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A very preliminary draft. Comments are welcomed.

Abstract

Since the 1990s, there has been a rapid increase in the proportion of temporary workers in the Japanese workforce. This paper empirically explores a linkage between the shift from permanent to temporary workers in the Japanese manufacturing sector and economic globalization, using various industry level data. We find that FDI and/or outsourcing tend to encourage the replacement of permanent workers with temporary workers in home production. In addition, we find that industries with higher exports are the most aggressive in replacing permanent workers with temporary workers. However, some other measures of global market competition such as world share of value added are not always statistically significant. Our estimation suggests that the impact of these globalization channels is sizable relative to the impact of the Worker Dispatching Act in 2004.

Key words: temporary workers, permanent workers, FDI, outsourcing, international trade
JEL classification: F16, J23

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1 Introduction

Since the 1990s, there has been a rapid increase in the proportion of temporary workers in the Japanese workforce. This trend, substantial shifts from permanent workers to temporary workers, has already raised a broad range of debates on employment stability, income inequality, and human capital accumulation. For example, the rise 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 and lead to a concomitant difficulty in switching to permanent jobs when they are available.[1]

It has been postulated that the recent deregulation on temporary workers is an important factor in the rise of temporary workers in Japan. In particular, the Worker Dispatching Act in 2004 allows manufacturers to use workers dispatched from dispatching agencies. In response to the massive layoffs of temporary workers that occurred during the recent global financial crisis, there has been much debate on the need to revise the Worker Dispatching Act and create a more equitable social safety net.

Focusing on the fact that the shift from permanent to temporary workers began long before the late 1990s and has been greater among manufacturers, this paper argues that economic globalization such as export, FDI, and outsourcing encourages manufacturers to use temporary workers more aggressively.[2] In order to examine this claim, 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 facing better opportunities of FDI and/or outsourcing, manufacturers prefer lower labor adjustment costs in home production. Temporary workers have much lower dismissal costs than permanent workers. Consequently, manufacturers increase

[1] Jones (2007) argues that an increase in the proportion of the workforce of low-paying non-permanent positions compared to permanent workers (labor market dualism) is the main reason for recent increases in income inequality in Japan.

[2] As anecdotal evidence, in 2004, Nippon Keidanren, Japanfs largest lobbying group composed of 1,281 companies and 129 industrial associations, published a report on employment and personnel management. The report claims that labor market flexibility and more aggressive use of temporary workers are vital because of increasing market uncertainty and sales volatility caused by incrementally tough global competition. The report (only in Japanese) is available at http://www.keidanren.or.jp/japanese/policy/2004/041/honbun.html#s1.

the proportion of temporary workers among their labor input for saving expected labor adjustment costs. In a broad sense, domestic labor inputs become more substitutable with foreign labor inputs as a result of economic globalization.

The employment of permanent workers are more protected than that of temporary workers. Hence, permanent workers can be more easily motivated to accumulate firm-specific skill than temporary workers, resulting in relative efficiency superiority in permanent workers. Our second hypothesis is that it is more difficult for manufactures to incentivize workers to accumulate firm-specific skill because the employment relationship may become fragile under tougher competition. Since 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 or product-specific skill becomes 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.

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 supportive evidence that economic globalization is associated with the shift from permanent to temporary workers. In particular, the evidence is pronounced for the first hypothesis. Our main findings are as follows. First, industries more relying on FDI and/or outsourcing significantly tend to increase the ratio of temporary workers. This industry-level finding is consistent with the firm-level finding by Tomiura, Ito, and Wakasugi (2011), who evaluate the firm-level impact of off-shoring on employment flexibility (the percent of regular employment) by matching task-specific off-shoring survey data with firm-level statistics. Second, industries more relying on foreign sales via export tend to increase the ratio of temporary workers.

We also test alternative measures of the degree of global competition. Among them, world share of value added constructed from INDSTAT is moderately supportive for the second hypothesis (i.e., industry loosing word share tend to increase the ratio of tempo-

rary workers), but its statistical significance depends on estimation specifications. Import penetration used as another measure of the degree of global competition is not in general significant but occasionally significant with a negative sign which seems to contradict with our hypothesis. Thus, on the safe side, we claim that the second hypothesis is partially supported by the data.

