_{it})$. A negative β_{31} alongside a $(\beta_{32} + \beta_{33})$ indicates that unions have a reducing effect on wage dispersion, while shareholders contribute to its expansion. Thus, there exists a substitution effect between shareholder structure and unions with respect to reducing wage dispersion. Conversely, if both β_{31} and $(\beta_{32} + \beta_{33})$ are negative, it implies that both unions and shareholders are reducing wage dispersion, demonstrating a complementary effect between shareholder structure and unions with respect to reducing wage dispersion.

The union status hardly changed in most of the sample firms. The random effect model's drawback is that the estimated coefficients are inconsistent because we cannot control the characteristics of firms that are not reflected in time-variant explanatory variables within the sample period. In addition, we cannot correctly estimate the coefficients of almost time-invariant variables like union status dummies when using the fixed-effect model.

To address this problem, we used the hybrid model. Allison (2009) argues that the hybrid model combines some virtues of fixed effect and random effect models, where both the between and within effects can be correctly estimated. In the hybrid model, we modified explanatory variables while

maintaining the explained variables as is. We included both firm-specific means and deviations from firm-specific means for time-varying variables. In addition, we incorporated time-invariant variables in the model and estimate the following random effect model:

$$y_{it} = \beta_0 + \beta_1(x_{it} - \bar{x}_i) + \beta_2\bar{x}_i + \beta_3 z_i + \varepsilon_i + u_{it} \qquad (4)$$

y : explained variables, x : time-varying variables, z : time-invariant variables, ε : time-invariant error term, u : time-varying error term

β_1 corresponds to the within effect, and β_2 is the between effect. In this study, we assumed that industry dummies are time-invariant within the sample period. Year dummies are of little interest to us so we did not use them. First, we utilized the random effect model of equation (1). Then, we used a baseline model with two lists of explanatory variables, log of the number of employees, industry dummies, and year dummies as controls. Next, we compared the results of both models and examined the first hypothesis by estimating the hybrid model in the same way. Lastly, we examined the second and third hypotheses by estimating the hybrid model of equations (2) and (3) including some interaction effects.

In addition to the hybrid model, we employed the endogenous treatment effects model to address the endogeneity of the union dummy, enabling us to examine the effect of an endogenous binary variable on the dependent variable. This model is composed of two equations: (1) an equation for the outcome variables: LNWD1 – LNWD3 and (2) an equation for the endogenous binary variable, UNION. The explanatory variables included in these equations are essentially same as those in the hybrid model, however, equation (2) omits OYEAR to prevent potential multicollinearity problems with the instrumental variable, UDEN. UDEN represents the union density: the percentage of workers affiliated with a labor union at the country level when the firm was established.

The rationale for this empirical strategy is grounded in the idea that employees in the firms established in years when a substantial number of workers in the country participate in labor unions are more likely to have their labor union. Union members require diverse support to organize and set up their union activities. The availability of such support is expected to be more abundant when the firm is established during a period with a significant number of unionized workers. Consequently,

UDEN is likely to have a direct effect on the likelihood of the employees in the firm having their labor union. In contrast, UDEN is unlikely to directly affect the firm's productivity.

We estimate this model using the full sample to test the first hypothesis. Subsequently, we estimated the model for sample divided into two periods—the first half and the second half—to test the second hypothesis. Finally, we estimate the model for sample divided based on the median of the foreign corporate shareholding ratio or those divided based on the financial institution shareholding ratio to test the third hypothesis.

4. Results and Discussion

4.1. Baseline Models and Hybrid Models

Table 5 shows the results of the baseline model to examine the first hypothesis. The results of the simple model are reported in Columns (1)–(3). UNION was significantly negative in all the equations, indicating that wage dispersion is smaller in unionized firms. While FOREIGN was significantly positive in all equations, FINANCIAL was significantly negative, except column (3). This indicated that wage dispersion is larger in firms with higher foreign stock ownership ratios and smaller in firms with lower financial stock ownership ratios. Columns (4)–(6) reported the results of the model with all the controls. Although the overall tendency of key variables remains the same, UNION was insignificant at the 10% level in Column (6). As for controls, LnEMP was significantly positive in and OYEAR was significantly negative in all the equations. LnAWAGE was significantly negative in Columns (4) and (5). While OVER50 was significantly negative in all the equations, FEMALE was insignificant in any equation.

The results of the hybrid model including all the controls are reported in Columns (7)–(9). While UNION was insignificant in the within effect estimation, it was significantly negative in the between effect estimation in Columns (7) and (8). These results indicate that unions' influence on decreasing wage dispersion corresponds to between effects. Therefore, we confirm the first hypothesis that unions' influence exists.

Among the variables for corporate governance, FOREIGN was significantly positive in the within and between effects except the within effect of LNWD2, suggesting that firms with higher foreign stock ownership ratios have a larger wage dispersion. FINANCIAL was insignificant in the within effect, although it was significantly negative in the between effects except LNWD3. This implies

11

that firms with higher financial institutional stock ownership ratios have smaller wage dispersion. However, wage dispersion increased when the ratio was raised in the sample period, suggesting that financial institutions may have adopted different corporate governance structures that resulted to an increase in stock ownership ratio.

As for the other controls, LnEMP was significantly positive in both effects in all equations. OYEAR was significantly negative only in the between effects in all equations. LnAWAGE was significantly negative in between effect in Columns (7) and (8). OVER50 was significantly negative in both effects in all equations. FEMALE was significantly negative in the within effect and is significantly positive in the between effect in Columns (7) and (8).

Table 6 displays the results of the hybrid model including the interaction effects. Columns (10) - (12) include the interaction effects between UNION and YEAR while Columns (13) – (15) include the interaction effects between UNION and FINANCIAL or FOREIGN. Let us discuss the results in Columns (10) - (12) to examine the second hypothesis. UNION was significantly negative in the within effect in Columns (10) and (12). Although YEAR was insignificant, the interaction effects between UNION and YEAR in Columns (10) and (12) were significantly positive in within effect. This indicates that the unions' influence on decreasing wage dispersion has weakened year by year, confirming the partial validity of the second hypothesis. The results of the other variables were also similar to Columns (7) - (9).

Lastly, we examined the results in Columns (13) - (15) to determine if the third hypothesis is valid. UNION was significantly negative only in the between effect for Columns (13) and (15), implying that unions' influence exists. FOREIGN was significantly positive in the between effect, while FINANCIAL was significantly negative in between effects in all equations. These results were almost the same as Columns (7) - (9). In all equations, the interaction term between UNION and FOREIGN was significantly negative in the between effect except for column (15), whereas the interaction term between UNION and FINANCIAL was significantly positive in the between effect.

To summarize, the results of Columns (13) and (14) indicate that while wage dispersion is generally higher for firms with higher foreign stock ownership ratio, it is lower for unionized firms. In contrast, it also shows that while wage dispersion is generally lower for firms with a higher financial institutional stock ownership ratio in general, it is higher for unionized firms.

