Labour Economics 17 (2010) 1030–1037

Contents lists available at ScienceDirect

Labour Economics

journal homepage: www.elsevier.com/locate/labeco

Labor unions and productivity: An empirical analysis using Japanese firm-level data

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ARTICLE INFO

Article history:
Received 3 October 2009
Received in revised form 23 January 2010
Accepted 20 February 2010
Available online 25 February 2010

JEL classification:
J51
M12

Keywords:
Labor union
Productivity
Wage
Profitability
Part-time worker

ABSTRACT

This paper empirically analyzes the relationship between labor union and firm performance in areas such as productivity and profitability by using data on more than 4000 Japanese firms, ranging from listed large firms to unlisted SMEs, in both the manufacturing and non-manufacturing sector. The presence of labor unions has statistically and economically significant positive effects on firm productivity. Unions' effects on wages are also positive, their magnitude being slightly larger than those on productivity. The decrease in the number of employees is greater at unionized firms than at non-unionized firms. The difference in employment growth is mainly attributable to the change in the number of part-time workers. In order to enhance productivity, close cooperation between management and unions is essential.

1. Introduction

Faced with an aging population and a decreasing labor force, Japan must now focus its economic policy on enhancing productivity, especially in the service sector. Most European countries, likewise, are faced with slower productivity growth as compared with the U.S., which disparity has become a major policy issue. The reasons for countries' divergent productivity performance are a leading topic in economic researches (see, for example, Inklaar et al., 2008; van Ark et al., 2008). As there is considerable difference in productivity among firms, even among those within the same industry, it is essential to thoroughly understand and identify the types of firms that will perform well in order to plan and implement effective policy measures.

The focus of this paper is on labor unions' effects on productivity, profitability, wages, and employment by firms in Japan. Those effects are empirically investigated by using data on more than four thousands firms, both manufacturing and non-manufacturing, for the period 1998–2004.

Firm-based labor unions are a distinct characteristic of the Japanese labor system, along with long-term employment and a seniority-based wage structure. Japanese labor unions participated in the "productivity movement" during the high growth era and made efforts to enhance productivity in cooperation with management. In 1955, the Japan Productivity Center (JPC) was established; this organization is composed of managers, scholars, and labor unions. The Center has worked to change Japanese labor relations from their erstwhile confrontational nature to a new cooperative one. The concept of "The Three Guiding Principles"—1) the expansion of employment; 2) cooperation between labor and management; and 3) fair distribution of the fruits of productivity among labor, management, and consumers—was proposed by the Center and embraced by the participants. An important point here is the consistency between wage growth and productivity growth that has become the norm in the collective bargaining process. Today, labor unions participate in Service Productivity and Innovations for Growth (SPRING), a business-government-academia forum established in 2007, where two union representatives are, in fact, board members.

Under the long-term employment system, Japanese firm-based labor unions have been supportive of innovations. As quid pro quo, Japanese firms have been providing education and training to their employees in order to upgrade their human capital. Such complementary elements have been fundamental to fostering productivity growth.

However, according to the aggregated statistics on labor unions, the union membership rate has been declining steadily. The rate, which exceeded 50% at its postwar peak, stood at only 18.1% in 2007, according

[1] The activities of SPRING include provision of management services and information useful for improving productivity; assisting with the application of service innovation through scientific approaches, development of human resources, and efforts toward the globalization of service companies.

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doi:10.1016/j.labeco.2010.02.009

to the Basic Survey of Labor Unions (Ministry of Health, Labor, and Welfare).[2] This declining trend is similar to that witnessed in other advanced economies such as the U.S., UK, Germany, and France. The unionization rate in the manufacturing industry is 25.2%, but 10.6% in wholesale and retail, 8.5% in medical care and welfare services, and 6.2% in other services.[3] The non-manufacturing industries' unionization rate is generally lower than that of the manufacturing sector. Under these circumstances, this paper tries to shed light on the current economic roles played by the labor unions in Japan.

The rest of this paper is organized as follows. Section 2 briefly reviews relevant studies on labor unions and firm performance. Section 3 explains the data used and the method of analysis. Section 4 reports and interprets the results and Section 5 concludes.

2. Literature review

The relationship between labor unions and productivity has been an important theme in the research on labor economics and industrial relations. It is beyond the scope of this paper to comprehensively review these studies, but I will discuss very briefly the conclusions derived in these earlier works.

Brown and Medoff (1978) present the early representative contribution in this field. They indicate the positive effects of labor unions on the productivity of firms and argue that unions can raise productivity by improving communication between workers and management. On the other hand, unions may reduce productivity by distorting the labor market through their monopoly powers. Therefore, whether labor unions have a positive or negative effect on productivity is an empirical question. Although empirical studies in the U.S. and in European countries have produced widely varying results, including coefficients with opposite signs, unions have, at most, a small positive effect on productivity, at least in the U.S. (Hirsch, 2007, 2008). According to Fuchs et al. (1998), the mean and median values of the union productivity effect, in the view of economists at research universities in the U.S., are 3.1% and 0%, respectively. A meta-analysis by Doucouliagos and Laroche (2003) shows the simple mean of the estimated union productivity effect to be 4% and the weighted average to be 1%—small effects, both. Among the 73 studies analyzed by Doucouliagos and Laroche (2003), five studies are analyses of unions in Japan. According to the result of their meta-analysis, the union productivity effects in these five studies are negative and significant.