Our paper contributes to the literature of temporary and permanent workers. A permanent to temporary shift in the labor force is not a phenomenon exclusive to Japan. Blanchard and Landier (2002), Holmlund and Storrie (2002), and Dolado, Garcia-Serrano, and Jimeno (2002) contribute to the study of temporary labor markets in Europe. They find that temporary workers who stay in entry-job longer are not likely to obtain permanent jobs. In addition, adverse macroeconomic conditions let firms more prone to offer temporary jobs and workers more willing to accept such offers. Cahuc and Postel-Vinay (2002) study the theoretical consequences of attaching strong employment protections to temporary jobs, offering insights to why many workers support the combination of the two instruments. Aguirregabiria and Alonso-Borrego (2008) examine the impact on productivity following Spain's elimination of dismissal costs for permanent contracts. Recently, a literature of temporary and permanent workers is growing in Japan. Morikawa (2010), Asano, Ito, and Kawaguchi (2010), and Matsuura, Sato, and Wakasugi (2011) argue that firm-level volatility also seems to be an important determinant of the shift from permanent to temporary workers.

The relationship between trade and employment has been examined in empirical research. Slaughter (2001) find that trade-related variables have a mixed effect on increasing labor-demand elasticities. Based on a matched data set of four-digit manufacturing industries, Tomiura (2003) finds that import competition intensity reduced employment in recessionary periods when the yen appreciated. In addition, Tomiura (2004) shows 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) find that the sensitivity of wages to the current unemployment rate should increase when import competition

increases.

Our paper is the first that considers the effects of globalization on the proportion of the two types of workers, permanent and temporary. One of the few empirical paper that has a bering on the link between globalization and temporary workers is Matsuura, Sato, and Wakasugi (2011). They discuss global competition raises firm-level volatility by encouraging firms to streamline their product liens, and increases demand for temporary workers without adjustment costs. But, they do not analyze the impact of FDI or outsourcing.

The rest of the 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 serves robustness checks. Section 6 concludes.

2 Theoretical Background

One important characteristic of permanent workers with open-ended contracts is that firms have to incur adjustment costs when they dismiss permanent workers. 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 clarifies 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

Since the model is standard, we briefly describe its setup and results. Assume that identical firms maximize the expected discounted value of profits. In each period, firms obtain $zf(n)$ of revenue where z is an i.i.d. shock following the cdf $G(z)$, n is the effective unit of the labor input. The function $f(\cdot)$ satisfies $f' > 0$ and $f'' < 0$ (for example, we implicitly

assume the existence of another fixed production input and simply ignore it).

There are two types of workers: permanent workers and temporary workers. Firms must incur a firing cost γ per worker when they dismiss permanent workers. No such cost is needed when dismissing temporary workers. It is assumed that although both types of workers are perfectly substitutable in production, permanent workers are more efficient than temporary workers.[3] More specifically, we assume that the effective unit of labor is $\lambda > 1$ for permanent workers so that total effective labor units is $n = \lambda l + s$ where l denotes the employment of permanent workers and s the employment of temporary workers.

Assume that at the end of the period t, a firm observes an idiosyncratic shock on z for the next period. The firm determines the employment size at $t+1$, $l_{t+1} + s_{t+1}$ for maximizing the expected discounted value of the firm's profit at time $t+1$. The problem is represented 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 workers and temporary workers, respectively. 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 are lower than the wage rate of temporary workers is necessary for the coexistence of both types of workers. We impose the assumption of $\lambda w_s > w_l$.

Although it is difficult to find the value function analytically, it is straightforward to describe firms' employment policy. 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 by $\beta h(l_{t+1})$, the condition for

[3]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.

employing both types of workers simultaneously is give 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 employ both permanent and temporary workers. It is known that the expected firing cost $h(l)$ is increasing in l, the employment level of permanent workers (for the derivation of $h(l)$, see Appendix). This is intuitive since as the employment of permanent workers increases, it is more likely for the firm to dismiss permanent workers facing a negative shock on 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. Namely,

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

The intuition of equations (2) and (3) are illustrated in Figure 1. In the figure, the (effective) marginal cost of temporary workers is a horizontal line at w_s while the marginal cost of permanent workers, $(w_l + h(l))/\lambda$, 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, total employment level is determined at the intersection of the marginal revenue schedule $z_1 f'$ 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 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 work as a buffer against revenue fluctuations. This implies that the ratio of temporary temporary to permanent workers is positively correlated to firms' revenue.

In addition to revenue fluctuations from time to time, 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 (i.e. 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 lowers the expected firing cost $h(l)$, 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)). As a result, the ratio of temporary workers tends to increases.

The figure also shows that the introduction of temporary workers leads to firms' cost reduction. Suppose that temporary workers are unavailable (due to legal restrictions, for example). Then, the firm's 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 the unit production cost by using temporary workers.

2.2 Impact of Globalization

The discussions so far stress the roles played by the expected firing cost and the relative productivity of permanent workers. We can consider the following two channels through which economic globalization may influence employment of permanent and temporary workers.