Afterwards, we calculated the magnitude of unions' influence on the governance structures' wage

12

gap by comparing β_{32} with $(\beta_{32} + \beta_{33})$ using the estimated values in Columns (13)-(15). Using Column (13), β_{32} is 0.524 and $(\beta_{32} + \beta_{33})$ is 0.245 for FOREIGN, while β_{32} is -0.467 and $(\beta_{32} + \beta_{33})$ is -0.059 for FINANCIAL. Results indicate that there is substitutability between unions and foreign and financial institutions, as investors' influence is weakened in unionized firms. Using Column (14), β_{32} is 0.379 and $(\beta_{32} + \beta_{33})$ is 0.146 for FOREIGN, while β_{32} is -0.277, and $(\beta_{32} + \beta_{33})$ is -0.077 for FINANCIAL. The results are almost the same as the previous one. Using Column (15), β_{32} is 0.148 and $(\beta_{32} + \beta_{33})$ is 0.101 for FOREIGN, while β_{32} is -0.165, and $(\beta_{32} + \beta_{33})$ is 0.016 with FINANCIAL. The results obtained from Column (15) suggest that substitutability between UNION and FOREIGN lacks statistical significance, as evidenced by the insignificant interaction term. Furthermore, no evidence of complementarity between UNION and FINANCIAL is observed.

We confirm the validity of the third hypothesis for LNWD1 and LNWD2, while the results remain nearly unchanged for other control variables.

4.2. Endogenous Treatment Effects model

Table 7 shows the results of the endogenous treatment effects model to examine the first hypothesis considering the endogeneity of union dummy. The coefficients of UNION are consistently negative and statistically significant in all equations, indicating reduced wage dispersion in unionized firms when controlling for the endogeneity of the union dummy. This supports the presence of the union's effect in reducing wage dispersion, consistent with findings from random effects model and hybrid model. We confirm the validity of our first hypothesis. The coefficients of the control variables align with those observed in the aforementioned models. In the equations with UNION as the dependent variable, the coefficients of UDEN are positive and significant, aligning with our expectation.

Table 8 shows the results of the endogenous treatment effects model for the sample divided into two periods. The coefficients of UNION in the two periods basically similar, with the coefficients of second half are slightly larger in terms of absolute value. This suggests that union's effect on reducing wage dispersion has not changed significantly over our sample period, contrary to our second hypothesis.

Table 9 shows the results of the endogenous treatment effects model for sample divided based on the median of the foreign corporate shareholding ratio or those divided based on the median or the

financial institution shareholding ratio. The coefficients of UNION for the sample with a foreign shareholding ratio less than the median value are larger in absolute value, than those for the sample with a ratio larger than or equal to the median value. It indicates that the union's reducing wage dispersion effect is weaker when the influence of foreign shareholders is strong, consistent with findings from our hybrid model. Conversely, the coefficients of UNION for the sample with a financial institution shareholding ratio larger than or equal to the median value are larger in absolute value, than those for the sample with a ratio less the median value. It suggests that the union's reducing wage dispersion effect is stronger when the influence of financial institute shareholders is strong, also consistent with findings from our hybrid model. These outcomes support the validity of our third hypothesis.

5. Conclusion

Using panel data on Japan's listed firms, we examined the unions' influence on wage distribution. Specifically, we examined (1) whether unions can reduce wage dispersion, (2) whether unions' influence changed over time, and (3) whether unions' influence differs depending on the ownership structure of firms. We found very small changes in union status partly because the data set only covered the period from 2004 to 2015. We used the hybrid model to address the data challenge, then estimated the endogenous treatment effects model to solve the endogeneity problem for the union dummy.

Our results are summarized as follows: Based on the hybrid model, first, we discovered that labor unions have a role in decreasing wage dispersion based on the results of the between effect. Second, we learned that the union effect has gradually decreased within the sample period. Finally, we discovered that there is substitutability between foreign investors and labor unions, while there is complementary between financial institutional shareholders and labor unions in terms of decreasing wage dispersion. Through the application of the endogenous treatment effects model, we validated the validity of the first and third hypotheses mentioned earlier.

This led to the conclusion that unions' bargaining power depends on differences in corporate governance structure. We also concluded that the decreasing influence of unions may be attributed to the change in corporate governance structure, particularly to the rise in foreign stock ownership and the fall in financial institutional stock ownership.

14

For the limitations, we could not clarify how corporate governance structure affects unions' bargaining power. It was also difficult to identify the causal relation between labor unions and corporate governance structure since both can be regarded as endogenous. Lastly, we only used the highest, the mean, and the lowest wages to create the measures for wage dispersion instead of the commonly used quantiles due to data limitations. We hope that these limitations can be addressed in future studies.

References

Abe,N. and S,Shimizutani. (2007). "Employment Policy and Corporate Governance: An Empirical Comparison of The Stakeholder and The Profit Maximization Model," *Journal of Comparative Economics*, 35, 346–368

Akesaka,M. and Miyoshi.K.(2018). "Wage Inequality during the Long-term Stagnation in Japan: Changes within and between Establishments," ISER Discussion Paper. No.1045.

Allison, P. D. (2009). Fixed Effects Regression Models. Thousand Oaks, CA: Sage.

Aoki, M. (1994) "The Contingent Governance of Teams: Analysis of Institutional Complementarity," *International Economic Review*, 35(3), 657-676.

Blau, F. D. and Kahn, L. M. (1999) "Institutions and Laws in the Labor Market," Ashenfelter O. C. and Card, D. (eds.), Handbook of Labor Economics, vol. 3A, 1399-461, Amsterdam: Elsevier.

Booth, A.L. (1995). The Economics of the Trade Union, Cambridge University Press.

Bryson, A., Willman, P., Gomez, R., and Kretschmer, T. (2013). "The Comparative Advantage of Non-Union Voice in Britain, 1980-2004," *Industrial Relations: A Journal of Economy and Society*, 52, S1, 194-220

Brunello,G.(1992) "The Effect of Unions on Firm Performance in Japanese Manufacturing," *Industrial and Labor Relations Review,* 45(3), 471-487.

Doucouliagos, C. and Laroche, P. (2003). "What Do Unions Do to Productivity? A meta-analysis," *Industrial Relations: A Journal of Economy and Society*, 42(4), 650-691

Doucouliagos, C. and Laroche, P. (2009). "Unions and Profits: A Meta-regression Analysis," *Industrial Relations: A Journal of Economy and Society*, 48(9), 146-183

Farber, H. S., Herbst, D., Kuziemko, I., and Naidu, S. (2021) "Unions and Inequality over the Twentieth Century: New Evidence from Survey Data," *The Quarterly Journal of Economics*, 136(3), 1325–1385.