Studies on union wage effects (union wage premium) outnumber those on productivity. Generally speaking, union wage effects are large and their magnitude is larger than that of the effects on productivity. According to Fuchs et al. (1998), the mean and median values of union wage effects are 13.1% and 15%, respectively.[4] Recent studies that account for the imputation bias of the Current Population Survey (CPS) show that the union wage premium is around 20% (see, for example, Hirsch and Schumacher, 2004). As a result, the effects of labor unions on firm profitability are generally negative in the U.S.-based studies (Addison and Hirsch, 1989; Hirsch, 2007, 2008). Recently, Doucouliagos and Laroche (2009) conducted a meta-analysis of the effect of unions on profits; the study finds that unions have a significant negative effect on firm profitability in the U.S., but that that effect is insignificant for non-U.S. countries.

However, most of the past empirical studies use a small number of firms, because the official statistics on firms and establishments rarely include information on the presence of labor unions. In addition, most of the studies using firm-level data cover only manufacturing firms, with some exceptions in the case of the construction or airline industries.

In Japan, Muramatsu (1984) is an early study that quantitatively assesses the union productivity effect. This study uses two-digit manufacturing industry data for the years 1973 and 1978, and indicates that the union effect on labor productivity in 1978 was about 20% after controlling for labor quality,[5] while that for 1973 was insignificant. This study interprets the results as indicating that union productivity effects devolve from the reduction of the employee turnover rate. Sakamoto (1995), too, uses aggregated manufacturing industry data from 1980 to 1990 and shows that unions reduce employee turnover and enhance labor productivity.[6]

On the other hand, Brunello (1992), by using firm-level, cross-section data for unlisted manufacturing firms in 1986, indicates that the presence of labor unions reduces labor productivity—sales per employee—by approximately 15% and also reduces profitability by between 20% and 30%.[7] Although the number of sample firms is relatively large (979 firms), listed firms are not included and the study covers only seven manufacturing industries. It is not certain why the results of Brunello (1992) are so different from other studies, since for all the studies the data, the variables used, and the methods of estimation are substantially different. One possible reason is that the sample year (fiscal year 1986) fell just after the Plaza Accord. In 1986, the yen appreciated against the USD by more than 40% and the Japanese manufacturing industry experienced a severe downturn as a result. Under the circumstances, the productivity performance of the unionized firms, which did not fire their employees quickly, might have been lower than that of the non-unionized firms. Benson (1994) uses data from a survey (conducted in 1991) for 253 manufacturing firms and reports that Japanese unions were associated with lower productivity and lower levels of profit. However, the measures used in the analysis are managers' subjective five-point scale evaluation of productivity and profitability.

Tachibanaki and Noda (2000) utilize two separate data sets on Japanese firms to investigate the union effect on productivity. The first data set covers 404 listed firms from 1990 to 1993 and the second data set covers 106 unlisted firms from 1989 to 1995. Both of the data sets are for manufacturing firms. Several characteristics of workers (average tenure, average age, and the fraction of female employees) are controlled to estimate production functions. They report that union effect on productivity is 3.8% for the listed firms with average tenure workers and 3.6% for the unlisted firms with average age workers. The quantitative effects of unions differ by firms' composition of their workforce, because their regressions include various interaction terms.[8] According to Doucouliagos and Laroche (2003), the union effect of Tachibanaki and Noda (2000) is reported to be an extremely large negative figure (−50%). However, as Tachibanaki and Noda (2000) describe in the text, the union

[2] These union membership rates include public sector workers. The figure is 16.9% for the private sector. The Basic Survey on Labor Unions is conducted annually by the Ministry of Health, Labor, and Welfare and includes all the labor unions. These rates are estimated by the Ministry, because in Japan individual level statistics (e.g. Labor Force Statistics) do not aggregate information on union status.

[3] According to the BLS statistics, the union membership rates in the U.S. (2007) are 12.1% (all wage and salary workers), 11.3% (manufacturing), 5.2% (wholesale and retail trade), 7.9% (health care and social assistance).

[4] Lewis (1986) is an early representative survey on the union wage premium. Recent examples include Blanchflower and Bryson (2002, 2003).

[5] The industry-level labor quality variables used are the fraction of female employees, the fraction of workers with higher education, and the average age of male production workers.

[6] Torii (1992) analyzed the determinants of technical efficiency among Japanese manufacturing industries in 1978 and found no statistically significant relationship between industry-level union density and technical efficiency.

[7] The regression of Brunello (1992) includes several control variables, which include firm size, firm age, capital–labor ratio, average age of employees, female employment ratio, market share, and the square terms of some of these variables.

[8] Tachibanaki and Noda (2000) use a random effect panel estimation for the sample of listed firms and a fixed effect estimation for the sample of unlisted firms. However, as the time-series variation of union presence seems to be very small, the validity of using panel estimation is questionable.

[9] The conclusion of Doucouliagos and Laroche (2003) that unions have a negative impact on productivity in Japan seems to be due to their interpretation of the results of the study by Tachibanaki and Noda (2000), which uses the largest samples among the five Japanese studies.

effect on productivity is positive both for the sample of listed firms and unlisted firms in their preferred specifications.[9]

Benson (2006) is an example of an empirical study on the relationship between union and firm *profitability*. This study uses survey data on Japanese manufacturing firms from the years 1991, 1995, and 2001 (sample sizes are 253, 172, and 184, respectively), and conducts an ordered-probit analysis to explain the rate of return on assets (five-categories). The results indicate that the profitability of unionized firms is significantly low.