FDI and/or 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 in the sense that the firm will incur a setup cost (Helpman, Melitz, and Yeaple (2004)) or need to search an appropriate local manager who operates a foreign plant (Sato (2009)). In these frameworks, home labor is imperfectly substitutable by foreign labor. Suppose that the FDI setup cost or the cost for searching an appropriate manage decreases. FDI will consequently become easier, and a small good shock on z will be sufficient for switching the production location from the home country to the foreign country. In such a situation, the expected firing cost will increase for firms currently engaged in local production (when switching production location, firms must layoff home workers). As a result, firms increase the ratio of temporary to permanent workers in home production. The same logic works for outsourcing to foreign firms.

Product market competition: In the model, it is simply assumed that permanent workers are more productive than non-permanent workers (λ is exogenously given). This assumption is plausible since firms can use job security as a device to raise workers efficiency. The source of the efficiency increase can be attributable either to relation-specific investment or to improving information asymmetry between an employer and workers (e.g. 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 have 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 (e.g., Grossman and Helpman (1991)). In such a case, it becomes difficult for firms to incentivise workers to maintain the level of λ by offering job security. This means a decline of λ, resulting in decreases the demand for permanent workers.[4]

These two channels are plausible. We test the empirical validity of these channels in what follows.

3 Empirical Strategy and Data

3.1 Temporary Worker Ratio and Indicators of Globalization

We perform panel regression to examine the impact of globalization on the ratio of temporary workers to the total labor input over time within an industry. Based on the theoretical framework discussed in the previous section, we focus on the relative demand for temporary workers to permanent workers. Thus, we use the ratio of temporary workers to total labor input as the dependent variable and various indices of globalization as explanatory variables

[4]Another potential channel is that product market competition may increase the expected firing cost of permanent workers though the reduction of firms' product lines. Multiple-product firms are broadly observed in various industries. Assuming that sales revenues from each product are imperfectly correlated, firms can reduce sales revenue volatility per product by holding multiple products. This implies that firms with more products will tend to hire more permanent workers. As decreases in international trade costs bring about tougher competition, and firms are forced to reduce the number of products (Eckel and Neary (2010) and Bernard, Jensen, Redding, and Schott (2007), for example). Reduction in the number of products means higher per-product revenue volatility, which lowers the demand for permanent workers. This channel of increases in temporary workers is examined by Matsuura, Sato, and Wakasugi (2011).

in our estimation.

As already mentioned in 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 have emerged, and the number of dispatched workers in the manufacturing sector has grown since this change. We control the impact of this policy change by year dummies. In addition, our dataset includes the number of workers from private temporary job agencies across industries. Consequently, although our primary definition of temporary workers are all employees except for permanent employees, we also use the ratio of dispatched workers to permanent workers as an alternative in order to examine whether the impact of globalization is still observable.

Since there is no single and publicly available data set 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 at the three-digit industry level. The data are available for four years (1999, 2001, 2004, and 2006).[5] We focus on the manufacturing sector since 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.

[5]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.

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. 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:

- Ratio of foreign labor input: This index computed from JIP 2009 measures the ratio of employment at foreign affiliates to domestic total employment. Based on our hypothesis on FDI in the previous section, we expect that industries more relying on FDI (in terms of employment) tend to exhibit high temporary worker ratios.

- 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 in JIP 2009. Based on our hypothesis on outsourcing, we expect that the sign of the coefficient is positive.

- 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.

- Import share (import penetration): The ratio of import to domestic absorption calculated from JIP 2009. This is an alternative measure of globalization and competitiveness in the world market.

- Percentage changes in export prices: We assume that greater price increases suggest less price competition in the world market. Thus, we expect that the coefficient is

negative.[6]

- World share of value added: the Japanese share of value added among OECD countries. We compute this measure from the INDSTAT. 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.

The following indicators are employed in order to control possible influences on the temporary worker ratio other than economic globalization. All indicators are calculated from JIP 2009.

- Output growth: This index, showing percentage changes in industry output, measures output changes that may have a positive impact on the temporary worker ratio based on the model discussed in the previous section. A possible explanation is that firms may have an incentive to hire temporary workers to adjust short-run output changes without adjustment costs.

- Total-factor-productivity (TFP) growth: This index, showing percentage changes in TFP, measures technological changes that may impact the temporary worker ratio. A possible explanation is that production labor may become more substitutable by new technology, which in turn may raise labor adjustment costs. We add value-added growth as an alternative.

- Information-technology-related (IT) capital share: The share in total capital stock of computers and other IT-related equipment. This is an alternative measure of TFP growth.

- Information-technology-related (IT) capital-labor ratio: The ratio of computers and other IT-related equipment to total labor input. This is an alternative measure of technological changes.

[6]We alternatively use percentage changes in the relative price of exports to imports. However, we do not significant results with this specification of export prices.

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 an unbalanced longitudinal data set of 45 manufacturing industries between 1996 and 2006. Since the labor data with labor classifications are limited to four periods (1999, 2001, 2004, and 2006), all variables except for the temporary ratio are smoothed by taking a three-year moving average when the variables are used for regression analysis.