Francisco, J., Dominguez, C., and Gutierrez, C. R. (2020) "Does collective bargaining influence the way the size of the firm impacts wage dispersion? Spanish evidence," *International Journal of Manpower*, 41(4), 357-374.

Freeman, R.B. (1980). "Unionism and The Dispersion of Wages," *Industrial and Labor Relations Review*, 34(1), 3-23

Freeman, R. B. and Medoff, J. (1984). *What do Unions do?* New York: Basic Books.

Gollan, P. J. (2006). "Editorial: Consultation and Non-union Employee Representation," *Industrial Relations Journal*, 37(5), 428-437

Hall, A. and D. Soskice (2001) *Varieties of Capitalism:The Institutional Foundations of Comparative Advantage*, Oxford: Oxford University Press.

Hara, H., and Kawaguchi, D. (2008). "The Union Wage Effect in Japan," *Industrial Relation: A Journal of Economy and Society*, 47(4), 569-590

Hayter, S. (2015). "Unions and Collective Bargaining," J.Berg (eds.) *Labour Markets, Institutions and Inequality Building Just Societies in the 21st Century*, pp.95-122. Cheltenham: Edward Elgar

Kahn, L. M. and Curme, M. (1987) "Unions and Nonunion Wage Dispersion," *The Review of Economics and Statistic*s, 69(4), pp. 600-607.

Kaufman, B.E., and Taras, D. (2000). Nonunion Employee Representation: History, Contemporary Practice, and Policy, Routledge.

Kaufman, B.E., and Taras, D. (2010). "Participation Through Non-Union Forms of Representation," in Wilkinson, A., Goll, P., Marchington, M., and Levine, D. (eds.), The Oxford Handbook of Participation in Organizations, edited by Adrian, 258-285, Oxford: Oxford University Press

Matsuura, T. and Noda, T. (2013). "The Development of Human Resource Management and its Effect on Turnover Rate in Family Firm", *The Economic Analysis*, 186, 137-16, Cabinet Office, Government of Japan [in Japanese]

Morikawa, M. (2010). "Labor Unions and Productivity: An Empirical Analysis Using Japanese Firm-Level Data. 23," *Labour Economics*, 17(6), 1030-1037

Morishima, M. (1991) "Information Sharing and Firm Performance in Japan," *Industrial Relation: A Journal of Economy and Society,* 30(1), 37-61.

Nakamura, J. (2023) "A 50-year history of "zombie firms" in Japan: How banks and shareholders have been involved in corporate bailouts? ," Japan & The World Economy, 66, pp. 1-24.

Noda, T. and Hirano, D. (2013). "Enterprise Unions and Downsizing in Japan Before and After 1997," *Journal of Japanese and International Economies*, 28, 91-118

Okamoto, H. and Matsuura, T. (2020). "The Influence of Unions on Wages in Japan：Taking into Account Factors Related to Corporate Governance," *The Annual of the Institute of Economic Research*, 52, 361-375, Chuo University

Suzuki, K.(2020). "The Effects of Labor Unions on Wages of Regular Employees," *The Journal of Ohara Institute for Social Research*, 738, 67-89 [in Japanese]

Tachibanaki, T. and Noda, T. (2000). The Economic Effects of Trade Unions in Japan, London: Macmillan Press Ltd

Teulings, C., and J. Hartog (1998). Corporatism or Competition. Labour contracts, institutions and wage structures in international comparison. Cambridge, UK, Cambridge University Press.

Tsuru, T. (2002). The Nonunionization of Labor Relations: Micro and Institutional Analysis, Toyo Keizai Inc [in Japanese]

Tsuru, T., and Rebitzer, J.B. (1995) "The Limits of Enterprise Unionism: Prospects for Continuing Union Decline in Japan," *British Journal of Industrial Relations*, 33(3), 459-492.

Wallerstein, M. (1999) "Wage-Setting Institutions and Pay Inequality in Advanced Industrial Societies," *American Journal of Political Science*, 43(3), 649-680

Figure 1. Trends in Number of Labor Union Members and Organization Rate
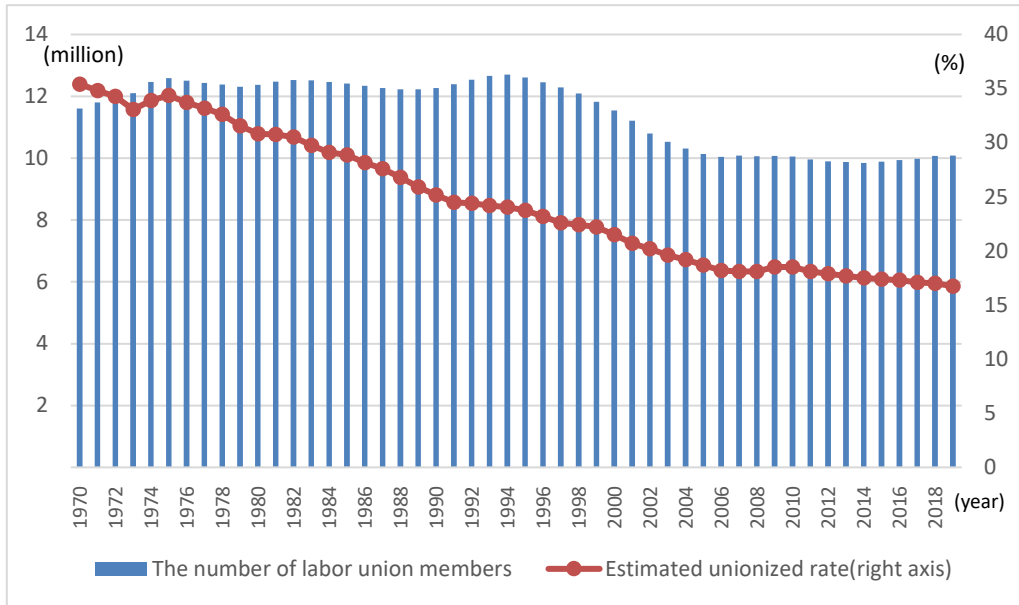
Source: Ministry of Health, Labour and Welfare, ***Basic Survey on Labour Unions***