In summary, although there have been several studies investigating the relationship between labor union and productivity in Japan, the results are diverse and far from suggesting a consensus. All of the prior studies focus only on manufacturing industries or firms and the numbers of sample firms are small. Labor productivity is often calculated as sales per employee (not value-added productivity or TFP). Furthermore, past studies analyze union effects on productivity *level*, but do not deal with productivity *growth*. The previous productivity studies covered the period before the first half of the 1990s, but the Japanese labor market has been changing rapidly since the latter half of the 1990s through deregulation and prolonged recession. In order to overcome the limitations of the previous studies, this paper uses data on more than 4000 Japanese firms for the period 1998–2004, ranging from listed large firms to unlisted SMEs, both manufacturing and non-manufacturing, and analyzes the union effects on value-added labor productivity, TFP, profitability, and employment. In addition, not only *level* effects but also *growth* effects are analyzed—underscoring the importance of understanding the role of unions in recent years, particularly in light of the rapid changes in the Japanese labor market since the latter half of the 1990s.

3. Data and methods

The data used in this paper come from the Basic Survey of Japanese Business Structure and Activities (Ministry of Economy, Trade, and Industry) and the Survey of Corporate Management (Small and Medium Enterprise Agency).

The Basic Survey of Japanese Business Structure and Activities, an annual survey that was begun in 1991, accumulates representative statistics on Japanese firms with 50 or more regular employees, including those engaged in mining, manufacturing, electricity and gas, wholesale, retail, and several service industries. Over 25,000 firms are surveyed every year. The purpose of this survey is to capture a comprehensive picture of Japanese firms, including their basic financial information (sales, costs, profits, book value of capital, number of employees, etc.), composition of businesses, R&D activities, IT usage, and foreign direct investments. As the sample firms are coded by using perpetual numbers, it is possible to construct a firm-level longitudinal data set.

The aim of the Survey of Corporate Management, which was conducted in 1998, was to find facts related to the internal structure and governance of Japanese firms. Specifically, this survey investigates firms' managerial objectives, structure of shareholders, internal organization, and so forth. Information on unionization is also compiled; the specific question on the subject of labor union activity is simple—"Does your company have a labor union or not?" Unfortunately, this survey does not ascertain the union density/coverage of the firms. Under Japan's firm-based labor union system, however, wages and working conditions agreed between the management and the unions are usually applied to nonmember regular workers as well. The distinction between union presence and union coverage is, therefore, not a serious issue in Japan.

Although the Survey of Corporate Management was conducted by the Small and Medium Enterprise Agency, the survey sample covers both SMEs and large firms in order to facilitate a wider comparison. The sample was obtained from the registered list of the Basic Survey of Japanese Business Structure and Activities. Therefore, the two surveys used in this study could be merged at the firm level by using the perpetual firm numbers. The number of firms surveyed was 10,000, of which more than 5000 firms responded (the response rate was 51.5%). In order to check for a possible response bias, the characteristics of the reporting firms were compared with those of the 26,270 firms covered in the 1998 Basic Survey of Japanese Business Structure and Activities. The average number of employees for the reporting firms was 379; when all firms were considered, the average was 385. The average labor productivity (value-added/employee) was 7.27 million yen for the reporting firms, and 7.03 million yen for all firms.

This paper constructs a longitudinal data set from the Basic Survey of Japanese Business Structure and Activities 1998–2004, and then matches the set with the data from the Survey of Corporate Management. It is thus possible to analyze the relationship between the union presence in sample firms in 1998 and the firms' medium-term performance until 2004. The number of matched companies in 1998 was around 4500. Of these, around 3500 were still in existence in 2004. As shown in the last row of Table 1, the number of unionized firms was 1689 in 1998 and 1360 in 2004. The number of non-unionized firms was 2877 in 1998 and 2148 in 2004.[10] As is obvious from the above explanation, information on union status is available only for the year 1998. We cannot rule out the possibility that a union dissolved, even though the firm survived, or that a new union was established after 1999 in a formerly non-unionized firm. That uncertainty is a limitation of this study, but such changes in union status are infrequent in Japan. According to the Basic Survey on Labor Unions, in 2007, the number of new unions other than those of new establishments was 510, and the number of instances of the dissolution of a union for reasons other than the shutting down of the establishment was 861. Either figure is quite small compared with the total number of labor unions (58,265) in Japan.

As mentioned already, 1689 firms (37.0%) had labor unions among the sample in 1998. The share of firms with labor unions was relatively high, because the Basic Survey of Japanese Business Structure and Activities only sampled firms that had 50 or more regular employees. When classified by firm size, 29.7% of all firms with 300 or less employees were found to be unionized; among those with more than 300 employees, the share was 52.4%. By industry, unionized firms accounted for 44.7% of those in manufacturing and 21.2% of those in the non-manufacturing sector. From the perspective of firm age, unionized firms accounted for 27.3% of the firms that were less than 40 years old, and for 43.0% of the firms that had existed for 40 years or more. Large and old firms in the manufacturing sector tended to have labor unions.