3.2 Summary Statistics

Table 1 shows the ratio of temporary workers across 45 manufacturing sectors in Japan. The ratios are ranked by level in 2006. The data suggest that on the average approximately 28.5% of workers are employed on a temporary basis. Since the median value is above the mean, it follows that some sectors have smaller shares of temporary workers. The top five sectors with high ratios of temporary workers in 2006 are Processed Food, Fish Products, Meat Products, Glass Products, and Plastic Products. Leather and Footwear as well as Beverage also have high ratios of temporary workers. The ratio in Processed Food reaches approximately 60%. Motor Vehicle is located near the mean, with the ratio of temporary workers at 28%.

== Table 1 ==

Table 2 presents the growth rate of temporary workers. Motor Vehicle experienced almost 70% growth in the proportion of temporary workers between 1999 and 2006. This industry outgrew the mean (29.4%) and median growth rate (30.6%). More importantly, all sectors except for Pig Iron and Steel increased their ratio of temporary workers during the sample periods.

== Table 2 ==

Table 3 exhibits summary statistics on the trade and technology-related indicators mentioned above. These indicators cover 11 years between 1996 and 2006. The export-share variable signifies the industry's exporting behavior and commitment to competing in the world market. As mentioned before, the share of value added is computed from the UNIDO's INDSTAT. Unfortunately, since the database has quite a few missing values especially for developing countries, we have to construct a "world" composed only of OECD countries. Due to the limited availability, the data on world share of value added is limited to the period of 1997-2005. The ratio of IT capital stock to all capital stock is 0.112 on average, which means that approximately 10% of capital stock is IT-related.

== Table 3 ==

4 Results

Main results are presented in Table 4. Column 1 finds that industries with larger increases in the share of foreign labor inputs have increased the share of temporary workers. Column 2 shows that industries with larger increases in the share of imported inputs have also increased the share of temporary workers. Column 3 shows that these results are intact when using the share of foreign labor inputs and the share of imported inputs simultaneously. These results support our hypothesis on FDI and outsourcing: industries with more FDI and/or outsourcing tend to replace their permanent workers with temporary workers.

As we expected, the coefficient of output growth rate is positive. However, other variables for industry characteristics are statistically insignificant in Column 1, 2, and 3. 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.

Column 4, 5, and 6 show the impact of market competition. Column 4 suggests that industries with larger increases in the export share have further increased the share of

temporary workers. We expect that industries with decreases in the growth rate for export prices have increased the ratio of temporary workers. The sign is consistent with our hypothesis, but the coefficient does not have any significance.[7]

The impact of increases in world share of value added is negative, but the standard error is large. Its coefficient is significant at 10 % level. The coefficient implies that the share of temporary workers increases when industries experience some loss of world share of value added. However, although the sign of this coefficient is consistently negative, the statistical significance depends on estimation specification. For example, when estimated with import share, world share of value added becomes insignificant (Column 5). Column 4 and 6 show that when estimated with export share, world share of value added increases its significance.

Column 7 estimates our two hypotheses in an equation. The main results observed in Columns 3 and 4 are also found in Column 7. The coefficients of the ratio of foreign labor input, the share of imported input, and the share of export sales are positive and significant. Interestingly, world share of value added becomes significant at 1 % level in this specification.

In addition, 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 import share (import penetration) used here correctly captures the decree of competition pressure from abroad, this result seems to contradict with our hypothesis. However, it should be noted that import share is significant only when estimated with FDI/outsourcing related variables.

With respect to industry characteristics, only output growth ratio is significant at 5% level. Other variables such as growth of value added, TFP growth, IT capital-labor ratio, and IT capital share in general do not have a significant explanatory power for the ratio of temporary workers. For example, IT capital share are positive and significant in only Column 1.[8]

[7] When a linear time trend (year) is used instead of year dummy variables, the significance of the coefficient of growth of export price increases. However, the standard error is still large. See coefficients of the rate of growth of export prices of Appendix Table 7.

[8] Appendix Table 7 in which the year dummies are replaced with a linear time trend exhibits very similar

== Table 4 ==

Next, we turn to the results when using the ratio of dispatched workers to total labor input instead of the ratio of temporary workers to total labor input. The demand for dispatched workers was directly influenced by the policy change in 2004. Thus, if the impact of globalization on the ratio of dispatched workers can be observed in this specification, it will be strong evidence about the impact of globalization on the demand for temporary workers.

The results reported in Table 5 are very similar to those reported in Table 4 except for the fact that the share of imported input is insignificant in estimating the ratio of dispatched workers. In addition, world share of value added also completely loses its explanatory power. Export share are always positive and significant for the ratio of dispatched workers, and increases in import share tend to be significantly negative when estimated with export share and/or the ratio of foreign labor input.

