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Keywords: temporary workers, permanent workers, FDI, outsourcing, international trade.

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This version: February 2016

Abstract

Deregulation of the use of temporary workers in 2004 (the Worker Dispatching Act of 2004) has been regarded as an important reason for the recent rise of temporary workers in Japan. However, the shift from permanent to temporary workers began long before. This paper empirically explores links between the shift from permanent to temporary workers in the Japanese manufacturing sector and economic globalization, using industry-level data. We find that outsourcing is positively correlated with the replacement of permanent workers with temporary workers in domestic production. In addition, we find that industries losing world share of value added tend to decrease the employment of permanent workers. Industries with higher exports or imports are aggressive in using temporary workers, which suggests the role of temporary workers as an employment buffer.

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1 Introduction

In recent years, there has been a rapid increase in temporary workers in the Japanese manufacturing sector. According to the Census of Establishment and Firms, during 2001–2006, the total manufacturing workforce decreased by 0.6 million, with 1 million permanent workers lost and 0.4 million temporary positions created. About 40% of permanent work has been replaced with temporary work. This trend of substantial shifts from permanent workers to temporary workers has already resulted in a broad range of debates on employment stability, income inequality, and human capital accumulation in the Japanese political arena.[1]

It has been postulated that relaxing regulations on temporary workers is an important reason for the rise of temporary workers in Japan. For example, by allowing the manufacturing sector to use workers dispatched from private agencies, the Worker Dispatching Act, enacted in 2004, may be responsible for manufacturers' more aggressive use of temporary workers. Nevertheless, economic globalization such as trade and foreign direct investment (FDI) may also play a role in the rapid increase in temporary work by downplaying national borders and thereby encouraging firms to reconsider labor contracts with their employees. In particular, in countries with strong labor protections and rigid labor markets, such as European countries and Japan, firms have faced more pressure from substantial labor adjustment costs. As anecdotal evidence, a report published by Nippon Keidanren, Japan's largest lobbying group, composed of 1,281 companies and 129 industrial associations, claimed that labor market flexibility and more aggressive use of temporary workers were vital because of increasing market uncertainty and sales volatility caused by incrementally tougher global competition.[2]

It is important to examine the effects of trade and FDI on labor contracts, because firms' choice of labor contracts potentially influences the bargaining position of workers and human capital accumulation, yet the choice has rarely been investigated as a source of

[1] For example, an increase of temporary workers leads to a decline in future productivity due to the lack of job training within firms. It also may hinder skill formation for younger employees, leading to a concomitant difficulty in switching to permanent jobs when they are available. Jones (2007) argued that an increase in the proportion of the workforce in low-paying, non-permanent positions compared with permanent workers (labor-market dualism) was a main reason for recent increases in income inequality in Japan.

[2] The report (in Japanese) is available at http://www.keidanren.or.jp/japanese/policy/2004/041/index.html as of October 2015.

distributional effects of trade. This paper investigates whether trade and FDI encourage manufacturers to reduce permanent workers and use temporary workers more aggressively. We present two hypotheses to explain the shift from permanent to temporary workers in the face of global competition and test those using industry-level data. The first hypothesis is that when facing better opportunities for FDI or outsourcing, manufacturers prefer lower labor adjustment costs in domestic production. Temporary workers have much lower dismissal costs than permanent workers. Consequently, manufacturers increase the proportion of temporary workers among their labor input for expected labor adjustment cost savings. In a broad sense, domestic labor inputs become more substitutable with foreign labor inputs as a result of economic globalization. The second hypothesis is that it is more difficult for manufacturers to incentivize workers to accumulate firm-specific skills because the employment relationship may become fragile under tougher competition. The employment of permanent workers is more protected than that of temporary workers. Hence, permanent workers can be more easily motivated to accumulate firm-specific skills than can be temporary workers, resulting in relative efficiency superiority in permanent workers.[3] Because international trade provides a larger market and causes tough competition among firms, firms face higher probability of exiting the market. In addition, R&D activity encouraged by international flows of knowledge capital may accelerate the introduction and retirement of products. Firm-specific and product-specific skills become obsolete sooner in such situations. These factors may lower the efficiency advantage of permanent workers over temporary workers. As a result, firms come to use more temporary workers.

Our focus is consistent with some key characteristics of the Japanese labor market: flexible, highly organized internal labor markets and substantial competitive fringes with low pay and high turnover. While sustaining a flexible and highly organized labor market incurs higher search costs in finding suitable workers as well as higher costs for firing workers, competing on the fringe has much lower hiring and firing costs.[4] In addition, we match

[3]If temporary jobs are potential "stepping stones" to permanent employment, workers on temporary contracts might be motivated and provide high effort (Engellandt and Riphahn, 2005). However, Booth, Francesconi, and Frank (2002) empirically showed that even though there was some evidence that temporary jobs are stepping stones to permanent jobs, temporary workers still faced lower probabilities of receiving work-related training and tended to be poorly paid even after moving to permanent jobs (especially among male temporary workers). It is also difficult for temporary workers to convert their labor contracts to permanent ones in Japan (Shikata, 2012).

[4]In addition, temporary workers are usually unable to convert their employment contract to permanent

information about temporary jobs with many trade-related variables to capture several dimensions of global competition.

Using the Establishment and Enterprise Census, the Japan Industrial Productivity Database 2009 (JIP 2009), and UNIDO's Industrial Statistics Database (INDSTAT), we perform panel-data analyses and find evidence that economic globalization is associated with the shift from permanent to temporary workers. Our main findings are as follows. First, industries more reliant on outsourcing significantly tend to decrease the employment of permanent workers, thereby increasing the ratio of temporary workers. This industry-level finding is consistent with the firm-level finding by Tomiura, Ito, and Wakasugi (2011), who evaluated the firm-level impact of offshoring on employment flexibility (the percent of regular employment). Second, world share of value added as constructed from INDSTAT supports the second hypothesis, that industries losing world share tend to decrease the employment of permanent workers. Third, industries relying more on foreign sales via export or facing higher import penetration tend to increase the employment of temporary workers, which implies that firms tend to use temporary workers more as a buffer against output fluctuations in globally competitive environments.

[Related Literature] Our paper contributes to the literature of labor market flexibility. A permanent-to-temporary shift in the labor force is not a phenomenon exclusive to Japan. There is a rich body of literature that contributes to the study of temporary labor markets in Europe. Dolado, Garcia-Serrano, and Jimeno (2002) reviewed the Spanish experience of aggressively using temporary employment contracts since the mid-1980s.Blanchard and Landier (2002) found that temporary workers in France who stay in entry-level jobs longer were not likely to obtain permanent jobs. Holmlund and Storrie (2002) observed that adverse Swedish macroeconomic conditions in the 1990s made firms more prone to offer temporary jobs and workers more willing to accept such offers. More recently, Aguirregabiria and Alonso-Borrego (2008) examined the impact on productivity following Spain's elimination of dismissal costs for permanent contracts. A literature of temporary and permanent workers is growing in Japan. Morikawa (2010), Asano, Ito, and Kawaguchi (2011),

employment. Firms do not invest in training temporary workers. Furthermore, the wage level of temporary workers is almost 50% of that of permanent workers. As a result, firms can save (short-term) production costs and set labor inputs as variable costs.

and Matsuura, Sato, and Wakasugi (2011) argued that firm-level volatility also seemed to be an important determinant of the shift from permanent to temporary workers. Our paper first explores how economic globalization could affect firms' demand for temporary and permanent workers.