In this study, I begin with statistically testing the difference between the mean performance measures of the unionized and non-unionized firms. Then, I conduct simple OLS regressions to estimate the coefficients of a union dummy after controlling for various firm characteristics such as size, age, and industry (as indicated below).

$$y_i = \beta_0 + \beta_1 size_i + \beta_2 age_i + \beta_3 industry\ dummies + \beta_4 union\ dummy + u_i \quad (1)$$

$$\Delta y_i = \beta_0 + \beta_1 size_i + \beta_2 age_i + \beta_3 productivity\ level + \beta_4 industry\ dummies + \beta_5 union\ dummy + u_i \quad (2)$$

Productivity measures used as dependent variables (y and Δy) are the productivity (labor productivity and TFP) levels for the years 1998, 2004, and the pooled years of 1998 to 2004 and the productivity (labor productivity, TFP) growth rates from 1998 to 2004. These measures are calculated from the data obtained from the Basic Survey of Japanese Business Structure and Activities. Labor productivity is the value-added per working hour. Value-added is the sum of the operating profit, rent, wage, depreciation, and paid tax. This paper uses industry-level working hour data from the Monthly Labor Survey (Statistics Bureau, Ministry of

[10] The survival rate for unionized firms, therefore, is 80.5%, while that of non-unionized firms is 74.7%. On average, firm size, firm age, profit rate, and capital intensity in 1998 are higher for surviving firms than non-surviving firms. According to a simple probit estimation, union presence is not significantly related to firm survival, after controlling for these firm characteristics.

Table 1
Summary statistics and the comparisons of the mean values by union presence.

Variables	Year	Total		Unionized	Non-unionized		
		(1)		(2)	(3)	(4)	
		Mean	Std. dev.	Mean	Mean	Difference	*t*-value
Labor productivity	1998	−3.207	0.452	−3.117	−3.260	0.144	10.48
	2004	−3.128	0.511	−3.015	−3.201	0.186	10.49
	Pooled	−3.161	0.473	−3.058	−3.224	0.166	28.23
TFP	1998	−0.035	0.415	0.032	−0.074	0.106	8.36
	2004	0.019	0.462	0.099	−0.033	0.131	8.13
	Pooled	−0.003	0.429	0.069	−0.049	0.118	22.01
Profit rate on total asset	1998	0.017	0.065	0.011	0.020	−0.009	−4.48
	2004	0.038	0.111	0.042	0.036	0.007	1.76
	Pooled	0.027	0.070	0.025	0.029	0.004	−4.57
Wage per hour	1998	−6.018	0.318	−5.926	−6.071	0.145	15.22
	2004	−6.056	0.421	−5.946	−6.125	0.179	12.54
	Pooled	−6.021	0.345	−5.921	−6.083	0.162	38.77
Number of employees	1998	5.066	0.939	5.513	4.804	0.710	26.48
	2004	5.118	0.947	5.528	4.858	0.670	21.75
	Pooled	5.086	0.940	5.514	4.820	0.694	63.69
Capital intensity	1998	1.798	1.132	1.904	1.735	0.169	4.89
	2004	2.050	1.050	2.184	1.965	0.219	6.04
	Pooled	1.934	1.100	2.057	1.857	0.200	14.66
Labor productivity growth	98–04	0.179	0.458	0.228	0.147	0.081	4.93
TFP growth	98–04	0.141	0.465	0.177	0.117	0.060	3.56
Change in the number of employees	98–04	−0.081	0.307	−0.128	−0.050	−0.077	−7.17
Change in the number of full-time employees	98–04	−0.106	0.948	−0.101	−0.110	0.009	0.19
Change in the number of part-time employees	98–04	0.037	1.007	−0.015	0.067	−0.082	−1.69
Change in wage per hour	98–04	−0.044	0.356	−0.031	−0.053	0.021	1.69
Change in profit rate	98–04	0.015	0.118	0.024	0.010	0.014	3.45
Number of firms	1998	4566		1689	2877		
Number of firms	2004	3508		1360	2148		
Number of observations	Pooled	27,431		10,520	16,911		

Note: Measures of productivity, wage, employment, and capital intensity are logarithmic forms. "Pooled" means seven years from 1998 to 2004 are poled. Growths and changes are from 1998 to 2004.

Internal Affairs and Communications), because the Basic Survey of Japanese Business Structure and Activities does not include information on working hours. The total hours are calculated as the sum of the number of full-time employees multiplied by their working hours and the number of part-time employees multiplied by their working hours. TFP is calculated by using value-added, capital (total assets), labor (total hours), and cost of shares of capital and labor. TFP is calculated in a nonparametric manner that uses a hypothetical representative firm as the reference (see, for example, Caves et al., 1982; Nishimura et al., 2005; Fukao and Kwon, 2006). The input and output of a hypothetical representative firm are calculated as the geometric means of the input and output of all firms and the cost shares of labor and capital are calculated as arithmetic means. The TFP for each firm is calculated relative to the hypothetical representative firm.[11] One reason for using this methodology is to ensure cross-section and time-series comparability of firm-level productivity. Another reason is to avoid problems by using restrictive functional forms. While analyzing the productivity *level*, nominal values are used. When analyzing the productivity *growth*, deflated real values are used. Industry-level GDP deflators are taken from the National Accounts (Economic and Social Research Institute, Cabinet Office) and are used to calculate real values of value-added and capital. In addition to these productivity measures, wage rate (total wages divided by total hours), the profit rate, and the change in the number of employees are used as dependent variables. All dependent variables are expressed in logarithmic form with the exception of the profit rate, which often has a negative value.