Figure 2. Trends in Shareholding Ratio by Shareholder Type
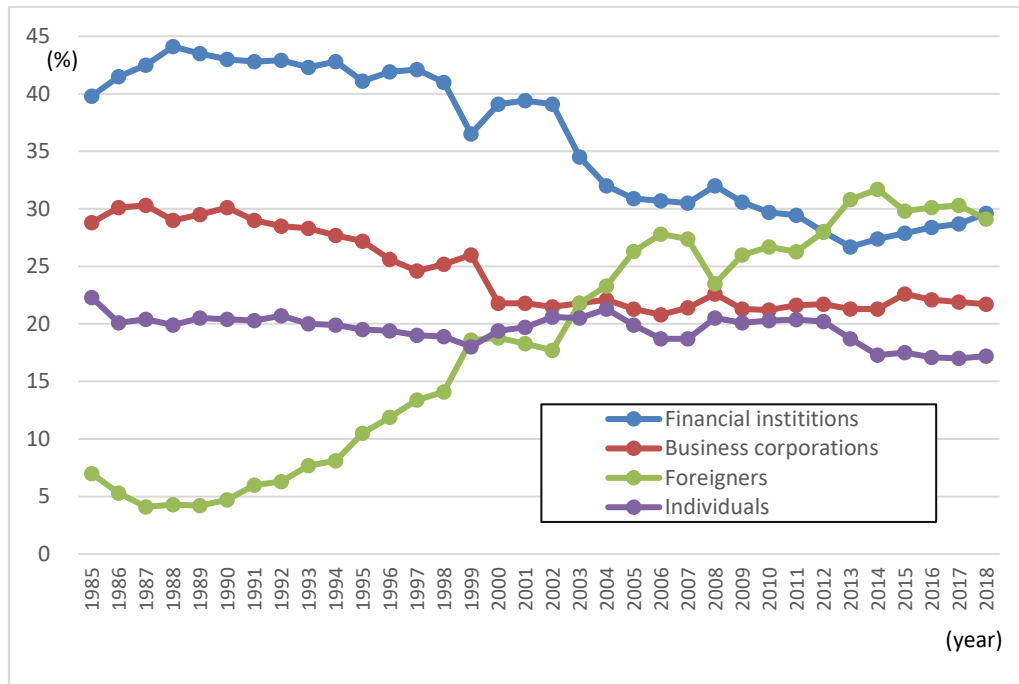
Source:Japan Exchange Group, ***Distribution of Shareholders***

Figure 3. Trends of wage difference (Max/Min, Max/Avg. Avg/Min): Union vs Non-Union

Highest vs Lowest wage gap
(Max/Min vs YEAR; Non-Union, Union)

Highest vs Average wage gap
(Max/Avg vs YEAR; Non-Union, Union)

Average vs Lowest wage gap
(Avg/Min vs YEAR; Non-Union, Union)
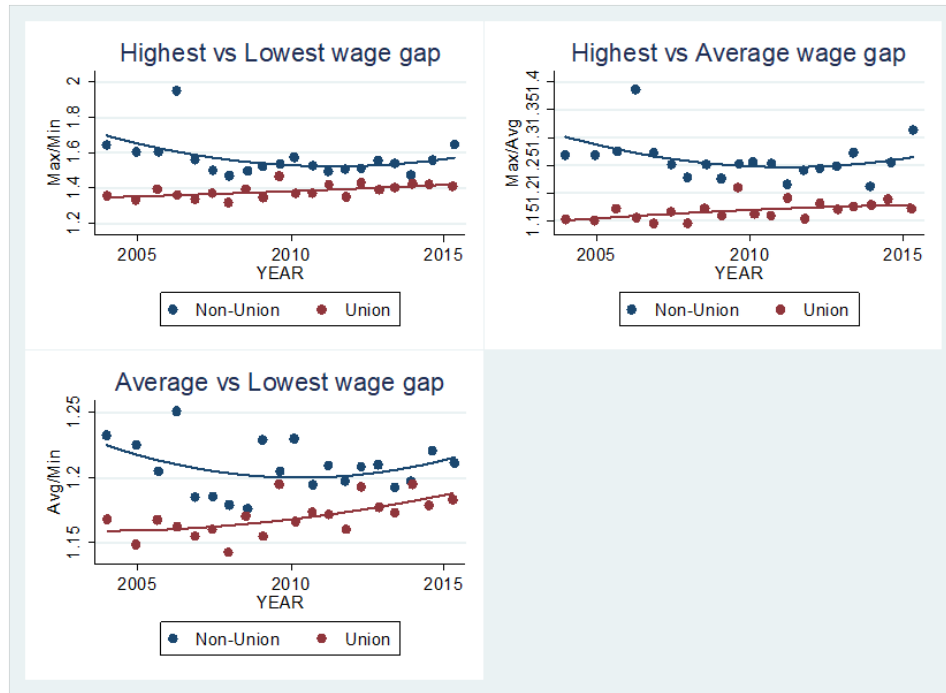
Table 1. Descriptive Statistics

Whole sample					
Variable	Obs	Mean	Std. Dev.	Min	Max
Highest wage at age of 30	3863	346375.0	122650.2	204300.0	3361935.0
Lowest wage at age of 30	3851	246068.0	36743.7	92173.0	467110.0
Average wage at age of 30	3859	288035.9	43163.0	172705.0	581097.0
Wage gap(Highest/Lowest)	3850	1.430	0.584	1.000	20.727
Wage gap(Highest/Average)	3856	1.192	0.265	1.000	6.710
Wage gap(Average/Lowest)	3845	1.180	0.153	1.000	3.089
UNION(1=UNION, 0=Non-Union)	3864	0.735	0.441	0.000	1.000
FOREIGN(shareholding ratio by foreign investors)	3864	0.153	0.128	0.000	0.968
FINANCIAL(shareholding ratio by financial institutions)	3864	0.229	0.115	0.000	0.660
Number of all employees	3864	2632.1	3716.4	10.0	33153.0
Average wage of all employees	3864	6418777.0	1278896.0	295000.0	14500000.0
OYEAR(Operation years)	3864	61.3	23.0	0.1	133.8
OVER50(Ratio of 50 years old or older employees)	3864	0.202	0.088	0.000	0.573
FEMALE(Ratio of female employees)	3864	0.186	0.125	0.012	0.935

	UNION					Non-UNION				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Highest wage at age of 30	2839	333360.5	75747.0	204300.0	1417578.0	1024	382457.3	197736.9	212500.0	3361935.0
Lowest wage at age of 30	2827	247123.8	35715.1	92173.0	467110.0	1024	243153.4	39315.9	137000.0	415700.0
Average wage at age of 30	2837	286361.7	40729.7	186750.0	581097.0	1022	292683.4	49014.9	172705.0	554116.0
Wage gap(Highest/Lowest)	2826	1.367	0.345	1.000	4.425	1024	1.606	0.954	1.000	20.727
Wage gap(Highest/Average)	2835	1.160	0.164	1.000	3.068	1021	1.282	0.425	1.000	6.710
Wage gap(Average/Lowest)	2823	1.167	0.138	1.000	2.507	1022	1.215	0.182	1.000	3.089
UNION(1=UNION, 0=Non-Union)	-					-				
FOREIGN(shareholding ratio by foreign investors)	2840	0.158	0.124	0.000	0.968	1024	0.139	0.137	0.000	0.799
FINANCIAL(shareholding ratio by financial institutions)	2840	0.250	0.111	0.000	0.660	1024	0.169	0.103	0.000	0.517
Number of all employees	2840	2906.5	3789.7	17.0	33153.0	1024	1871.1	3392.7	10.0	22855.0
Average wage of all employees	2840	6550717.0	1229993.0	295000.0	14500000.0	1024	6052849.0	1339891.0	2702148.0	11700000.0
OYEAR(Operation years)	2840	67.3	21.3	0.9	133.8	1024	44.6	19.1	0.1	103.3
OVER50(Ratio of 50 years old or older employees)	2840	0.222	0.079	0.001	0.573	1024	0.149	0.090	0.000	0.494
FEMALE(Ratio of female employees)	2840	0.166	0.114	0.012	0.873	1024	0.244	0.138	0.027	0.935