The relationship between trade and employment has been intensively examined in empirical trade research. For example, Slaughter (2001) found that trade-related variables had a mixed effect on increasing labor-demand elasticities. Tomiura (2003) found that import competition intensity reduced employment in recessionary periods when the yen appreciated. In addition, Tomiura (2004) showed that import competition also has a significant effect on job creation and loss through plant startups and shutdowns. Using the assumption that intense import competition causes firms and industries to switch away from implicit contracts, Bertrand (2004) found that the sensitivity of wages to the current unemployment rate should increase when import competition increases. There is a growing body of theoretical studies that consider labor market frictions in open economy settings. Helpman and Itskhoki (2010), Helpman, Itskhoki, and Redding (2010), and Cuñat and Melitz (2007) are recent such studies. Hummels, Jørgensen, Munch, and Xiang (2014) investigated the wage-effect of offshoring, using the Danish employer-employee matched data. However, none of these consider workers in terms of employment flexibility. Our paper considers the effects of globalization on the proportion of the two types of workers, permanent and temporary.

The rest of this paper is organized as follows. Section 2 proposes a simple theoretical framework to derive testable implications. Section 3 describes the matched dataset and summary statistics. Section 4 presents the results from an empirical analysis, and Section 5 concludes.

2 Theoretical Background

One important characteristic of permanent workers with open-ended contracts is that firms incur adjustment costs when those workers are dismissed. In contrast, it is much less costly for firms to terminate temporary workers' contracts. Many theoretical models of permanent and temporary workers focus on the difference in adjustment costs. Examples of earlier contributions are Bentolila and Bertola (1990), Bentolila and Saint-Paul (1992), and

Bentolila and Saint-Paul (1994). This section presents a standard model of permanent and temporary workers, closely following Saint-Paul (1997). Although it is a partial equilibrium analysis and highly stylized, the model reveals what motivates firms to use temporary workers. The model is helpful to consider how economic globalization may influence firms' demands for permanent and temporary workers.

2.1 Simple Model of Permanent and Temporary Workers

Because the model is standard, we only briefly describe its setup and results. Assume that identical firms maximize their expected discounted value of profits. In each period, firms obtain $zf(n)$ of revenue, where z is an independent and identically distributed shock following the cumulative distribution function $G(z)$, and n is the effective unit of the labor input. The function $f(\cdot)$ satisfies $f' > 0$ and $f'' < 0$, implicitly assuming the existence of another fixed production input and simply ignoring it.

There are two types of labor contracts: open-ended and fixed-term contracts. Firms incur a firing cost γ per worker when they dismiss workers with open-ended contracts (permanent workers). No such cost is incurred when dismissing workers with fixed-term contracts (temporary workers). However, using temporary labor contracts is disadvantageous in terms of labor productivity because both firms and workers tend to underinvest in firm-specific skills due to relatively high job turnover. To model this productivity difference in a simple manner, it is assumed that permanent workers are more efficient than temporary workers and the effective unit of labor is $\lambda > 1$ for permanent workers.[5] To highlight the trade-off between the adjustment cost and labor productivity, we assume that both types of workers are perfectly substitutable in production and that total effective labor units is given by $n = \lambda l + s$, where l denotes the employment of permanent workers and s the employment of temporary workers.

At the end of each time period, a firm observes an idiosyncratic shock to the revenue for the next period. After observing this shock, the firm determines the employment size for maximizing the expected discounted value of the firm's profit. This problem is expressed

[5]Employing permanent workers is less volatile than employing temporary workers. Hence, permanent workers may be encouraged to accumulate firm-specific skills more than temporary workers would be, resulting in an efficiency difference between the two types of workers.

in a recursive manner such that

$$V(l_t, z_{t+1}) = \max_{l_{t+1}, s_{t+1}} z_{t+1} f(\lambda l_{t+1} + s_{t+1}) - w_l l_{t+1} \\ - w_l \gamma \max\{l_t - l_{t+1}, 0\} - w_s s_{t+1} + \beta E_t V(l_{t+1}, z_{t+2}), \tag{1}$$

where β denotes the discount factor and w_l and w_s are wage rates for permanent and temporary workers, respectively. After observing z_{t+1} at the end of t, the firms determines both l_{t+1} and s_{t+1}. The third term suggests that if $l_{t+1} < l_t$, the firm will incur the firing cost. We assume that these wage rates are constant over the time horizon. Since firms must incur a firing cost when dismissing permanent workers, having the effective wage rate of permanent workers lower than the wage rate of temporary workers is necessary for the coexistence of both types. We thus impose the assumption $\lambda w_s > w_l$.

While it is difficult to analytically determine a value function, it is straightforward to describe firms' employment policies. First, observe that when the firm employs both permanent and temporary workers, the marginal cost for hiring permanent workers is equalized to the marginal cost for hiring temporary workers. The marginal cost of temporary workers is simply the wage rate w_s. The marginal cost of permanent workers includes the expected value of the firing cost. Denoting the expected firing cost as $\beta h(l_{t+1})$, the condition for employing both types of workers simultaneously is given by

$$\frac{w_l + \beta h(l_{t+1})}{\lambda} = w_s, \tag{2}$$

which implies that the employment of permanent workers is time invariant as long as the firm employs both permanent and temporary workers. It is known that the expected firing cost $\beta h(l)$ is increasing in l, the employment level of permanent workers (for the derivation of $h(l)$; see the Appendix). Intuitively, as the employment of permanent workers increases, it is more likely for the firm to dismiss permanent workers when facing a negative shock to z.

Total employment is determined by profit maximization. The marginal revenue from increasing temporary workers must be equal to the wage rate of temporary workers as long as the firm employs both permanent and temporary workers. Namely,

$$z f'(n_{t+1}) = w_s. \tag{3}$$

The intuition of equations (2) and (3) is illustrated in Figure 1. In the figure, the marginal cost of temporary workers is a horizontal line at w_s, while the marginal cost of permanent workers, $(w_l + \beta h(l))/\lambda$, is an upward-sloping schedule. Equation (2) is represented at point A, which shows the upper boundary of permanent workers, $\bar{l}$. The figure depicts three different shocks $z_1 > z_2 > z_3$. If z_1 is realized, then the total employment level is determined at the intersection of the marginal revenue schedule $z_1 f'(n)$ and the marginal cost line w_s (point C). Notice that the firm does not change the employment level of permanent workers as long as the realized z is greater than z_3; the firm responds to all fluctuations above z_3 by changing the level of temporary workers. This prediction captures one important characteristic of temporary workers: they function as a buffer against output fluctuations. This implies that the ratio of temporary to permanent workers is positively correlated with firm output.

In addition to occasional output fluctuations, the ratio of temporary to permanent workers may change for several structural reasons. First, as the relative productivity of permanent workers increases ($\lambda \uparrow$), the marginal cost of permanent workers declines (a downward shift of $(w_l + \beta h(l))/\lambda$). Thus, the upper boundary of permanent workers $\bar{l}$ rises, which decreases the ratio of temporary to permanent workers. Second, decreases in the firing cost γ lower the expected firing cost $\beta h(l)$, which also yields a downward shift of $(w_l + \beta h(l))/\lambda$. As a result, the temporary ratio declines. Third, it is known that as firms' revenues become more volatile, the expected firing cost tends to increase (Saint-Paul, 1997). Consequently, the ratio of temporary workers tends to increase.

Figure 1 also shows that the introduction of temporary workers leads to firms' cost reduction. For example, suppose that temporary labor contracts are unavailable due to legal restrictions. Then, the firm's employment choice is point D rather than point C when the realized shock is z_1. One can see immediately that the marginal cost that the firm faces goes down to w_s. Thus, firms can reduce unit production costs by using temporary contracts.

2.2 Impact of Globalization

The discussion so far has highlighted the roles played by the expected firing cost and the relative productivity of permanent workers. Based on these insights, we conjecture the

following two channels through which economic globalization may influence employment of permanent and temporary workers.