Other industry characteristics show that the coefficients of IT capital share increases significance in this specification. More interestingly, the year dummy for 2001 becomes insignificant and the year dummy for 2004 lose significance in some specifications. In contrast, the year dummy for 2006 remains positive and significant. These facts seem to prove the year dummies appropriately capture the impact of the Worker Dispatching Act in 2004.

In sum, the estimation reveals that industries with larger increases in the ratio of foreign labor input and the share of imported inputs tend to increase the ratio of temporary workers. Indicators related to tougher product market competition show the mixed results. Although the coefficient of export share is always positive and significant, the coefficient of world share of value added is significant only when estimated along with the ratio of foreign labor input and the share of imported input. In addition, increases in import share exhibits a negative sign. This results on import share seem inconsistent with our hypothesis. However, import share is significant only when estimated along with the ratio of foreign labor input and the share of imported input. We obtain qualitatively similar results for the ratio of

results although only IT capital share increases significance in some specifications.

dispatched workers to total labor input although some explanatory variables such as the share of imported input become insignificant. The policy change in 2004 directly influenced manufacturers' demand for dispatched workers. Nevertheless, we find the evidence that globalization increases the ratio of dispatched workers to total labor input especially through FDI and export. Therefore, we conclude that economic globalization increases the demand for temporary workers relative to permanent workers. Tomiura, Ito, and Wakasugi (2011), a recent study using firm-level panel data, also supports this finding. To match task-specific off-shoring survey data with firm-level statistics, they conclude that off-shoring firms depend significantly less on regular full-time workers. This impact is especially strong in off-shoring of professional services.

== Table 5 ==

5 Robustness Checks

As shown in Table 1, some industries have extremely large ratios of temporary workers to total labor input. For example, in 2006, the ratios of temporary workers to total labor input in Processed Food and Fish Products are more than 50%, and the ratio of temporary workers in Meat Products was close to 50% (the mean and median ratios of temporary workers in all manufacturers are 28.5% and 29.0%, respectively). Furthermore, these three industries tend to have very low growth rates of the temporary worker ratios through the sample periods (Table 2). Thus, we conjecture that these three industries are anomalies.

Our second concern is the measurement errors observed especially in the world share of value added. The average world share of value added between 1997 and 2006 for Fish Products is 0.583 with standard deviation of 0.043. This is unaccountably high. We are concerned that the lack of data accuracy may magnify the standard errors of this variable in our estimation.

We address these concerns by verifying the robustness of our main results by dropping the three industries from our dataset. As a result, we have 168 observations, 42 industries

multiplied by four years (1999, 2001, 2004, and 2006). Table 6 presents the results. After excluding the three industries, the regression of the temporary worker ratio on various explanatory variables generates similar results with those in Table 4. Furthermore, as we expected, the impact of the world share of value added becomes sharp, increasing statistical significance. Thus, the estimation enhances the validity of our hypothesis about product market competition.

== Table 6 ==

6 Conclusions

This paper attempts to test if economic globalization such as FDI, outsorucing, and exports raises firms' demand for temporary workers relative to permanent workers. For this purpose, we construct an industry-level panel data, 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 consider potential channels though which economic globalization may raise the demand for temporary workers by employing a standard model of temporary and permanent workers. We identify two possible channels: FDI and/or outsourcing and product competition in the world market.

Various indicators capturing the impact of these two channels are constructed along with several indicators for controlling industry characteristics may vary in the sample periods. Main findings are as follows: First, increases in FDI and/or outsourcing raise the ratio of temporary workers to total labor input. Second, when firms come to rely on foreign sales, they increases the demand for temporary workers. This effect is captured by increases in export share. However, other indicators representing market competition do not always work satisfactory. We do not obtain significant results from growth of export price. World share of value added shows correct sign but its significance depends on the specification of estimation. However, when we exclude anomalies from the data, the performance of world

share of value added improves. Thus, we conclude that these two channels of globalization may explain the demand shift toward temporary workers in Japanese manufacturers since the 1990s.

Although the estimation presents several plausible results, it also contains several qualifications. First, the Establishment and Enterprise Census contains employment information according to establishment size. Using such information can enrich our study since we can identify changes in the ratio of temporary workers according to the categories of establishment size. For example, it is possible to see which size of establishments most intensively expand the demand for temporary workers. An extension of the analysis in this line is in progress. Second, in this study, we attempt to control the issue of endogeneity by taking a one-period lag for explanatory variables. However, it is desirable to use appropriate instruments for eliminating potential biases on estimated coefficients. All these issues are left for future research.