Table 2. Industry Composition of Sample Firms

	Whole sample		UNION		Non-UNION			Whole sample		UNION		Non-UNION	
	n	%	n	%	n	%		n	%	n	%	n	%
1 Foods	173	4.48	153	5.39	20	1.95	35 Fishery	11	0.28	9	0.32	2	0.2
3 Textiles and Apparels	86	2.23	86	3.03			41 Construction	289	7.48	191	6.73	98	9.57
5 Pulp and Paper	22	0.57	22	0.77			43 Wholesale Trade	378	9.78	164	5.77	214	20.9
7 Chemicals	352	9.11	266	9.37	86	8.4	45 Retail Trade	255	6.6	172	6.06	83	8.11
9 Pharmaceutical	59	1.53	47	1.65	12	1.17	52 Other Financing Business	87	2.25	43	1.51	44	4.3
11 Oil and Coal Products	3	0.08	2	0.07	1	0.1	53 Real Estate	45	1.16	8	0.28	37	3.61
13 Rubber Products	74	1.92	74	2.61			55 Railway and Bus Transpotation	17	0.44	17	0.6		
15 Glass and Ceramics Products	57	1.48	55	1.94	2	0.2	57 Land Transportation	19	0.49	11	0.39	8	0.78
17 Iron and Steel	63	1.63	63	2.22			59 Marine Transportation	22	0.57	22	0.77		
19 Nonferrous Metals	141	3.65	94	3.31	47	4.59	61 Air Transportation	5	0.13	2	0.07	3	0.29
21 Machinery	308	7.97	278	9.79	30	2.93	63 Warehousing	40	1.04	33	1.16	7	0.68
23 Electric Appliances	489	12.66	410	14.44	79	7.71	65 Information & Communication	9	0.23	2	0.07	7	0.68
25 Shipbuilding	1	0.03	1	0.04			67 Electric Power	1	0.03	1	0.04		
27 Automobile	205	5.31	205	7.22			69 Gas	5	0.13	5	0.18		
29 Transportation Equipment	34	0.88	34	1.2			71 Services	354	9.16	168	5.92	186	18.16
31 Precision Instruments	123	3.18	85	2.99	38	3.71	Total	3864	100	2840	100	1024	100
33 Other Products	137	3.55	117	4.12	20	1.95							

Table 3. Trends in Number and Ratio of Unionized Firms

	n	UNION(%)
2004	207	75.8%
2005	272	71.7%
2006	302	72.2%
2007	334	74.3%
2008	341	71.3%
2009	342	72.2%
2010	345	71.0%
2011	341	74.2%
2012	350	73.7%
2013	361	75.9%
2014	325	75.4%
2015	344	74.7%
	3864	

Table 4. Trends in Status of Unionization

YEAR	Obs	UNION(%)	NonUNION →NonUNION(n)	UNION →UNION(n)	NonUNION →UNION(n)	UNION →NonUNION(n)
2004	207	75.8%	49	154	1	
2005	272	71.7%	76	194	1	1
2006	302	72.2%	83	215	3	
2007	334	74.3%	85	247	1	1
2008	341	71.3%	96	238	5	1
2009	342	72.2%	95	247		
2010	345	71.0%	99	245		1
2011	341	74.2%	88	250	2	
2012	350	73.7%	92	256	2	
2013	361	75.9%	85	272	2	2
2014	325	75.4%	76	244	1	
2015	344	74.7%	86	255	1	
	3864		1010	2817	19	6

Table 5. Regression Results of Basic Models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)		(9)	
	Random Effects						Hybrid					
	LNWD1	LNWD2	LNWD3	LNWD1	LNWD2	LNWD3	LNWD1		LNWD2		LNWD3	
							Within	Between	Within	Between	Within	Between
UNION	-0.0826***	-0.0528***	-0.0308***	-0.0422**	-0.0290***	-0.0142	-0.0104	-0.0337*	-0.0176	-0.0203*	0.00673	-0.0137
	(-4.465)	(-4.527)	(-3.652)	(-2.336)	(-2.633)	(-1.596)	(-0.337)	(-1.861)	(-0.914)	(-1.786)	(0.398)	(-1.607)
FOREIGN	0.205***	0.104***	0.101***	0.218***	0.117***	0.102***	0.109*	0.337***	0.0235	0.223***	0.0829**	0.116***
	(3.307)	(2.582)	(3.504)	(3.460)	(2.784)	(3.432)	(1.698)	(5.152)	(0.592)	(5.466)	(2.378)	(3.751)
FINANCIAL	-0.0951*	-0.0815**	-0.0232	-0.0274	-0.0419	0.00649	0.105	-0.156**	0.0390	-0.125***	0.0601	-0.0301
	(-1.669)	(-2.363)	(-0.832)	(-0.498)	(-1.279)	(0.233)	(1.449)	(-2.128)	(0.873)	(-2.729)	(1.526)	(-0.872)
LnEMP	0.0411***	0.0241***	0.0178***	0.0433***	0.0254***	0.0187***	0.0606***	0.0417***	0.0357***	0.0238***	0.0279***	0.0182***
	(4.796)	(4.382)	(4.825)	(5.016)	(4.593)	(4.998)	(5.041)	(5.948)	(4.760)	(5.431)	(4.266)	(5.505)
OYEAR				-0.00149***	-0.000819***	-0.000656***	-5.95e-05	-0.00110***	0.000565	-0.000577***	-0.000631	-0.000518***
				(-3.831)	(-3.405)	(-3.647)	(-0.0214)	(-3.096)	(0.326)	(-2.609)	(-0.462)	(-3.113)
LnAWAGE				-0.0661*	-0.0494*	-0.0167	0.0302	-0.123***	0.0229	-0.0964***	0.0115	-0.0258
				(-1.672)	(-1.957)	(-0.879)	(0.609)	(-3.236)	(0.743)	(-4.069)	(0.426)	(-1.422)
OVER50				-0.275***	-0.136***	-0.128***	-0.192**	-0.345***	-0.0803*	-0.188***	-0.0927**	-0.149***
				(-3.824)	(-2.970)	(-3.511)	(-2.572)	(-3.707)	(-1.733)	(-3.231)	(-2.273)	(-3.381)
FEMALE				0.0101	0.0486	-0.0317	-0.355***	0.120*	-0.149**	0.103***	-0.206***	0.0135
				(0.103)	(0.776)	(-0.772)	(-3.612)	(1.958)	(-2.445)	(2.687)	(-3.850)	(0.466)
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	0.00985	-0.00887	0.0151	1.109*	0.786**	0.315	2.033***		1.542***		0.481*	
	(0.168)	(-0.250)	(0.541)	(1.799)	(1.997)	(1.065)	(3.442)		(4.178)		(1.700)	
var(_cons[S_code])							0.0225***		0.00882***		0.00450***	
							(15.07)		(15.31)		(13.43)	
var(e.Dep.Variable)							0.0224***		0.00862***		0.00664***	
							(39.36)		(39.50)		(39.21)	
Observations	3,850	3,856	3,845	3,850	3,856	3,845	3,850	3,850	3,856	3,856	3,845	3,845
Number of S_code	785	784	784	785	784	784	785	785	784	784	784	784