Among the explanatory variables, log number of employees (*lnemp*) is used as the measure of firm size. Firm age (*age*) is the number of years since the firm was established.[12] Three-digit industry dummies are used to control for the industry effects. There are around 100 industries, although the figures differ by year. If a firm has a labor union, the union dummy is assigned. The coefficients of this dummy are the focus of this study. The initial productivity level (labor productivity or TFP) is included in the productivity growth equations to control for the convergence effect and to avoid bias caused by the regression toward the mean. Previous productivity growth studies using firm or establishment data have pointed to these effects.[13] When regressions use labor productivity as a dependent variable, difference in capital intensity (K/L) may bias the results, and most of the previous studies explaining labor productivity control for capital–labor ratio. For these reasons, in the labor productivity level regression, capital intensity (log of the total assets divided by the total number of employees) is added as an independent variable. When conducting regression through the pooling of data for seven years from 1998 to 2004, year dummies are used to control for price level difference and the business cycle effect. Previous studies take into consideration several workforce characteristics such as average

[11] The formula for calculating TFP level of firm f in year t is as follows.

$$\ln \mathrm{TFP}_{\mathrm{ft}} = (\ln \mathrm{Y}_{\mathrm{ft}} - \ln Y_t) - (1/2)\Sigma_i \left(\mathrm{W}^i_{\mathrm{ft}} + W^i_t\right)\left(\ln \mathrm{X}^i_{\mathrm{ft}} - \ln X^i_t\right) + (\ln Y_t - \ln Y_0) - (1/2)\Sigma_i \left(W^i_t + W^i_0\right)\left(\ln X^i_t - \ln X^i_0\right)$$

Y_{ft} denotes the output of firm f in year t and $\mathrm{X}^i_{\mathrm{ft}}$ is the input of factor i at firm f in year t. $\mathrm{W}^i_{\mathrm{ft}}$ is the cost share of input i. *Italics* means the average value.

[12] Firm size and firm age are commonly used controls in the prior researches using firm-level data. For example, Brunello (1992) and Benson (1994) use the number of employees as a firm size variable. Brunello (1992) and Tachibanaki and Noda (2000) use firm age as a control variable.

[13] Fukao et al. (2005) and Kimura and Kiyota (2007) are examples of analyzing Japanese firms' productivity growth including the initial productivity level as an independent control variable. Oulton (1998) found evidence of regression toward the mean of labor productivity among UK companies. Griffith et al. (2002) found TFP convergence to the frontier among manufacturing establishments in the UK.

age, tenure, education, or ratio of part-time workers. The original data used in this paper provide only limited information on worker characteristics, but the number of part-time workers is available. I use the ratio of part-time worker (*part*) as an additional control variable for performing the robustness check.[14]

Major variables and summary statistics are shown in column (1) of Table 1. The definitions and calculations of the major variables are explained in Appendix A.

4. Results

4.1. Level effects

Columns (2)–(4) of Table 1 represent the simple comparisons between the mean productivity levels, wage levels, and profit rates of unionized and non-unionized firms. Converting these figures into percentage differentials, the mean labor productivity and the TFP of unionized firms in 2004 were, respectively, about 20% and 14% higher than those of non-unionized firms; in 1998, the unionized firms had 15% higher labor productivity and 11% higher TFP in comparison with non-unionized firms (see also Table 2). When pooling seven years, the productivity differentials are 18% (labor productivity) and 13% (TFP). The union wage premium was about 20% in 2004 and about 17% in 1998, a figure similar to that reported in recent studies conducted in the U.S. and Japan (Hara and Kawaguchi, 2008). Unionized firms' profit rate on total assets is 0.9 percentage point lower in 1998 and 0.7 percentage point higher in 2004. An important finding that merits attention is the very small differences between the figures denoting the labor productivity differential and the union wage premium.

After splitting the sample into manufacturing and non-manufacturing firms, one finds that in both types of industries the mean labor productivity, TFP, and wage rate are significantly higher for unionized firms (see Table 2). Union productivity effects are observed not only in manufacturing firms but also in non-manufacturing firms and the differentials are similar in magnitude for both industries. Profit rates of unionized firms are generally lower in the manufacturing industry, but not significantly different in the non-manufacturing industry.

However, as mentioned earlier, it is important to control for firm characteristics, because the presence of labor unions differs significantly by firm size, firm age, and industries. Table 3 shows the coefficients of the union dummy after controlling for firm size, firm age, and three-digit industry dummies. Signs of the control variables are as expected and statistically significant—firm size is positive, firm age is negative, and capital intensity (only in the labor productivity regression) is positive. The sizes of the coefficients of labor union shrink compared with the raw comparisons mentioned above, but are still large and significant in both productivity and wage regressions. Column (3) of Table 3 indicates the pooled regression results, where year dummies are added as explanatory variables. The results confirm the abovementioned findings. According to these regression results, the union productivity effects in percentage terms are between 8% and 10%. These figures are far higher than those of the U.S. "consensus" (Fuchs et al., 1998) and of the mean value of the meta-analysis by Doucouliagos and Laroche (2003). On the other hand, the union wage premium is around 12%. Since labor's share of the value-added is approximately 70%, these results are consistent with the union effect on profitability being neutral or of small value.[15] According to the regression results for profit rate on total assets, the coefficient of the union dummy is negative and significant in 1998 and positive but insignificant in 2004. Since profit forms part of the capital share of the value-added, which includes rent, depreciation, and interest payment, the measured union effect on profitability depends also on these other factors. The careful interpretation is that unions raise productivity and wages, but the net effect on firm profitability is mixed or unclear.

Table 2
Differentials with and without labor union (by industry).