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

Code	Industry Name	2006	1999–2006	2001–06	2004–06
11	Processed food	0.577	0.127	0.064	0.002
9	Fish products	0.539	0.065	0.044	−0.018
8	Meat products	0.496	0.109	0.006	−0.027
32	Glass products	0.383	0.378	0.294	0.094
58	Plastic products	0.376	0.213	0.143	−0.003
21	Leather and footwear	0.373	0.011	0.067	−0.060
13	Beverages	0.357	0.164	0.097	−0.034
59	Other manufacturing	0.331	0.136	0.099	−0.006
53	Other electrical equipment	0.329	0.399	0.358	0.120
23	Fertilizer	0.328	0.363	0.218	0.068
48	Accounting and computing machines	0.327	0.372	0.393	0.047
47	Radio and television	0.323	0.363	0.269	0.013
15	Textiles and fabrics	0.323	0.077	0.076	−0.028
51	Electronic valves and tubes	0.320	0.353	0.304	0.007
10	Grain mill products	0.316	0.234	0.098	0.071
50	Scientific instruments	0.316	0.352	0.265	0.003
46	Heavy electrical machinery	0.312	0.420	0.285	0.145
12	Prepared animal feeds	0.308	0.260	0.116	0.119
19	Paper products	0.299	0.198	0.123	−0.008
45	Office machinery	0.298	0.151	0.040	−0.147
34	Ceramic products	0.294	0.358	0.163	0.052
57	Precision machinery	0.292	0.341	0.293	0.035
28	Other chemical products	0.288	0.302	0.140	0.014
56	Transport equipment	0.288	0.198	0.213	0.042
54	Motor vehicle	0.286	0.690	0.397	0.102
41	Metal products	0.280	0.232	0.200	0.020
40	Structural metal products	0.252	0.254	0.101	0.056
17	Furniture	0.248	0.358	0.228	0.068
39	Non-ferrous metal	0.244	0.345	0.263	0.023
27	Chemical fiber and textiles	0.243	0.641	0.561	0.218
16	Wood products	0.228	0.279	0.174	0.012
38	Non-ferrous metal refining	0.227	0.204	0.253	0.050
35	Other ceramic products	0.223	0.409	0.273	0.093
42	General industrial machinery	0.223	0.465	0.342	0.140
20	Printing	0.218	0.172	0.107	−0.037
33	Cement and concrete	0.217	0.342	0.243	0.117
29	Pharmaceutical	0.210	0.480	0.233	0.080
37	Other iron and steel products	0.198	0.517	0.230	0.016
31	Coal products	0.188	0.158	−0.221	0.035
25	Organic chemical	0.172	0.310	0.374	0.180
18	Pulp, paper, and paperboard	0.149	0.288	0.217	−0.040
36	Pig iron and steel	0.129	−0.040	−0.073	0.248
30	Refined petroleum products	0.118	0.436	0.077	0.063
14	Tobacco	0.094	0.450	0.664	0.643
Mean		0.285	0.294	0.200	0.059
Median		0.290	0.306	0.215	0.038

Notes: The codes and industry name are sorted in order by the ratio of temporary workers in 2006. Establishment and Enterprise Census and JIP 2009.

Table 2: Growth Rate of the Temporary Workers Ratio during 1999–2006

Code	Industry Name	2006	1999–2006	2001–06	2004–06
54	Motor vehicle	0.286	0.690	0.397	0.102
27	Chemical fiber and textiles	0.243	0.641	0.561	0.218
37	Other iron and steel products	0.198	0.517	0.230	0.016
29	Pharmaceutical	0.210	0.480	0.233	0.080
42	General industrial machinery	0.223	0.465	0.342	0.140
14	Tobacco	0.094	0.450	0.664	0.643
30	Refined petroleum products	0.118	0.436	0.077	0.063
46	Heavy electrical machinery	0.312	0.420	0.285	0.145
35	Other ceramic products	0.223	0.409	0.273	0.093
53	Other electrical equipment	0.329	0.399	0.358	0.120
32	Glass products	0.383	0.378	0.294	0.094
48	Accounting and computing machines	0.327	0.372	0.393	0.047
23	Fertilizer	0.328	0.363	0.218	0.068
47	Radio and television	0.323	0.363	0.269	0.013
34	Ceramic products	0.294	0.358	0.163	0.052
17	Furniture	0.248	0.358	0.228	0.068
51	Electronic valves and tubes	0.320	0.353	0.304	0.007
50	Scientific instruments	0.316	0.352	0.265	0.003
39	Non-ferrous metal	0.244	0.345	0.263	0.023
33	Cement and concrete	0.217	0.342	0.243	0.117
57	Precision machinery	0.292	0.341	0.293	0.035
25	Organic chemical	0.172	0.310	0.374	0.180
28	Other chemical products	0.288	0.302	0.140	0.014
18	Pulp, paper, and paperboard	0.149	0.288	0.217	−0.040
16	Wood products	0.228	0.279	0.174	0.012
12	Prepared animal feeds	0.308	0.260	0.116	0.119
40	Structural metal products	0.252	0.254	0.101	0.056
10	Grain mill products	0.316	0.234	0.098	0.071
41	Metal products	0.280	0.232	0.200	0.020
58	Plastic products	0.376	0.213	0.143	−0.003
38	Non-ferrous metal refining	0.227	0.204	0.253	0.050
19	Paper products	0.299	0.198	0.123	−0.008
56	Transport equipment	0.288	0.198	0.213	0.042
20	Printing	0.218	0.172	0.107	−0.037
13	Beverages	0.357	0.164	0.097	−0.034
31	Coal products	0.188	0.158	−0.221	0.035
45	Office machinery	0.298	0.151	0.040	−0.147
59	Other manufacturing	0.331	0.136	0.099	−0.006
11	Processed food	0.577	0.127	0.064	0.002
8	Meat products	0.496	0.109	0.006	−0.027
15	Textiles and fabrics	0.323	0.077	0.076	−0.028
9	Fish products	0.539	0.065	0.044	−0.018
21	Leather and footwear	0.373	0.011	0.067	−0.060
36	Pig iron and steel	0.129	−0.040	−0.073	0.248
Mean		0.285	0.294	0.200	0.059
Median		0.290	0.306	0.215	0.038