FDI and outsourcing: Consider a firm that can choose a production location from either the home country or a foreign country. It is assumed that setting up a plant in a foreign country is more costly than in the home country (Helpman, Melitz, and Yeaple, 2004). In this framework, domestic labor is imperfectly substitutable by foreign labor. Suppose that the FDI setup cost decreases. FDI will thereby become easier, and a small positive shock to z will be sufficient for switching the production location from the home country to the foreign country.[6] In such a situation, the expected firing cost will increase for firms currently engaged in local production (when switching production locations, firms must lay off domestic workers). As a result, firms increase the ratio of temporary to permanent workers in domestic production. The same logic works for outsourcing to foreign firms.

Product market competition: In the model, it is assumed that permanent workers are more productive than temporary workers, characterized by λ. This assumption is plausible because firms can use job security as a device to raise worker efficiency. The source of the efficiency increase is attributable either to relation-specific investment or to reduction of information asymmetry between an employer and workers (e.g., the efficiency wage discussion). In either case, the durability of the relationship between the firm and workers is crucial. It is likely that economic globalization intensifies product market competition, which makes the relationship between the firm and workers less durable. For example, R&D activity encouraged by international flows of knowledge capital accelerates the introduction of new products (Grossman and Helpman, 1991). In such a case, it becomes difficult for firms to incentivize workers to maintain the level of λ by offering job security. This means a decline of λ, resulting in decreases in the demand for permanent workers.

A key intuition of the model is that when the likelihood of labor adjustment and its size increase, the expected firing cost of permanent workers will increase, leading to the re-

[6] One may consider a firm's investment decision in which, when facing uncertainty regarding future demand or productivity, the firm chooses an appropriate timing for opening a new factory abroad. The firm starts the foreign factory only when it receives demand (or productivity) shocks above a certain level. Decreases in sunk entry costs lower the threshold shock level, thereby increasing the probability of FDI. See Dixit and Pindyck (1994) for detailed discussions.

placement of permanent workers with temporary workers. Furthermore, higher likelihood of layoffs may discourage permanent workers from accumulating firm-specific skills, thus lowering the productivity advantage over temporary workers.[7] Both channels of globalization are plausible, and we test the empirical validity of these channels in the following.

3 Empirical Strategy and Data

3.1 Workers and Indicators of Globalization

We perform industry-level panel regressions to examine the impact of globalization on temporary workers as it affects the total labor input over time within an industry. Based on the theoretical framework discussed in the previous section, we focus on whether economic globalization is attributable to increases in the relative demand for temporary workers over permanent workers. It is ideal to develop a well-specified model in which firms engaging in international activities such as trade and FDI endogenously determine their demands for temporary and permanent workers and to estimate structural equations. However, there are several channels through which economic globalization influences firms' relative demand for temporary workers. Although we suggested two possible channels in the previous section, we are not certain which channel better describes the recent increase of temporary workers among Japanese manufacturers. Thus, we estimate reduced-form equations of the ratio of temporary workers to total labor inputs on various indices of globalization, controlling for the effects of other potential causes. We estimate the reduced-form regression

$$RTW_{it} = \mathbf{X}'_{git}\boldsymbol{\beta}_g + \mathbf{X}'_{it}\boldsymbol{\beta} + d_i + d_t + u_{it}, \tag{4}$$

where RTW_{it} is the ratio of temporary workers to permanent workers in industry i at time t, $\mathbf{X}_{git}$ is a set of explanatory variables to measure globalization, $\mathbf{X}_{it}$ is a set of control variables including technological changes, and d_i and d_t represent industry and time-fixed effects, respectively. The industry dummy variables absorb all unobservable industry-specific effects. For example, some industries may intrinsically have high demand for temporary workers depending on the variability of their business. The year dummies absorb all time effects

[7] It is also possible that permanent workers are willing to accumulate firm-specific skills in an attempt at lowering the probability of layoffs. Thus, the effect of the possibility of layoffs on permanent workers' incentive to invest in firm-specific skills is an empirical question.

common across industries. In particular, we expect that the year dummies appropriately deal with the effect of the Worker Dispatching Act in 2004. As already mentioned in the Introduction, private temporary job agencies in Japan have been allowed to dispatch workers to manufacturers since 2004. Indeed, a large number of private temporary job agencies has emerged, and the number of dispatched workers in the manufacturing sector has grown since this change. We control for the impact of this policy change by year dummies. In addition, as Wasmer (1999) suggests, business cycles could influence the demand for permanent and temporary workers. The year dummies also absorb all such macroeconomic effects.[8]

In addition to the ratio of temporary workers to total workers, it is important to examine changes in the number of permanent and temporary workers. The theory in the previous section suggests that globalization is likely to affect the relative demand for temporary to permanent workers by lowering the upper boundary of permanent workers. Hence, we estimate equation (4) by replacing the dependent variable with the number of permanent and temporary workers as

$$PW_{it} = \mathbf{X}_{git}^{'}\boldsymbol{\beta}_{Pg} + \mathbf{X}_{it}^{'}\boldsymbol{\beta}_{P} + d_i + d_t + u_{it}, \tag{5}$$

$$TW_{it} = \mathbf{X}_{git}^{'}\boldsymbol{\beta}_{Tg} + \mathbf{X}_{it}^{'}\boldsymbol{\beta}_{T} + d_i + d_t + u_{it}, \tag{6}$$

where PW_{it} and TW_{it} are (the log of) the number of permanent and temporary workers in industry i at time t. We expect that the effects of globalization should be found mainly in $\boldsymbol{\beta}_{Pg}$. By contrast, the effect of output should tend to be found in $\boldsymbol{\beta}_{T}$ if the employment of temporary workers works as a buffer agains output fluctuations.

Because there is no single publicly available dataset containing information about both industry activities and the Japanese labor market, we collect our data from different sources. For information about permanent and temporary workers, we use the Establishment and Enterprise Census. Covering all sites and firms, the census provides detailed workforce information according to the three-digit Japanese Industrial Classification. The data are

[8]Another macroeconomic effect in the Japanese labor markets is increases in social insurance taxes (e.g., unemployment insurance, pension fund, and health insurance). Japanese firms are obliged to incur these taxes partially for the employment of permanent workers, but can evade such burden for temporary workers when certain labor conditions are satisfied. Thus, when the government increases social insurance taxes, the relative labor cost of permanent to temporary workers would increase, which leading to a higher temporary ratio. Such government policy changes are in general uniform across sectors. Thus, the year dummy also appropriately absorbs this effect.

available for four years (1999, 2001, 2004, and 2006).[9] We focus on the manufacturing sector because our primary interest is in the impact of economic globalization on the shift from permanent to temporary employment. One appealing characteristic of the Establishment and Enterprise Census is the comprehensive coverage of firms and detailed classifications of the workforce. The census reports the total number of workers, the number of employees, the number of permanent employees, the number of temporary employees, and the number of workers dispatched from temporary employment agencies. We define total labor input as the sum of permanent employees, temporary employees, and workers dispatched from temporary employment agencies. We also define the number of temporary workers as the sum of temporary employees and workers dispatched from temporary employment agencies. The share of temporary workers among total labor input is calculated for each manufacturing industry.

We construct explanatory variables using the Japan Industrial Productivity Database 2009 (JIP 2009) and the UNIDO's Industrial Statistics Database (INDSTAT). The JIP 2009 database contains annual data on 108 sectors covering the entire Japanese economy from 1970 to 2006, counting 52 manufacturing sectors. The INDSTAT provides production-related data such as labor input and value added according to the three-digit ISIC Revision 3 classification. We use value added for OECD countries in the INDSTAT. Based on these two databases, we construct FDI/outsourcing, product market competition, and technology-related indicators for each manufacturing industry. We start with indicators related to globalization:

- Foreign-affiliate labor: The size of employment at foreign affiliates comes from JIP 2009 and attempts to measure the likelihood of FDI expansion. Based on our hypothesis on FDI in the previous section, we expect that industries more relying on foreign workers through FDI tend to exhibit high temporary worker ratios at home.