Variables	Year	Total	Manufacturing	Non-manufacturing
Labor productivity	1998	15.4%	18.6%	18.1%
	2004	20.4%	24.8%	18.7%
	1998–2004 pooled	18.0%	21.9%	19.5%
TFP	1998	11.2%	13.3%	17.7%
	2004	14.0%	17.2%	15.6%
	1998–2004 pooled	12.5%	15.2%	17.3%
Average wage (per hour)	1998	15.6%	21.3%	13.3%
	2004	19.6%	23.5%	18.4%
	1998–2004 pooled	17.6%	22.2%	17.0%
Profit rate on total asset	1998	−0.9%	−1.3%	*0.1%*
	2004	0.7%	*0.6%*	*0.4%*
	1998–2004 pooled	−0.4%	−0.7%	*−0.1%*

Notes: The figures indicate the percentage differentials between unionized and non-unionized firms. The percentage differential is calculated as $\exp(d)-1$, where d is the log differential between unionized and non-unionized firms. Profit rates are expressed as percentage points. Figures in italics mean insignificant at 10% level.

In order to check the robustness of the results, I conduct estimations by adding the part-time ratio (*part*) as an additional explanatory variable to control for the quality of the workforce. As expected, the coefficient of this variable is negative and highly significant for both the productivity equation and the wage equation. Both of the estimated union effects on productivity and wages are reduced by about 1.3% points (see columns [4]–[6] of Table 3), but the major conclusions are essentially unchanged.

As described in Section 2, although unions in the U.S. may enhance productivity, the magnitude of such enhancement is far smaller than their effects on wages. As a result, unions are widely regarded as having a negative effect on firm profitability. In Japan, union productivity effect is relatively large and comparable with the union wage premium. The negative union productivity effect that appeared in some previous studies in Japan seems to be the result of their sample, specific years of the analysis, poor productivity measures, or a combination of these. Serious conflict between the unions and management is not detected in Japanese firms.[16]

4.2. Growth effects

In this subsection, I examine union effects on *changes* in productivity, wage, and profitability from 1998 to 2004. Table 4 shows simple comparisons between the mean productivity growth, wage growth, and change in profit rate of unionized and non-unionized firms. The annual labor productivity growth rate of unionized firms is 1.4% points higher and the TFP growth rate is 1.0% point higher than the corresponding figures for non-unionized firms. These simple comparisons suggest that labor unions may have positive productivity *growth* effects. During the period of the analysis, the growth rates of average wages are negative both for unionized and non-unionized firms on account of prolonged deflation and the loose labor market conditions. However, the absolute size of the wage decrease rate on an annual basis is 0.4% point smaller for unionized

[14] In the Basic Survey of Japanese Business Structure and Activities, "part-time workers" are defined as workers whose scheduled daily working hours or weekly working days are lower than those of full-time workers.

[15] Labor's share (simple average of the sample firms) is 73% in 1998 and 68% in 2004.

[16] Theoretically, the union wage effects may be passed on to customers by fixing higher prices. In such a case, the measured value-added productivity may overstate the true (physical) productivity. Although testing this possibility is outside the scope of this paper, it seems unlikely that large numbers of unionized firms including SMEs would be able to raise their output price.

Table 3
Coefficients of union dummy (regression results).

Dependent variables	1998	2004	1998–2004 pooled	1998	2004	1998–2004 pooled
	(1)	(2)	(3)	(4)	(5)	(6)
Labor productivity	0.088	0.094	0.093	0.075	0.081	0.076
	(6.53)	(5.54)	(16.09)	(5.59)	(4.81)	(13.28)
TFP	0.094	0.082	0.083	0.081	0.069	0.068
	(6.80)	(4.88)	(14.54)	(5.94)	(4.16)	(11.84)
Average wage (per hour)	0.111	0.108	0.118	0.098	0.094	0.100
	(11.25)	(7.11)	(27.04)	(10.10)	(6.30)	(23.49)
Profit rate on total asset	−0.013	0.004	−0.008	−0.013	0.004	−0.008
	(−5.76)	(0.99)	(−8.09)	(−5.69)	(0.96)	(−8.01)

Notes: OLS estimates with t-values in parentheses. Firm size, firm age, and 3-digit industry are controlled. Capital intensity (K/L) is added as an explanatory variable for labor productivity estimation. Pooled estimations include year dummies as independent variables. Estimations (4)–(6) include the ratio of part-time workers as explanatory variables.

Table 4
Differentials in growth rates with and without labor union (by industry).

Variables	1998–2004		
	Total	Manufacturing	Non-manufacturing
Labor productivity growth	1.4%	0.9%	1.1%
TFP growth	1.0%	0.6%	0.6%
Average wage growth (per hour)	0.4%	*0.1%*	0.9%
Change in profit rate on total asset	0.2%	0.3%	*0.1%*

Notes: The figures indicate the percentage differentials on an annual basis between unionized and non-unionized firms. Profit rates are annual change in percentage points. Figures in italics mean insignificant at 10% level.

firms.[17] The profit rate on total assets rose by 2.4% points for unionized firms and 1.0% point for non-unionized firms from 1998 to 2004. Although both kinds of firms increased their profitability during the six-year period, unionized firms show a significantly better performance. All of these results suggest that labor unions have favorable growth effects for both the employees and management.

Even when looking at manufacturing and non-manufacturing firms separately, similar pictures emerge (see columns [2] and [3] of Table 4). For both industries, the labor productivity growth rate and the TFP growth rate are higher for unionized firms. Although the union effect on the change in average wages does not show a significant difference in the manufacturing sector, the unionized firms' wage growth rate is 0.9% point higher in non-manufacturing industries and the difference is statistically significant.