Robust z-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6. Regression Results of Models with Interaction Terms

	(10)		(11)		(12)		(13)		(14)		(15)	
	Hybrid						Hybrid					
	LNWD1		LNWD2		LNWD3		LNWD1		LNWD2		LNWD3	
	Within	Between	Within	Between	Within	Between	Within	Between	Within	Between	Within	Between
UNION	-9.412**	7.141	-4.477	7.252	-5.242**	-0.489	-0.0354	-0.0727**	-0.0390	-0.0270	0.00218	-0.0439***
	(-2.110)	(0.693)	(-1.617)	(1.123)	(-2.157)	(-0.0984)	(-0.817)	(-2.260)	(-1.449)	(-1.341)	(0.0923)	(-2.863)
YEAR	-0.0203	0.00597	-0.0352	0.00356	0.00621	0.00230						
	(-0.225)	(1.389)	(-0.630)	(1.322)	(0.126)	(1.109)						
FOREIGN	0.116*	0.338***	0.0227	0.223***	0.0922***	0.117***	0.0744	0.524***	0.00319	0.379***	0.0570	0.148***
	(1.898)	(5.169)	(0.599)	(5.457)	(2.769)	(3.773)	(0.680)	(5.235)	(0.0469)	(6.066)	(0.959)	(3.120)
FINANCIAL	0.110	-0.154**	0.0379	-0.124***	0.0644	-0.0299	0.0293	-0.467***	-0.0351	-0.277***	0.0662	-0.180***
	(1.517)	(-2.108)	(0.850)	(-2.705)	(1.637)	(-0.866)	(0.220)	(-3.505)	(-0.425)	(-3.330)	(0.914)	(-2.844)
UNION*YEAR	0.00468**	-0.00357	0.00222	-0.00362	0.00261**	0.000237						
	(2.107)	(-0.696)	(1.611)	(-1.127)	(2.160)	(0.0956)						
UNION*FOREIGN							0.0470	-0.279**	0.0285	-0.233***	0.0339	-0.0468
							(0.404)	(-2.440)	(0.394)	(-3.260)	(0.535)	(-0.865)
UNION*FINANCIAL							0.0987	0.408***	0.0953	0.200**	-0.00503	0.196***
							(0.704)	(2.797)	(1.095)	(2.200)	(-0.0659)	(2.823)
LnEMP	0.0618***	0.0413***	0.0367***	0.0234***	0.0282***	0.0181***	0.0608***	0.0454***	0.0359***	0.0259***	0.0281***	0.0197***
	(5.133)	(5.887)	(4.894)	(5.345)	(4.302)	(5.485)	(5.059)	(6.437)	(4.779)	(5.903)	(4.289)	(5.888)
OYEAR	0.0198	-0.00107***	0.0348	-0.000551**	-0.00650	-0.000517***	0.000406	-0.00110***	0.000823	-0.000562**	-0.000427	-0.000536***
	(0.220)	(-3.013)	(0.624)	(-2.481)	(-0.132)	(-3.099)	(0.147)	(-3.125)	(0.477)	(-2.559)	(-0.313)	(-3.223)
LnAWAGE	0.0109	-0.123***	0.0217	-0.0963***	-0.00391	-0.0263	0.0293	-0.130***	0.0220	-0.102***	0.0115	-0.0279
	(0.242)	(-3.246)	(0.772)	(-4.067)	(-0.158)	(-1.448)	(0.590)	(-3.440)	(0.713)	(-4.312)	(0.424)	(-1.539)
OVER50	-0.170**	-0.353***	-0.0727	-0.197***	-0.0780*	-0.148***	-0.196***	-0.319***	-0.0844*	-0.177***	-0.0920**	-0.136***
	(-2.268)	(-3.776)	(-1.565)	(-3.364)	(-1.906)	(-3.355)	(-2.616)	(-3.433)	(-1.814)	(-3.051)	(-2.249)	(-3.074)
FEMALE	-0.347***	0.120**	-0.143**	0.102***	-0.204***	0.0145	-0.355***	0.108*	-0.149**	0.0985***	-0.206***	0.00571
	(-3.545)	(1.961)	(-2.344)	(2.664)	(-3.817)	(0.500)	(-3.613)	(1.758)	(-2.446)	(2.578)	(-3.853)	(0.196)
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	-9.970		-5.607		-4.146		2.143***		1.608***		0.524*	
	(-1.158)		(-1.040)		(-0.997)		(3.644)		(4.387)		(1.856)	
var(_cons[S_code])	0.0225***		0.00882***		0.00449***		0.0221***		0.00861***		0.00446***	
	(15.08)		(15.33)		(13.43)		(15.01)		(15.18)		(13.44)	
var(e.Dep.Variable)	0.0224***		0.00862***		0.00665***		0.0224***		0.00863***		0.00663***	
	(39.37)		(39.51)		(39.22)		(39.36)		(39.48)		(39.24)	
Observations	3,850	3,850	3,856	3,856	3,845	3,845	3,850	3,850	3,856	3,856	3,845	3,845
Number of groups	785	785	784	784	784	784	785	785	784	784	784	784

Robust z-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7. Regression Results of Endogenous Treatment Effects Model(1)