- Share of imported intermediate goods: This index attempts to capture the extent to which each industry relies on imported intermediate inputs as a proxy index of outsourcing. We construct this index using the input-output table and import data

[9]The Japanese government began the Economic Census, a new comprehensive census, in 2010 as a replacement for the Establishment and Enterprise Census. The latest data from the Establishment and Enterprise Census is for 2006.

in JIP 2009. Based on our hypothesis on outsourcing, we expect that the sign of the coefficient is positive in the ratio of temporary workers and negative in the employment of permanent workers.

- World share of value added: the Japanese share of value added among OECD countries. We compute this measure from the INDSTAT.[10] This is a measure of how competitive international product markets are. We interpret a decline in the share of value added as a sign of intensified global competition and expect a negative sign in the estimation of the ratio of temporary workers and a positive sign in the employment of permanent workers.

- Export share: The ratio of exports to output calculated from JIP 2009. This is a measure of the extent to which each industry relies on the world market for sales. Assuming that the world market is more competitive than the Japanese domestic market, we expect that the coefficient is positive in the ratio of temporary workers and negative in the employment of permanent workers.

- Import share (import penetration): The ratio of imports to domestic absorption calculated from JIP 2009. This is an alternative measure of globalization and competitiveness in the world market. We expect the same sign direction as for export share.

It should be noted that the above regressors (except for the share of value added) are endogenously determined in a fully specified model and tend to suffer from reverse causality. For example, firms can increase foreign-affiliate workers or export simply by reducing permanent workers and increasing temporary workers. Although we admit that it is difficult to control for such endogeneity (or reverse causality) using our dataset, we will use regressors lagged one year instead of contemporaneous regressors and attempt two-stage least squares (2SLS) when applicable.

The following indicators are employed in order to control possible influences on the temporary worker ratio other than economic globalization. They include industry real output,

[10]The INDSTAT reports value added in current U.S. dollars. Two sets of the world share of value added are prepared. One is simply computed from the original data. For the other, we convert the unit of values form current U.S. dollars to PPP-based U.S. dollars. PPP-based U.S. dollars are taken from the Penn World Table 6.3. Both measures show similar results in our estimation, so we report the results of the PPP-based world share of valued added.

the capital-labor ratio, and variables representing technological changes. All indicators are calculated from JIP 2009.

- Real output: Based on the model discussed in the previous section, fluctuations in real output are mostly absorbed by the employment of temporary workers. Hence, we expect that the coefficient of real output shows a positive sign in the regression of the ratio and number of temporary workers, while showing statistical insignificance in the permanent employment regression.

- Capital intensity (K/L): This may affect the demand for temporary workers in the following ways: Saving labor adjustment costs may be less important in high-capital-intensity industries than low-capital-intensity industries. Alternatively, firm-specific skills may be more important in industries with high capital intensity, and such industries may hold high upper boundaries of permanent employees, showing low ratios of temporary workers. We expect that the coefficient is negative in the temporary-ratio regression and positive in the permanent-employment regression.

- Total-factor-productivity (TFP): This index measures changes in productivity. It is a priori uncertain how TFP would affect the relative employment of temporary to permanent workers. On the one hand, if it captures Hicks-neutral technological change, it is highly likely that this index is neutral in the ratio of temporary workers. Conditioning upon real output, this index will be insignificant in both temporary and permanent employment regressions. On the other hand, production labor may become more substitutable by new technology, which in turn may raise the expected labor adjustment costs. As a result, the ratio of temporary workers may rise and the employment of permanent workers may decrease.

- Information technology (IT): The recent literature on "job polarization" emphasizes that the rapid development of IT (computerization) has encouraged replacing labor for routine tasks, decreasing the demand for middle-skilled jobs relative to high-skilled and low-skilled jobs (Autor, Levy, and Murnane, 2003).[11] Firms are likely to use

[11] Goos, Manning, and Salomons (2014) and Goos and Manning (2007) study the effect of computerization and outsourcing on job polarization.

temporary labor contracts or dispatched workers for routine jobs, resulting in increases in demand for temporary workers. We use the ratio of computers and other IT-related equipment to total labor input (IT-capital intensity) as a proxy of the prevalence of IT. The share in total capital stock of computers and other IT-related equipment will be used as an alternative measure.

- Demographic changes: It is well known that elderly workers and female workers tend to have temporary labor contracts. Thus, increases in elderly workers or female workers can raise the ratio of temporary workers. To control for these effects, we include the ratio of workers aged 55 or over and the ratio of female workers.

To match the data from the Establishment and Enterprise Census with those constructed from JIP 2009 and UNIDO's INDSTAT, we use the industrial classification of JIP 2009 to the greatest extent possible. Although we have to merge some industries, we can construct a balanced longitudinal dataset of 45 manufacturing industries between 1996 and 2006, where the labor data with labor classifications are limited to four periods (1999, 2001, 2004, and 2006).

3.2 Temporary Workers in Japan

Before proceeding to estimation, it is useful to observe the data of temporary and permanent workers. Table 1 presents the ratio of temporary workers to total workers across 45 manufacturing sectors in Japan. The first two columns, the ratios of temporary workers in 1999 and 2006, show that shifts from permanent to temporary workers occurred in almost all manufacturing sectors. The top five sectors with high ratios of temporary workers in 2006 are Other Processed Food (4), Fish Products (2), Meat Products (1), Glass Products (23), and Plastic Products (44). Leather Products (14) and Beverages (6) also have high ratios of temporary workers. The ratio in Other Processed Food reaches approximately 60%. However, these sectors tend to have high temporary worker ratios as of 1999, and the shifts from permanent to temporary workers were not so striking.

More dramatic shifts from permanent to temporary workers can be found in Motor Vehicles (41) and Chemical Fibers and Textiles (18). The third column presents the average annual growth rate of the ratio of temporary workers during 1999–2006. Motor Vehicle

records a more than 10% annual growth rate, and Chemical Fibers and Textiles follow at about 9%. The fourth column presents annual growth rates of the ratio of temporary workers during 2004–06. In most industries, the average growth rates per annum of this period fall bellow those in the full sample period, which implies that the effect of the Worker Dispatching Act in 2004 may be limited.

The Establishment and Enterprise Census allows including information about the number of permanent and temporary workers by enterprise size measured as the number of employees. Although we are unable to use these data for estimation because of inaccessibility to matched firm-activity data, observing which firms change the relative demand for temporary workers is helpful to interpret estimation results. Figure 2 presents changes in the ratio of temporary workers between 1999 and 2006 by establishment size. The figure shows that (i) as of 1999, the ratio of temporary workers tended to be lower as the size of establishment increases, (ii) the shift from permanent to temporary workers mainly occurred in relatively larger establishments, and (iii) as a result, the variety of the ratios of temporary workers across establishments substantially decreased. The recent literature of heterogeneous trade firms has empirically revealed that only sufficiently productive firms can cover fixed entry costs and will be internationalized through trade and FDI.[12] Because the size of enterprises is in general positively correlated to their productivity, the figure suggests that temporary workers dramatically increased among enterprises that are likely to be engaged in international activities such as trade and FDI.

Summary statistics on the explanatory variables mentioned above are reported in Table 2. Because some measures including the world share of value added are limited to the nine years between 1997 and 2005, we take the same period for other measures. It should be noted that JIP 2009 does not report FDI-related data for three industries—Fish Products (2), Grain Mill Products (3), and Other Processed Food (4)—due to the number of firms being too small. In addition, Tobacco (7) has no foreign affiliates in the sample period. As for the world share of value added, we find that the Japanese share is incredibly high (more than 80%) in Coal Products (22), which is simply because some countries' data are not

[12]These studies include Bernard, Eaton, Jensen, and Kortum (2003) for the United States, Tomiura (2007) for Japan, Mayer and Ottaviano (2007) for various EU countries, and Kasahara and Lapham (2013) for some developing countries.

reported in the INDSTAT. We therefore drop the coal product industry from our sample, leaving 40 industries for most regressions.