Regression results, which control for firm size, firm age, three-digit industry, and the initial productivity level, indicate that the coefficients of the union dummy on labor productivity growth and TFP growth are positive and significant (see Table 5). The union coefficient is negative but insignificant for wage growth. The unionized firms' change in profit rate is slightly higher after controlling for firm characteristics. It may therefore be surmised that the Japanese labor unions have been functioning well, both for the union members and the management, at least during the period of this study.

4.3. Interpretation

Although the union membership rate has been declining, Japanese labor unions have had positive effects on firms' productivity, both in terms of their levels and growth rates. On the other hand, the results of union presence on firm profitability are mixed and inconclusive. These results contrast with those of studies for U.S. firms, and suggest that even today Japanese firm-based labor unions function effectively in fostering productivity. As explained in the introduction, under the long-term employment system wherein a stable relationship between management and the employees is maintained through frequent communication and consultation on important issues, Japanese firm-based labor unions have been supportive of innovation.[18] Japanese firms have been providing education and training (especially OJT) to their employees in order to upgrade their human capital. These factors complement each other and contribute toward productivity growth.[19] "The Three Guiding Principles," especially the third—the fair distribution of the fruits of productivity—have been accepted as a norm by management and the labor unions. In collective bargaining, fair distribution has been interpreted as an arrangement whereby wage growth and productivity growth should keep pace with each other. This frame of reference seems to form the background for the close cooperation between management and workers.

During the period of the analyses (1998–2004), the Japanese economy had been suffering from recession and a loose labor market condition. In 2002, the unemployment rate was an unprecedented 5.4%.[20] Tachibanaki and Noda (2000) present suggestive evidence that the productivity of unionized firms is higher in a booming economy and lower in a recession. According to their interpretation of the results, unions enhance productivity during the boom years by reducing the separation rate. Although the results of this paper cannot be generalized across other time periods, the union productivity effect may indeed be stronger when the labor market condition is tight.

However, Japan's labor market had been experiencing structural changes throughout the period of the analyses. The number of non-regular workers, who were often not covered by labor unions, increased rapidly and the union membership rate declined continuously. Under such circumstances, it is important to analyze the relationship between union presence and employment.

4.4. Union presence and employment

This subsection looks at the relationship between labor unions and employment at the firm level. Table 6 shows the ratio of part-time workers in 1998 and 2004 by union presence. Among the sample firms in this study, the ratio of part-time workers in unionized firms is nearly 4% lower than that in non-unionized firms. As shown in the last row of this table, the differences are not caused by firm size, firm age, and industry. Unionized firms have a relatively small number of part-time workers, irrespective of industry.

[17] There is no simple comparison between figures of productivity growth and those of wage growth, because productivity measures are real values and wages are nominal values. If nominal productivity measures are used, unionized firms' labor productivity growth is 0.7% higher and TFP is 0.4% higher than that of non-unionized firms. The differential for the productivity growth rate is larger than or identical to that of the wage growth rate.

[18] In fact, R&D intensity (R&D expenditure divided by total sales) of unionized firms is about 0.4% higher than that of non-unionized firms after controlling for three-digit industries.

[19] For example, Morishima (1991) indicates that information-sharing between workers and management has a positive effect on productivity.

[20] The unemployment rate was 4.1% in 1998, which then increased to 5.4% in 2002. After 2002, the rate gradually decreased to 4.7% in 2004.

Table 5
Union effects on growth performance (regression results).

Dependent variables	1998–2004	
	(1)	(2)
Labor productivity growth	0.033	0.027
	(2.06)	(1.66)
TFP growth	0.028	0.022
	(1.72)	(1.39)
Average wage growth (per hour)	−0.016	−0.009
	(−1.11)	(−0.63)
Change in profit rate on total asset	0.008	0.009
	(1.76)	(1.83)

Notes: OLS estimates with *t*-values in parentheses. Firm size, firm age, 3-digit industry, and initial productivity level are controlled. Estimation (2) includes the ratio of part-time workers as explanatory variable.

Table 6
Ratio of part-time employees.

	1998	2004	1998–2004 pooled
(Simple comparisons)			
Unionized firms	6.2%	6.8%	6.5%
Non-unionized firms	10.1%	10.6%	10.5%
(difference)	−3.9%	−3.8%	4.0%
(*t*-value)	(−9.09)	(−7.53)	(−22.49)
(Regression results)			
Coefficients of union dummy	−3.0%	−2.6%	−3.3%
(*t*-value)	(−6.66)	(−4.91)	(−17.91)

Notes: Regression coefficients indicate the regression results by controlling for firm size, age, and 3-digit industry.

Table 7 indicates the annual changes in employment from 1998 to 2004. The decrease in numbers of total employees in unionized firms was 2.1% per annum—significantly greater than the corresponding figure (a decrease of 0.8%) for non-unionized firms. Even when firm size, age, and three-digit industry are controlled for, the coefficient of the union dummy on employment growth is negative and statistically significant (not reported here). The negative effect of unions on employment growth is similar to that recently found in other advanced countries (Addison and Belfield, 2004 for UK; Walsworth, 2010 for Canada; Wooden and Hawke, 2000 for Australia). After categorizing employees into full-time and part-time, the declining employment rates for full-time employees are found to be similar for unionized and non-unionized firms. On the other hand, union presence made a significant difference to the changes in the employment of part-time workers. The number of part-time workers increased at 1.1% per annum for non-unionized firms, but decreased at 0.3% per annum for unionized firms. Hence, the different trend in the number of part-time workers is entirely responsible for the different trend in the total number of employees.