Notes: The codes and industry name are sorted in order by the growth rate of the temporary workers ratio during 1999–2006. Establishment and Enterprise Census and JIP 2009.

Table 3: Summary Statistics of Explanatory Variables

Variable	N	Mean	Std. Dev.	Min	Max
FDI/Outsourcing					
Ratio of foreign labor input	450	0.165	0.137	0.000	0.503
Share of imported input	495	0.070	0.060	0.000	0.360
Product market competition					
Export share	495	0.133	0.137	0.002	0.586
Growth of export price	495	0.010	0.134	−0.381	0.938
World share of value added	405	0.210	0.131	0.038	0.958
Import share	495	0.117	0.113	0.002	0.641
Industry characteristics					
Output growth rate	495	−0.003	0.068	−0.242	0.432
Growth of value added	495	−0.021	0.522	−11.105	1.075
TFP growth	495	0.005	0.043	−0.198	0.205
IT capital share	495	0.112	0.069	0.025	0.373
IT capital-labor ratio	495	2.968	3.926	0.071	29.754

Source: JIP 2009 and UNIDO Industrial Statistics Database (INDSTAT).

Table 4: Impact of Globalization on the Ratio of Temporary Workers

Panel regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FDI/Outsourcing							
Ratio of foreign labor input	0.247**		0.221**				0.192**
	[0.066]		[0.065]				[0.059]
Share of imported input		0.372**	0.312**				0.487**
		[0.119]	[0.116]				[0.135]
Product market competition							
Export share				0.331**		0.358**	0.280**
				[0.063]		[0.065]	[0.062]
Growth of export price				−0.038		−0.039	−0.033
				[0.030]		[0.030]	[0.028]
World share of value added				−0.145+	−0.126	−0.152+	−0.215**
				[0.082]	[0.090]	[0.081]	[0.078]
Import share					0.010	−0.118	−0.338**
					[0.086]	[0.080]	[0.090]
Industry characteristics							
Output growth rate	0.131	0.202*	0.194*	0.130	0.175+	0.110	0.208*
	[0.091]	[0.096]	[0.092]	[0.092]	[0.102]	[0.093]	[0.089]
Growth of value added	0.024	0.036	0.020	0.056*	0.040	0.064*	0.047+
	[0.029]	[0.029]	[0.029]	[0.027]	[0.031]	[0.028]	[0.026]
TFP growth	−0.022	−0.009	−0.023	−0.038	−0.035	−0.017	−0.005
	[0.087]	[0.089]	[0.085]	[0.084]	[0.095]	[0.085]	[0.078]
IT capital share	0.305*	0.191	0.223	−0.006	0.277+	0.040	0.123
	[0.145]	[0.150]	[0.145]	[0.146]	[0.160]	[0.149]	[0.138]
IT capital-labor ratio	0.000	−0.001	−0.002	−0.001	0.001	−0.001	−0.002
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Year 2006 dummy	0.050**	0.059**	0.050**	0.050**	0.055**	0.051**	0.043**
	[0.006]	[0.005]	[0.005]	[0.006]	[0.007]	[0.006]	[0.006]
Year 2004 dummy	0.044**	0.052**	0.045**	0.046**	0.048**	0.047**	0.04**
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Year 2001 dummy	0.015**	0.020**	0.017**	0.015**	0.017**	0.015**	0.014**
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
R2	0.981	0.980	0.982	0.983	0.979	0.983	0.986
N	180	180	180	180	180	180	180

Notes: The dependent variable is the ratio of temporary workers to total labor input. All regressors lagged one-year. The baseline year is 1999. The standard errors are in brackets. + significant at 10%; * significant at 5%; ** significant at 1%.