Table 2 confirms that Japanese manufacturers have reduced the employment of permanent workers (defined as full-time workers) and increased temporary workers during the sample period. In particular, among temporary workers, they have substantially increased the use of dispatched workers. As for globalization-related variables, the number of foreign-affiliate workers has slightly increased, while the share of imported input (a proxy for foreign outsourcing) increased more distinctively from about 6.1% to 8.6%. The world share of value added also has decreased by 0.7 percentage points during the sample period. The export share, signifying commitment to competing in the world market, has increased from 13.7% to 17.6%, while the import share, a proxy variable for the degree of domestic competition with foreign products, has increased from 10% to 14.4%.

We now turn to the variables representing industrial characteristics and technological changes. TFP has slightly improved during the sample period. While Japanese manufacturers have increased their capital stock by about 44% during the sample period, they have increased the IT-related capital stock more aggressively, resulting in an increase in the share of IT-related capital in total capital by 2 percentage points. The share of elderly workers has increased by 5%, but that of female workers has declined during the sample period.

4 Estimation Results

4.1 Impact on Temporary Ratio

The estimation results on the ratio of temporary workers to total labor input are reported in Table 3. While column (1) excludes explanatory variables related to technological changes, the results are almost same as those in the full specification reported in column (2). The coefficients of year dummies and fixed effects by industry are suppressed for brevity.[13]

The effect of outsourcing measured by the share of imported intermediate goods is positive and significant. Because the ratios of temporary workers and imported intermediates are expressed as percentages, a parameter estimate of 0.44 implies that a 10% increase in the

[13]The year dummies which we expect to capture the impact of the policy change in 2004 are positive and significant. In particular, the magnitude of year dummies for 2004 and 2006 is much greater than that of the year dummy for 2001, which would imply that the year dummies appropriately pick up the impact of the policy change in 2004.

share of imported intermediates will raise the ratio of temporary workers by 4.4 percentage points. In contrast, the coefficient of foreign-affiliate labor is not statistically significant in both specifications. These results support our hypothesis on outsourcing but not on FDI; while industries with more outsourcing tend to increase the relative use of temporary workers, industries relying more on foreign-affiliate labor do not affect the domestic share of temporary workers.

As is expected, the impact of increases in world share of value added is negative and statistically significant at the 1% level (column (1)), implying that the share of temporary workers increases when industries experience some loss of world share of value added. When estimated with explanatory variables on technology, world share of value added is still significant at the 5% level without altering the sign and size of the coefficient. Furthermore, in both specifications, we obtain positive and statistically significant coefficients for export share. Industries with larger increases in export tend to increase the ratio of temporary workers in total labor input.

Import share shows a negative significant sign in this specification, which implies that industries with larger increases in import penetration tend to decrease the share of temporary workers in total labor input. If the import share used here correctly captures the degree of competition pressure from abroad, this result seems to contradict our hypothesis.

With respect to industry characteristics, real output is significant at the 1% level with the correct sign. The parameter estimate of 0.06 implies that a 10% increase in real output will raise the share of temporary workers by 0.6 percentage points. This estimate is consistent with the theoretical model. Capital intensity is also statistically significant and shows a negative sign, which is reasonable. However, the effect is almost negligible.

Technology-related variables such as the log of TFP and IT-capital intensity in general do not have significant explanatory power for the ratio of temporary workers.[14] This result—the ineffectiveness of IT on the ratio of temporary workers—appears inconsistent with the main idea in the literature of "job polarization," because we expect that the job routinization caused by IT will increase the demand for temporary workers.

Overall, the estimation results indicate correlation between relative increases in the

[14]Replacing IT-capital intensity with IT-capital share does not alter the estimation results.

employment of temporary workers and some globalization indices in the Japanese manufacturing sector. In contrast, technological change in the IT field appears to be irrelevant to the recent shift from permanent to temporary workers.

4.2 Impact of the Employment of Permanent and Temporary Workers

The previous section revealed that the relative demand for temporary workers was correlated to some globalization indices. To examine further how globalization would change the demand for temporary and permanent workers, we perform regressions of the globalization indices on the log of the employment of permanent and temporary workers, controlling for real output, capital intensity, and technology-related variables.

Table 4 presents estimates of equations (5) and (6). We find that the estimation results largely support the predictions of the theoretical model in Section 2. First, the coefficient of the share of imported input is negative and significant at the 1% level with respect to permanent workers. The dependent variable is expressed in logarithm and the share of imported input is a percentage. Hence, an estimate of -2.5 implies that as the share of imported input increases by 10 percentage points, the employment of permanent workers on average will decrease by 0.25%. The world share of value added is also significant and shows the predicted sign with respect to permanent workers. The coefficient of 1.9 is slightly smaller than the share of imported input.

These results imply that the direction of causality is likely to be as expected from the model's predictions. Suppose that firms decrease domestic employment to use imported intermediates more aggressively. However, this mechanism hardly explains the reason why firms decrease *only* permanent workers, in spite of their adjustment costs. It is natural to interpret this estimation result as meaning that increasing opportunities for using imported intermediates raises the expected adjustment cost of permanent workers, so firms reduce their employment of permanent workers. The interpretation of the results for world share of value added is more straightforward. It is unlikely that firms decrease their permanent workers, giving rise to decreases in their world share of value added in that industry. Consequently, we confirm two convincing channels of globalization—outsourcing and world market competition—that reduce firms' demand for permanent workers.

In contrast, export share and import share are insignificant for permanent workers. The

coefficient of export share is positive in the employment of temporary workers. If export share properly represents the fierceness of world market competition, our theory suggests lower demand for permanent workers. Thus, we should interpret this result as meaning that firms respond to fluctuations in foreign demand by adjusting the employment of temporary workers. The coefficient of import share is negative and significant only for temporary workers. Probably, we should interpret this result in the same way as export share: when import share (i.e., import penetration to domestic markets) is high, firms adjust their output decreases by reducing their employment of temporary workers. Thus, we conclude that export share and import share do not capture the effect of globalization on the relative demand of permanent to temporary workers.

Other explanatory variables largely confirm the validity of the regressions. The coefficient of the log of real output is positive and significant only for temporary workers, consistent with the theory. The coefficient of TFP is insignificant for both permanent and temporary workers, which suggests that there is no room for TFP to influence the employment of permanent and temporary workers after controlling for output.[15] Capital intensity affects only permanent workers, but is almost negligible in magnitude. IT-capital intensity is insignificant for both permanent and temporary workers, which clearly denies the effect of the prevalence of IT-technology.[16] Increases in the ratio of female workers raises the employment of temporary workers. This result is also consistent with the fact that the share of temporary workers is higher among female workers than male workers.

The demand for dispatched workers—one category of temporary workers—was directly influenced by the policy change in 2004. We control for the impact of the policy change in 2004 by year dummies. Thus, if the impact of globalization on the employment of dispatched workers can be observed similarly to temporary workers, it will be strong evidence for the impact of globalization on the demand for temporary workers. We replace temporary workers with dispatched workers in column (3). The results are similar to those reported in column (2), except for the fact that world share of value added is significantly negative in estimating the employment of dispatched workers and import share becomes insignificant.

[15]However, as Table 2 shows, TFP has hardly changed during the sample period. We note that this particular trend of TFP might contribute to generating these insignificant results.

[16]Using IT-capital share in total capital stock instead of IT-capital intensity does not change the results at all, and we thereby do not report this in detail.