Although labor unions have positive effects on productivity and wages at the firm level, the increase in part-time workers among non-unionized firms partly offsets the favorable effects on the macro-economy. Unfortunately, Japanese labor unions have not yet succeeded in realizing overall productivity growth through the involvement of the growing ranks of non-regular workers. In 2006, part-time workers comprised 18.2% of workers in the manufacturing sector, 69.9% in hotels and restaurants, and 63.5% in retail. As Japan makes its transformation to a service economy, firm-based labor unions are faced with the challenge of dealing with the issue of non-regular workers, since this issue is integral to managing both productivity growth and fair income distribution.

Table 7
Labor union and employment growth.

Variables	Unionized	Non-unionized	Differentials	*t*-value
Change in total employment	−2.1%	−0.8%	−1.3%	(−7.17)
Change in full-timers	−1.7%	−1.8%	0.1%	(0.19)
Change in part-timers	−0.3%	1.1%	−1.4%	(−1.69)

Note: The figures are expressed on an annual rate.

5. Conclusion

The relationship between labor unions and productivity growth has long been a topic of research in economics. Taking into account the recent changes in Japan's industrial structure—the trend toward a service economy—and labor market reforms, this paper empirically analyzes this issue by using a large firm-level data set that includes both manufacturing and non-manufacturing firms.

According to the view held by a majority in the U.S., although unions may enhance productivity, the magnitude of such enhancement is far smaller than their effects on wages. As a result, unions have a negative overall effect on firm profitability. However, in Japan, firm-based labor unions, which have been a distinct characteristic of the Japanese labor system, actively participated in the productivity movement during the high growth era and made efforts to enhance productivity in close cooperation with management. The system contributed to strengthening the international competitiveness of the manufacturing industries and to the growth of the Japanese economy. Today, with a dwindling population of working age, productivity growth, especially in the service industries, is a high priority on the country's policy agenda. The Service Productivity and Innovation for Growth initiative was established in 2007 to enhance the productivity of the service sector. Japanese labor unions are important members of this organization, which is expected to foster cooperative efforts between labor and management.

According to the analyses herein, the presence of labor unions has positive effects on firm-level productivity. The effect of union presence on wages is also positive, and the magnitude of such influence is slightly greater than that on productivity. The effect of union presence on firm profitability is mixed and inconclusive. These results are different from those of studies conducted in the U.S. The effects of labor unions may differ among countries, depending on their institutional settings. Under the long-term employment system, productivity growth through innovation and the corresponding wage growth have been beneficial for both firm-based labor unions and management. In my view, labor's and management's common identification with the principle that wages and productivity growth should keep pace with each other has played an important role in such growth.

However, the decline in the number of employees has been greater in the case of unionized firms than in that of non-unionized firms. Most of the difference in the employment trends is attributable to the change in the number of part-time workers. How to deal with non-regular workers poses a challenge for the future of Japanese firm-based labor unions.

Finally, in this study, there are various limitations related to the data and there are a number of future research possibilities. This paper uses information on the presence of firm-based labor unions in 1998 and subsequent firm performance, but does not explicitly deal with the possible endogeneity of labor unions. Although the analyses control for basic firm characteristics such as size, age, and industry, variables related to industrial relations are not available. In recent years, several studies have indicated that advanced human resources management (HRM) practices have had a positive impact on productivity (for example, Ichniowski and Shaw, 2003; Bloom and Van Reenen, 2007). Machin and Wood (2005) provide evidence that HRM practices and unions work complementarily in the UK. These studies suggest that the better productivity performance of firms with labor unions may reflect these firms' better HRM practices. In other words, the existence of labor unions may be working as a proxy for

better HRM practices. Another potential limitation of this study lies in the fact that the data do not contain enough information on the quality of workers, such as their education, age, and tenure. To conduct an analysis that explicitly considers worker characteristics, a matched employer–employee data set is essential.

Acknowledgements

The author would like to thank Masahisa Fujita, Kazuo Motoishi, Kotaro Tsuru and two anonymous reviewers for their helpful comments and suggestions.

Appendix A. Statistical appendix

Definitions of major variables.

Variables	Definition
Value-added (million yen)	Sum of the operating profits (total sales minus operating cost), rent, wage, depreciation and paid tax.
Total hours	Total hours are calculated as the sum of the number of full-time employees multiplied by their (industry-level) working hours and the number of part-time employees multiplied by their (industry-level) working hours. Data on industry level working hours for full-time and part-time employees are taken from the Monthly Labor Survey.
Labor productivity	Value-added (million yen) divided by the total hours.
TFP	TFP is calculated by using a hypothetical representative firm as a reference. Value-added, book value of tangible fixed assets, labor input, and the cost shares of capital and labor are used to calculate firm-level TFP. The input and output of a hypothetical representative firm are calculated as the geometric means of the input and output of all firms and the cost shares of labor and capital are calculated as arithmetic means. The TFP for each firm is calculated relative to the hypothetical representative firm. Deflators to make real values are taken from the National Accounts.
Total asset (million yen)	Sum of the book values of tangible fixed assets and intangible assets.
Capital intensity	Total asset divided by the number of total employees.
Profit rate on total asset	Current profit divided by total asset. Since the profit rate often takes a negative value, the profit rate is not expressed as a logarithm.
Wage per hour	Total wages divided by the total hours.
Ratio of part-time worker	The number of part-time employees divided by the number of total employees.

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