	(1)		(2)		(3)	
	LNWD1	UNION	LNWD2	UNION	LNWD3	UNION
UNION	-0.108***		-0.0591***		-0.0690***	
	(-3.421)		(-2.774)		(-3.401)	
UDEN		5.308***		5.258***		5.294***
		(5.504)		(5.407)		(5.589)
FOREIGN	0.306***	-0.887	0.195***	-0.829	0.106***	-0.949*
	(3.920)	(-1.577)	(3.912)	(-1.479)	(2.912)	(-1.686)
FINANCIAL	-0.0589	0.888	-0.0702*	0.854	0.0141	0.884
	(-0.955)	(1.243)	(-1.865)	(1.195)	(0.455)	(1.246)
LnEMP	0.0513***	0.253***	0.0295***	0.252***	0.0232***	0.258***
	(4.919)	(3.411)	(4.095)	(3.389)	(5.531)	(3.520)
OYEAR	-0.00103***		-0.000558**		-0.000421**	
	(-2.600)		(-2.276)		(-2.201)	
LnAWAGE	-0.0949**	0.674	-0.0770***	0.681	-0.0149	0.681
	(-2.225)	(1.590)	(-2.814)	(1.615)	(-0.733)	(1.602)
OVER50	-0.275***	4.661***	-0.176***	4.632***	-0.0695	4.663***
	(-2.894)	(5.547)	(-3.039)	(5.524)	(-1.375)	(5.577)
FEMALE	0.0378	-1.460***	0.0436	-1.460***	-0.0166	-1.442***
	(0.523)	(-2.658)	(0.951)	(-2.632)	(-0.504)	(-2.677)
Year Dummies	yes	yes	yes	yes	yes	yes
Industry Dummies	yes	yes	yes	yes	yes	yes
Constant	1.527**	-13.95**	1.209***	-14.02**	0.269	-14.06**
	(2.352)	(-2.145)	(2.922)	(-2.169)	(0.860)	(-2.155)
athrho		0.177***		0.115***		0.334***
		(2.961)		(2.694)		(2.903)
lnsigma		-1.541***		-2.000***		-2.245***
		(-28.59)		(-24.94)		(-76.27)
Observations	3,850	3,850	3,856	3,856	3,845	3,845

Robust z-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8. Regression Results of Endogenous Treatment Effects Model(2)

	2004-2010						2010-2015					
	(4)		(5)		(6)		(7)		(8)		(9)	
	LNWD1	UNION	LNWD2	UNION	LNWD3	UNION	LNWD1	UNION	LNWD2	UNION	LNWD3	UNION
UNION	-0.0967***		-0.0532**		-0.0645***		-0.106***		-0.0572**		-0.0650**	
	(-2.808)		(-2.407)		(-2.800)		(-2.675)		(-2.290)		(-2.315)	
UDEN		5.463***		5.429***		5.469***		5.199***		5.134***		5.182***
		(5.039)		(4.968)		(5.104)		(4.796)		(4.698)		(4.877)
FOREIGN	0.416***	-0.923	0.279***	-0.881	0.130***	-0.914	0.232**	-0.819	0.144**	-0.759	0.0840*	-0.928
	(4.465)	(-1.328)	(4.279)	(-1.264)	(3.165)	(-1.340)	(2.372)	(-1.281)	(2.456)	(-1.199)	(1.770)	(-1.406)
FINANCIAL	-0.0325	0.438	-0.0680	0.373	0.0378	0.463	-0.101	1.103	-0.0766	1.102	-0.0224	1.088
	(-0.497)	(0.571)	(-1.643)	(0.489)	(1.151)	(0.599)	(-1.117)	(1.227)	(-1.397)	(1.222)	(-0.505)	(1.222)
LnEMP	0.0499***	0.346***	0.0271***	0.349***	0.0247***	0.342***	0.0519***	0.192**	0.0306***	0.188**	0.0223***	0.199**
	(3.984)	(3.940)	(3.219)	(3.996)	(4.824)	(3.911)	(4.522)	(2.242)	(3.993)	(2.196)	(4.477)	(2.357)
OYEAR	-0.00154***		-0.000869***		-0.000610***		-0.000795		-0.000409		-0.000344	
	(-3.291)		(-2.918)		(-2.779)		(-1.613)		(-1.380)		(-1.393)	
LnAWAGE	-0.113**	0.856*	-0.0800**	0.863**	-0.0299	0.840*	-0.0711	0.488	-0.0734**	0.495	0.00507	0.527
	(-2.188)	(1.951)	(-2.373)	(1.971)	(-1.331)	(1.907)	(-1.233)	(0.950)	(-2.079)	(0.973)	(0.168)	(1.018)
OVER50	-0.251**	5.110***	-0.147**	5.086***	-0.0718	5.165***	-0.271**	4.502***	-0.191**	4.444***	-0.0577	4.461***
	(-2.464)	(4.929)	(-2.326)	(4.924)	(-1.238)	(4.971)	(-2.009)	(4.206)	(-2.347)	(4.153)	(-0.833)	(4.193)
FEMALE	-0.0964	-1.585**	-0.0563	-1.568**	-0.0554	-1.588**	0.145	-1.378**	0.115*	-1.379**	0.0228	-1.345**
	(-1.268)	(-2.328)	(-1.186)	(-2.298)	(-1.403)	(-2.378)	(1.517)	(-2.227)	(1.861)	(-2.211)	(0.552)	(-2.204)
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	1.850**	-17.51***	1.295**	-17.61***	0.503	-17.23**	1.140	-10.62	1.132**	-10.69	-0.0343	-11.23
	(2.368)	(-2.616)	(2.543)	(-2.637)	(1.462)	(-2.561)	(1.282)	(-1.335)	(2.091)	(-1.357)	(-0.0730)	(-1.400)
athrho		0.116*		0.0670		0.275**		0.199**		0.127**		0.348**
		(1.660)		(1.263)		(2.007)		(2.468)		(2.416)		(2.228)
Insigma		-1.558***		-2.017***		-2.279***		-1.547***		-2.003***		-2.237***
		(-26.87)		(-25.23)		(-60.73)		(-26.26)		(-22.14)		(-58.38)
Observations	1,792	1,792	1,791	1,791	1,788	1,788	2,058	2,058	2,065	2,065	2,057	2,057

Robust z-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9. Regression Results of Endogenous Treatment Effects Model(3)