Overall, the policy change in 2004 directly influenced manufacturers' demand for dispatched workers. Nevertheless, we find evidence that some globalization indicators still hold explanatory power. Therefore, we conclude that economic globalization decreases the demand for permanent workers, holding other factors constant. Employing industry-level datasets, we find that more outsourcing (proxied by increases in the share of imported inputs) tends to decreases the employment of permanent workers. Using Japanese firm-level panel data, Tomiura, Ito, and Wakasugi (2011) also found that that offshoring firms depend significantly less on regular full-time workers, which is consistent with our findings. In addition, we find that in industries where world value added share declines, firms tend to reduce the employment of permanent workers. This is another globalization conduit that we identified. Furthermore, we show that firms are encouraged to hire more temporary workers when their sales increasingly rely on foreign markets (increases in export share), or when their market positions deteriorate (decreases in world share in valued added). These results confirm that firms use more temporary workers as a buffer against output fluctuations from globalized market competition.

4.3 Robustness Checks

In the previous section, we found that in industries with a higher share of imported inputs, firms tend to reduce the employment of permanent workers. Our theory suggests that more outsourcing decreases the relative demand for permanent workers to temporary workers. Although our findings are based on panel regressions with fixed effects, they may still be insufficient to establish causality between outsourcing and the domestic non-regularization of employment. This section performs two-stage least squares (2SLS) to verify our findings about outsourcing.

We use the event of the Chinese accession to the WTO in 2001 as a natural experimental event. As we will verify, this event is highly likely to affect Japanese firms' outsourcing activity, but not directly influence firms' decisions on the relative demand for permanent workers. More concretely, we make an instrumental variable by multiplying the share of trade (export plus import) with China in total trade with a time dummy that takes 0 before year 2001 but 1 afterwards.

The results are reported in Table 5. To appropriately specify the first-stage regression,

we dropped export share and import share, which were insignificant in the fixed-effect regressions in Table 4. The share of imported inputs remains statistically significant in all specifications (columns (1), (2), and (3)). The first-stage F-values prove that the first stage is appropriately specified. The coefficient of the share of imported input increases in 2SLS, compared to that in the OLS with fixed effects, which suggests that the simultaneity of the employment of permanent workers and outsourcing is likely to underestimate the impact of outsourcing on the employment of permanent workers. Interestingly, the log of foreign-affiliate labor (column (3)) is significantly negative, which supports our first hypothesis.

5 Conclusions

This paper attempted to test if economic globalization such as FDI, outsourcing, and exports raises firms' demand for temporary workers relative to permanent workers. For this purpose, we constructed an industry-level panel dataset, matching employment statistics from the Establishments and Enterprise Census with production and trade related data from JIP 2009 and UNIDO's INDSTAT.

Before estimation, we considered potential channels through which economic globalization may change the demand structure for permanent and temporary workers by employing a standard model of temporary and permanent workers. We identified two possible channels, FDI or outsourcing and product competition in the world market. In particular, the theoretical model emphasized that (i) a firm sets an upper boundary for the employment of permanent workers and uses temporary workers to fill the gap between its actual labor demand and the upper boundary of permanent workers, and that (ii) economic globalization structurally lowers the firm's upper boundary for permanent workers.

Various indicators capturing the impact of the two globalization channels were constructed along with indicators for controlling for industry characteristics. However, the model's predictions guided us to identify the globalization channels; globalization indicators that affect the employment of permanent workers are likely to prove to be correct channels, while globalization indicators that affect the employment of temporary workers are likely to merely reflect firms' response to output fluctuations coming from international markets.

Our main findings are as follows: First, increases in outsourcing raise the ratio of temporary workers to total labor input by decreasing the employment of permanent workers. Second, the world share of value added showed the correct sign; industries tend to decrease the relative demand for permanent workers when losing competitive positions in the world market. Probably, in such industries, firms consider the probability that employment reduction becomes higher, which raises the expected firing costs. Third, when firms come to rely on foreign sales or face higher import penetration in their markets, they increase the demand for temporary workers without altering the employment of permanent workers. These effects are captured by increases in export share and import share. In sum, we conclude that the first two channels of globalization, outsourcing and world market competition, may explain the structural demand shift toward temporary workers in Japanese manufacturers.

Although the estimation presented several plausible results, it also contains several qualifications. First, the current empirical analysis is confined to industry-level data, although we reinforced our globalization hypothesis by presenting the fact that the recent employment shift to temporary workers has mainly occurred among large establishments. However, using firm- or establishment-level data with location information can definitely enrich our study in terms of more precisely identifying globalization channels. An extension of the analysis along these lines is promising. Second, though related to the first, increasing sample size is evidently desirable. For example, we could not find the effect of FDI, while the effect of outsourcing on permanent workers is found to be robust. This is a puzzling result. Larger datasets might help to solve this puzzle. These issues are left for future research.

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Table 1: Ratio of Temporary Workers in 1999 and 2006 and its Growth Rates

Code	Industry	Ratio of Temporary Workers		Annual Growth Rate	
		1999	2006	1999–2006	2004–2006
1	Meat products	0.44	0.50	1.6	−1.3
2	Fish products	0.50	0.54	0.9	−0.9
3	Grain mill products	0.25	0.32	3.4	3.7
4	Other processed food	0.51	0.58	1.8	0.1
5	Prepared animal feeds	0.24	0.31	3.8	6.3
6	Beverages	0.30	0.36	2.4	−1.7
7	Tobacco	0.06	0.09	6.2	30.2
8	Textiles and fabrics	0.30	0.32	1.0	−1.3
9	Wood products	0.17	0.23	3.9	0.6
10	Furniture	0.17	0.25	5.1	3.4
11	Pulp, paper, and paperboard	0.11	0.15	4.0	−1.9
12	Other paper products	0.25	0.30	2.8	−0.4
13	Printing	0.18	0.22	2.4	−1.8
14	Leather products	0.37	0.37	0.2	−2.8
15	Rubber products	0.23	0.33	5.4	3.6
16	Fertilizer	0.13	0.18	4.7	5.2
17	Chemical products	0.13	0.17	4.5	9.9
18	Chemical fiber and textiles	0.13	0.24	9.1	11.3
19	Other chemical products	0.21	0.29	4.5	0.7
20	Pharmaceutical	0.13	0.21	7.1	4.1
21	Refined petroleum products	0.08	0.12	6.4	3.2
22	Coal products	0.16	0.19	2.3	1.7
23	Glass products	0.26	0.38	5.6	4.9
24	Cement and concrete	0.15	0.22	4.8	5.9
25	Ceramics	0.21	0.29	5.0	2.6
26	Other ceramic products	0.15	0.22	5.9	4.8
27	Pig iron and steel	0.13	0.13	−0.6	13.5
28	Other iron and steel products	0.12	0.20	7.4	0.8
29	Non-ferrous metal refining	0.18	0.23	2.9	2.6
30	Non-ferrous metal	0.17	0.24	5.0	1.2
31	Architectural metal products	0.20	0.25	3.6	2.9
32	Other metal products	0.22	0.28	3.3	1.0
33	General industrial machinery	0.14	0.22	6.9	7.5
34	Office machinery	0.26	0.30	2.2	−7.2
35	Heavy electrical machinery	0.20	0.31	6.1	7.8
36	Radio and Television	0.22	0.32	5.2	0.6
37	Accounting and computing machines	0.23	0.33	5.3	2.3
38	Electronic instrument	0.22	0.32	5.2	0.2
39	Electronic parts	0.23	0.32	5.1	0.3
40	Other electrical equipment	0.22	0.33	5.9	6.3
41	Motor vehicle and its parts	0.14	0.29	10.6	5.5
42	Other transport equipment	0.24	0.29	2.8	2.1
43	Precision machinery	0.21	0.29	5.0	1.8
44	Plastic products	0.30	0.38	3.1	−0.1
45	Other manufacturing	0.29	0.33	1.9	−0.3

Notes: Authors' calculation based on Establishment and Enterprise Census and JIP database 2009. The industry code is from JIP database 2009. Growth rates are in percent.

Table 2: Summary Statistics of Dependent and Explanatory Variables

			Growth Rate	
Dependent & Explanatory Variables	1999	2006	1999–2006	2004–2006
Ratio of temporary workers (RTW)	0.207	0.275	33.1	3.9
	(0.073)	(0.075)	(2.8)	(−7.9)
ln(Permanent)	11.741	11.556	−1.6	0.0
	(0.943)	(0.947)	(0.4)	(1.2)
ln(Temporary)	9.808	9.968	1.6	−0.4
	(1.409)	(1.241)	(−11.9)	(0.5)
ln(Dispatched)	9.152	9.548	4.3	2.1
	(0.954)	(1.101)	(15.4)	(3.5)
	1998	2005	1998–2005	2003–2005
FDI/Outsourcing				
ln(Foreign-affiliate labor)	10.351	10.409	0.6	0.0
	(1.357)	(1.561)	(15.1)	(8.8)
Share of imported input	0.061	0.086	40.2	11.4
	(0.044)	(0.076)	(73.8)	(9.0)
Product market competition				
World share of value added	0.151	0.144	−4.3	0.3
	(0.051)	(0.058)	(13.6)	(8.2)
Export share	0.137	0.176	29.0	12.8
	(0.124)	(0.163)	(31.4)	(10.2)
Import share	0.100	0.144	44.5	12.5
	(0.098)	(0.133)	(35.5)	(10.0)
Industry characteristics				
ln(Output)	15.365	15.324	−0.3	0.2
	(0.879)	(1.008)	(14.8)	(4.5)
Capital intensity	28.462	41.036	44.2	13.4
	(41.721)	(61.275)	(46.9)	(13.7)
ln(TFP)	4.744	4.786	0.9	0.6
	(0.206)	(0.302)	(46.8)	(14.4)
IT-Capital share	0.111	0.130	17.2	8.9
	(0.066)	(0.076)	(16.1)	(8.1)
IT-Capital intensity	2.803	4.783	70.6	26.0
	(3.445)	(5.615)	(63.0)	(30.5)
Elderly workers share	0.208	0.249	19.8	3.1
	(0.066)	(0.075)	(14.0)	(3.3)
Female workers share	0.306	0.275	−10.0	−5.5
	(0.117)	(0.108)	(−8.1)	(−4.8)

Source: JIP 2009 and UNIDO Industrial Statistics Database (INDSTAT). The estimated sample drops following four industries: Fish products, Grain mill products, Processed food, and Tobacco. These four industries do not report FDI-related data in the sample period. The estimated sample also drops coal products which is the Japanese share of value added is incredibly high. Standard errors in parentheses.

Table 3: Impact of Globalization on the Ratio of Temporary Workers

	(1)	(2)
Dependent variable	RTW	RTW
ln(Foreign-affiliate labor)	0.008	0.009
	(0.008)	(0.008)
Share of imported input	0.438**	0.441**
	(0.147)	(0.148)
World share of value added	−0.376**	−0.370*
	(0.149)	(0.149)
Export share	0.149**	0.146**
	(0.036)	(0.038)
Import share	−0.202**	−0.204**
	(0.059)	(0.061)
ln(Output)	0.063**	0.062**
	(0.011)	(0.011)
Capital intensity	−0.000*	−0.000**
	(0.000)	(0.000)
Elderly workers	−0.002	−0.002
	(0.002)	(0.002)
Female workers	0.000	0.000
	(0.001)	(0.001)
ln(TFP)		0.005
		(0.013)
IT-Capital intensity		0.000
		(0.001)
Observations	160	160
R^2	0.890	0.890

Notes: Fixed effects regression with time-specific effects. All regressors related to globalization lagged one-year. The heteroskedasticity and autocorrelation robust standard errors are in brackets. + significant at 10%; * significant at 5%; ** significant at 1%.

Table 4: Impact of Globalization on the Employment of Permanent, Temporary, and Dispatched Workers

	(1)	(2)	(3)
	ln(Permanent)	ln (Temporary)	ln(Dispatched)
ln(Foreign-affiliate labor)	−0.032	−0.008	0.112
	(0.042)	(0.052)	(0.117)
Share of imported input	−2.482**	0.568	−0.616
	(0.625)	(0.493)	(1.647)
World share of value added	1.885*	−1.047	−4.460*
	(0.860)	(0.676)	(1.917)
Export share	0.425	1.101**	1.478*
	(0.262)	(0.281)	(0.728)
Import share	−0.042	−1.221**	−1.563
	(0.475)	(0.433)	(1.211)
ln(Output)	0.062	0.349**	0.743**
	(0.085)	(0.091)	(0.199)
Capital intensity	0.002*	0.000	−0.002
	(0.001)	(0.001)	(0.003)
ln(TFP)	−0.045	−0.019	−0.001
	(0.079)	(0.079)	(0.192)
IT-Capital intensity	−0.007	0.002	−0.001
	(0.007)	(0.008)	(0.015)
Elderly workers	−0.012	−0.032*	−0.108**
	(0.013)	(0.015)	(0.035)
Female workers	0.008	0.028**	0.019
	(0.010)	(0.010)	(0.024)
Observations	160	160	160
R^2	0.787	0.747	0.676

Notes: Fixed effects regression with time-specific effects. All regressors related to globalization lagged one-year. The heteroskedasticity and autocorrelation robust standard errors are in brackets. + significant at 10%; * significant at 5%; ** significant at 1%.

Table 5: Impact of Globalization on the Employment of Permanent Workers (2SLS)

	(1)	(2)	(3)
	ln(Permanent)	ln(Permanent)	ln(Permanent)
Share of imported input	−2.911*	−3.583**	−3.170**
	(1.382)	(1.180)	(1.040)
World share of value added		2.246***	1.867**
		(0.632)	(0.581)
ln(Foreign-affiliate labor)			−0.049*
			(0.022)
ln(Output)	0.149+	0.082	0.066
	(0.086)	(0.076)	(0.074)
Capital intensity	−0.000	−0.000	0.001*
	(0.001)	(0.001)	(0.001)
ln(TFP)	−0.071	−0.002	−0.025
	(0.066)	(0.071)	(0.067)
IT-Capital intensity	0.002	0.002	−0.001
	(0.009)	(0.009)	(0.008)
Elderly workers	−0.005	−0.002	−0.014
	(0.008)	(0.008)	(0.009)
Female workers	0.014	0.010	0.006
	(0.011)	(0.010)	(0.009)
Observations	160	160	160
R^2	0.723	0.750	0.778
First Stage F-stat	21.254	20.702	17.564

Notes: Fixed effects regression with time-specific effects. All regressors related to globalization lagged one-year. The heteroskedasticity and autocorrelation robust standard errors are in brackets. + significant at 10%; * significant at 5%; ** significant at 1%.