	FOREIGN < Median						FOREIGN >= Median					
	(10)		(11)		(12)		(13)		(14)		(15)	
VARIABLES	LNWD1	UNION	LNWD2	UNION	LNWD3	UNION	LNWD1	UNION	LNWD2	UNION	LNWD3	UNION
UNION	-0.144***		-0.0574**		-0.104***		-0.116**		-0.0702*		-0.0569**	
	(-2.873)		(-2.210)		(-5.091)		(-2.166)		(-1.848)		(-2.496)	
UDEN		4.624***		4.659***		4.374***		5.999***		5.904***		6.032***
		(3.943)		(3.834)		(3.971)		(4.581)		(4.482)		(4.683)
FOREIGN	0.0936	-3.650*	0.0816	-3.762**	-0.0171	-3.673**	0.332***	-0.943	0.243***	-0.903	0.0852*	-0.959
	(0.457)	(-1.957)	(0.643)	(-1.988)	(-0.178)	(-2.069)	(3.001)	(-1.203)	(3.320)	(-1.154)	(1.781)	(-1.229)
FINANCIAL	0.0345	1.068	-0.0239	1.024	0.0633*	1.128	-0.0948	0.699	-0.0746	0.667	-0.0190	0.701
	(0.504)	(1.042)	(-0.635)	(0.982)	(1.662)	(1.147)	(-0.991)	(0.709)	(-1.235)	(0.679)	(-0.426)	(0.713)
LnEMP	0.0566***	0.387***	0.0290***	0.385***	0.0297***	0.396***	0.0565***	0.197**	0.0344***	0.197**	0.0228***	0.201**
	(5.582)	(3.504)	(4.778)	(3.464)	(5.992)	(3.720)	(3.788)	(2.056)	(3.361)	(2.059)	(3.955)	(2.110)
OYEAR	-0.00110**		-0.000695***		-0.000345		-0.000792		-0.000392		-0.000397	
	(-2.324)		(-2.590)		(-1.575)		(-1.348)		(-1.040)		(-1.526)	
LnAWAGE	-0.101*	1.186**	-0.0655**	1.154*	-0.0308	1.202**	-0.0605	0.295	-0.0684	0.331	0.00886	0.297
	(-1.909)	(1.981)	(-2.188)	(1.922)	(-1.191)	(2.080)	(-0.881)	(0.545)	(-1.522)	(0.614)	(0.265)	(0.549)
OVER50	-0.119	3.847***	-0.103**	3.821***	0.00549	3.763***	-0.409***	5.999***	-0.256**	5.951***	-0.133**	6.015***
	(-1.112)	(3.967)	(-1.970)	(3.934)	(0.0870)	(3.997)	(-2.673)	(4.540)	(-2.413)	(4.524)	(-2.031)	(4.566)
FEMALE	0.0310	-1.903***	0.0591	-1.893***	-0.0420	-1.881***	0.00337	-1.204	0.0174	-1.167	-0.0181	-1.217
	(0.290)	(-2.907)	(0.850)	(-2.831)	(-0.967)	(-3.028)	(0.0383)	(-1.433)	(0.334)	(-1.380)	(-0.393)	(-1.476)
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	1.584*	-21.68**	1.020**	-21.16**	0.481	-21.95**	0.968	-8.731	1.037	-9.234	-0.0845	-8.784
	(1.943)	(-2.346)	(2.230)	(-2.285)	(1.206)	(-2.454)	(0.917)	(-1.033)	(1.507)	(-1.094)	(-0.162)	(-1.038)
athrho		0.395**		0.219*		0.661***		0.136**		0.0876		0.228**
		(2.362)		(1.732)		(4.276)		(2.136)		(1.615)		(2.501)
lnsigma		-1.691***		-2.214***		-2.327***		-1.443***		-1.873***		-2.180***
		(-40.19)		(-44.16)		(-52.55)		(-19.53)		(-18.06)		(-59.98)
Observations	1,928	1,928	1,926	1,926	1,923	1,923	1,922	1,922	1,930	1,930	1,922	1,922

	FINANCIAL < Median						FINANCIAL >= Median					
	(16)		(17)		(18)		(19)		(20)		(21)	
	LNWD1	UNION	LNWD2	UNION	LNWD3	UNION	LNWD1	UNION	LNWD2	UNION	LNWD3	UNION
UNION	-0.0721*		-0.0430*		-0.0403		-0.149**		-0.0773		-0.102***	
	(-1.805)		(-1.789)		(-1.481)		(-2.333)		(-1.577)		(-4.219)	
UDEN		6.265***		6.216***		6.324***		5.225***		5.124***		5.104***
		(5.814)		(5.756)		(5.901)		(3.545)		(3.440)		(3.737)
FOREIGN	0.471***	-0.648	0.286***	-0.612	0.181***	-0.669	0.0519	-1.284	0.0548	-1.267	-0.0115	-1.277
	(4.145)	(-0.961)	(3.889)	(-0.911)	(3.576)	(-0.988)	(0.580)	(-1.328)	(1.077)	(-1.302)	(-0.244)	(-1.375)
FINANCIAL	-0.0764	0.558	-0.0572	0.647	-0.0217	0.522	0.0829	3.176**	-0.00759	3.166**	0.0994*	2.981**
	(-0.499)	(0.453)	(-0.582)	(0.523)	(-0.307)	(0.424)	(0.710)	(2.278)	(-0.111)	(2.244)	(1.653)	(2.275)
LnEMP	0.0535***	0.436***	0.0322***	0.434***	0.0224***	0.436***	0.0512***	-0.0642	0.0283***	-0.0670	0.0232***	-0.0340
	(4.239)	(4.798)	(3.808)	(4.789)	(3.917)	(4.807)	(3.378)	(-0.538)	(2.659)	(-0.557)	(4.065)	(-0.301)
OYEAR	-0.00170***		-0.000927**		-0.000716**		-0.000379		-0.000209		-0.000107	
	(-2.696)		(-2.449)		(-2.270)		(-0.806)		(-0.700)		(-0.493)	
LnAWAGE	-0.107*	0.361	-0.0812**	0.371	-0.0226	0.362	-0.0466	1.597**	-0.0535	1.603**	0.0147	1.555**
	(-1.846)	(0.754)	(-2.134)	(0.779)	(-0.849)	(0.749)	(-0.718)	(2.240)	(-1.308)	(2.253)	(0.466)	(2.238)
OVER50	-0.277**	4.357***	-0.186***	4.361***	-0.0758	4.327***	-0.294**	5.854***	-0.168*	5.694***	-0.0901	5.827***
	(-2.162)	(4.080)	(-2.665)	(4.079)	(-0.999)	(4.036)	(-2.077)	(4.594)	(-1.656)	(4.483)	(-1.583)	(4.905)
FEMALE	0.0725	-1.999***	0.0697	-1.991***	-0.00724	-1.981***	0.0322	0.0823	0.0224	0.176	0.0110	-0.145
	(0.729)	(-3.184)	(1.057)	(-3.163)	(-0.165)	(-3.175)	(0.307)	(0.0800)	(0.337)	(0.170)	(0.226)	(-0.148)
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	1.744**	-9.797	1.286**	-9.927	0.404	-9.813	0.702	-27.79**	0.810	-27.83**	-0.219	-27.16**
	(1.977)	(-1.333)	(2.249)	(-1.357)	(0.981)	(-1.323)	(0.711)	(-2.557)	(1.298)	(-2.567)	(-0.454)	(-2.555)
athrho		0.0685		0.0382		0.155		0.273***		0.178***		0.531***
		(0.836)		(0.613)		(1.062)		(3.973)		(2.628)		(4.052)
lnsigma		-1.517***		-1.959***		-2.241***		-1.602***		-2.075***		-2.277***
		(-32.60)		(-32.04)		(-62.52)		(-15.07)		(-12.29)		(-53.99)
Observations	1,914	1,914	1,914	1,914	1,909	1,909	1,936	1,936	1,942	1,942	1,936	1,936

Robust z-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1