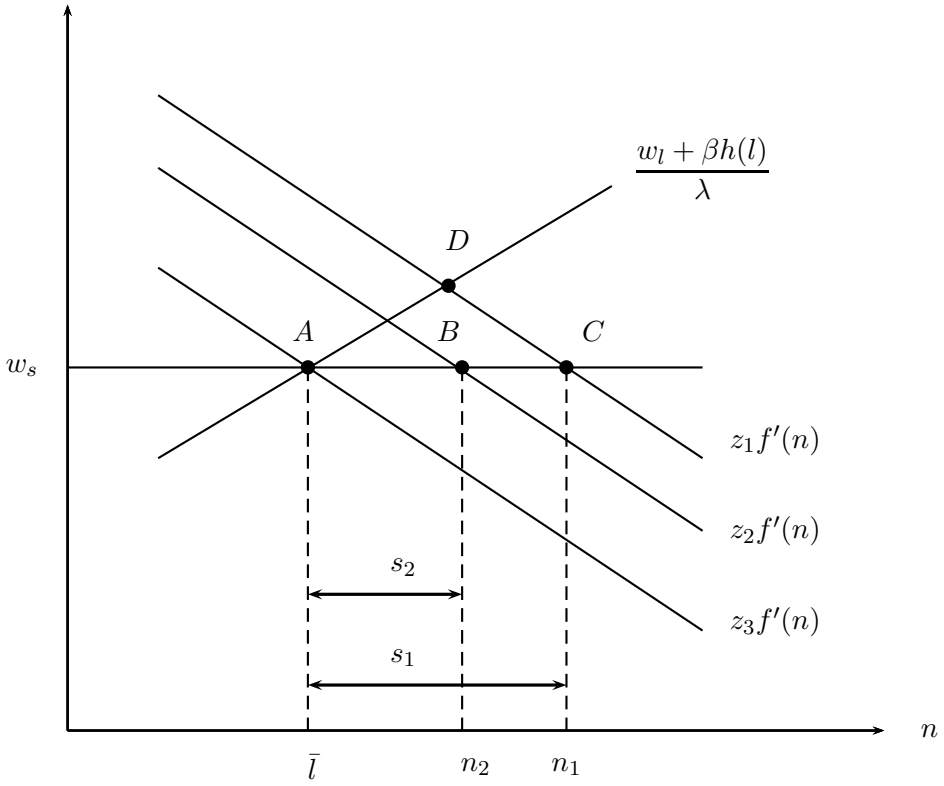

Figure 1: Determination of Employment

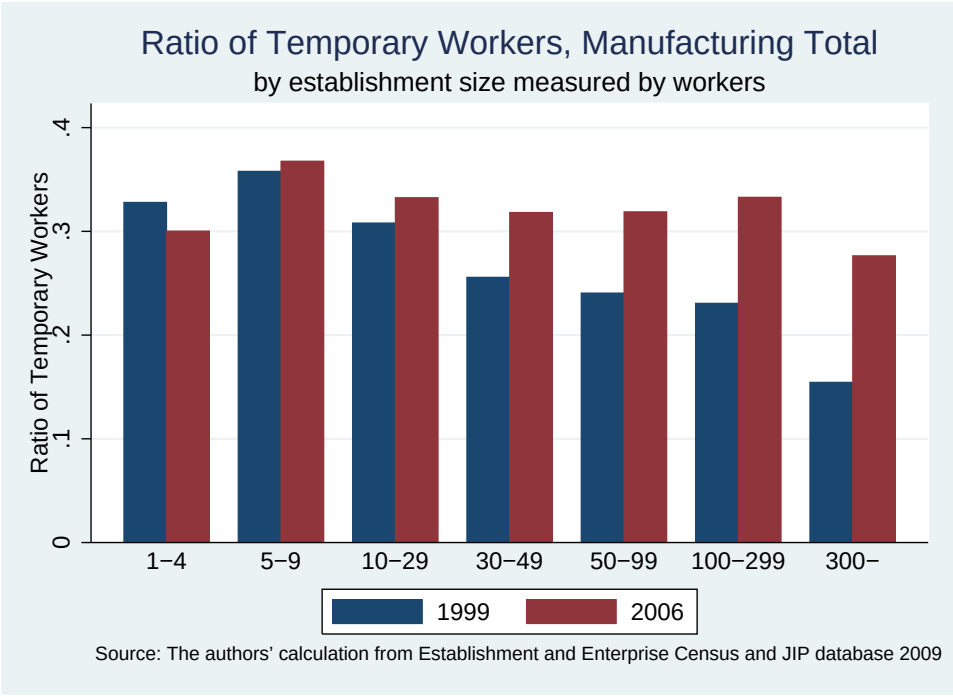

Figure 2: Ratio of Temporary Workers by Establishment Size

A Derivation of the Expected Firing Cost

Defining $E_tV(l_{t+1}, z_{t+2})$ such that $H(l_{t+1}) \equiv E_tV(l_{t+1}, z_{t+2})$, the FOCs with respect to permanent workers are as follows:

$$z_{t+1}\lambda f'(\lambda l_{t+1} + s_{t+1}) - \beta h(l_{t+1}) = w_l \quad \text{if} \quad l_{t+1} > l_t, \tag{A.1}$$

$$z_{t+1}\lambda f'(\lambda l_{t+1} + s_{t+1}) - \beta h(l_{t+1}) = w_l(1-\gamma) \quad \text{if} \quad l_{t+1} < l_t, \tag{A.2}$$

where $h(l_{t+1}) \equiv -H'(l_{t+1})$. These FOCs imply that the marginal value of permanent workers is equal to the marginal cost. The marginal cost of permanent workers is lower when the firm dismisses them than when it hires them. This is because by firing an additional permanent worker, the firm can save the wage rate w_l, but must pay the firing cost $w_l\gamma$.

The right-hand side of the FOCs, the marginal value of permanent workers is the marginal revenue earned by permanent workers, $z_{t+1}\lambda f'(l_{t+1} + s_{t+1})$, plus the discounted expected firing cost $\beta h(l_{t+1})$. Thus, $h(l_{t+1})$ is the shadow price of the stock of permanent workers at $t+1$, which is nothing but the expected value of the firing cost per worker.

The threshold z_M above which the firm increases permanent workers is given by setting $l_{t+1} = l_t$ in (A.1):

$$z_M\lambda f'(\lambda l_t + s_{t+1}) - \beta h(l_t) = w_l \Rightarrow z_M(\lambda l_t + s_{t+1}) = \frac{w_l + \beta h(l_t)}{\lambda f'(\lambda l_t + s_{t+1})}. \tag{A.3}$$

Likewise, the threshold z_m below which the firm decreases permanent workers is given by setting $l_{t+1} = l_t$ in (A.2): that is,

$$z_m\lambda f'(\lambda l_t + s_{t+1}) - \beta h(l_t) = w_l \Rightarrow z_m(\lambda l_t + s_{t+1}) = \frac{w_l(1-\gamma) + \beta h(l_t)}{\lambda f'(\lambda l_t + s_{t+1})} \tag{A.4}$$

Because of the firing cost, $z_m < z_M$. We obtain a well-known result that there exist a range of z where the firm does not change the employment level of permanent workers. Namely,

$$l_{t+1} = l_t, \quad \text{if} \quad w_l(1-\gamma) < z_{t+1}\lambda f'(l_t + s_{t+1}) - \beta h(l_t) < w_l. \tag{A.5}$$

The h function can be calculated as follows. Differentiating (1) with respect to l_t, we obtain

$$\frac{\partial V}{\partial l_t}(l_t, z_{t+1}) = \begin{cases} -w_l\gamma, & \text{if } l_{t+1} < l_t \ ; \\ z_{t+1}\lambda f'(\lambda l_t + s_{t+1}) + \beta h(l_t) - w_l, & \text{if } l_{t+1} = l_t; \\ 0, & \text{if } l_{t+1} > l_t, \end{cases} \tag{A.6}$$

where $h(l_t) = E_{t-1}\partial V(l_t, z_{t+1})/\partial l_t$. With the two threshold conditions for z in (A.3) and (A.4), $h(l_t)$ is given by

$$\begin{aligned} h(l_t) &= -E_{t-1}\frac{\partial V}{\partial l_t}(l_t, z_{t+1}) \\ &= w_l\gamma G(z_m) - \int_{z_m}^{z_M} [\lambda z f'(\lambda l_t + s_{t+1}) - \lambda w_s] dG(z) \quad (\beta h(l_t) = w_l - \lambda w_s \text{is used}) \\ &= \lambda f'(\lambda l_t + s_{t+1}) \int_{z_m}^{z_M} G(z)dz \quad \text{(Integrating by parts).} \end{aligned} \tag{A.7}$$