Source: Establishment and Enterprise Census, JIP 2009, and UNIDO Industrial Statistics Database (INDSTAT).

Table 5: Impact of Globalization on the Ratio of Dispatched Workers

Panel regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FDI/Outsourcing							
Ratio of foreign labor input	0.444**		0.442**				0.402**
	[0.086]		[0.087]				[0.081]
Share of imported input		0.146	0.027				0.081
		[0.169]	[0.156]				[0.184]
Product market competition							
Export share				0.443**		0.493**	0.436**
				[0.087]		[0.089]	[0.085]
Growth of export price				−0.045		−0.047	−0.019
				[0.041]		[0.041]	[0.038]
World share of value added				−0.151	−0.132	−0.164	−0.144
				[0.112]	[0.123]	[0.111]	[0.107]
Import share					−0.047	−0.222*	−0.328**
					[0.118]	[0.110]	[0.123]
Industry characteristics							
Output growth rate	0.181	0.202	0.186	0.166	0.214	0.128	0.148
	[0.119]	[0.135]	[0.123]	[0.127]	[0.140]	[0.127]	[0.122]
Growth of value added	0.006	0.037	0.006	0.058	0.040	0.073+	0.043
	[0.038]	[0.042]	[0.038]	[0.038]	[0.042]	[0.038]	[0.036]
TFP growth	0.030	0.059	0.030	0.025	0.041	0.065	0.061
	[0.114]	[0.125]	[0.115]	[0.116]	[0.130]	[0.117]	[0.107]
IT capital share	0.574**	0.504*	0.567**	0.153	0.564*	0.241	0.372+
	[0.189]	[0.212]	[0.194]	[0.202]	[0.219]	[0.204]	[0.189]
IT capital-labor ratio	−0.001	−0.001	−0.001	−0.002	0.001	−0.001	−0.003
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Year 2006 dummy	0.022**	0.040**	0.022**	0.028**	0.036**	0.031**	0.018*
	[0.007]	[0.007]	[0.007]	[0.008]	[0.009]	[0.008]	[0.008]
Year 2004 dummy	0.008	0.022**	0.008	0.015*	0.018*	0.017*	0.007
	[0.007]	[0.007]	[0.007]	[0.007]	[0.008]	[0.007]	[0.007]
Year 2001 dummy	−0.004	0.002	−0.004	−0.002	0.000	−0.002	−0.005
	[0.005]	[0.006]	[0.005]	[0.006]	[0.006]	[0.006]	[0.005]
R2	0.893	0.870	0.892	0.895	0.871	0.898	0.916
N	180	180	180	180	180	180	180

Notes: The dependent variable is the ratio of dispatched workers to permanent workers. All regressors lagged one-year. The baseline year is 1999. The standard errors are in brackets. + significant at 10%; * significant at 5%; ** significant at 1%.

Source: Establishment and Enterprise Census, JIP database 2009, and UNIDO Industrial Statistics Database (INDSTAT).

Table 6: The Impact of Globalization on the Ratio of Temporary Workers excluding Processed Food, Fish Products, and Meat Products

Panel regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FDI/Outsourcing							
Ratio of foreign labor input	0.273**		0.246**				0.207**
	[0.068]		[0.068]				[0.062]
Share of imported input		0.360**	0.290*				0.472**
		[0.123]	[0.119]				[0.137]
Product market competition							
Export share				0.324**		0.348**	0.271**
				[0.064]		[0.066]	[0.063]
Growth of export price				−0.042		−0.043	−0.033
				[0.030]		[0.030]	[0.028]
World share of value added				−0.173*	−0.152	−0.178*	−0.228**
				[0.084]	[0.093]	[0.084]	[0.081]
Import share					0.013	−0.109	−0.326**
					[0.088]	[0.082]	[0.091]
Industry characteristics							
Output growth rate	0.134	0.202*	0.194*	0.140	0.185+	0.120	0.216*
	[0.092]	[0.098]	[0.093]	[0.094]	[0.104]	[0.095]	[0.091]
Growth of value added	0.024	0.037	0.020	0.057*	0.041	0.065*	0.046+
	[0.030]	[0.030]	[0.029]	[0.028]	[0.031]	[0.028]	[0.026]
TFP growth	−0.033	−0.022	−0.033	−0.058	−0.058	−0.038	−0.020
	[0.090]	[0.093]	[0.088]	[0.088]	[0.099]	[0.089]	[0.081]
IT capital share	0.325*	0.204	0.245+	0.005	0.286+	0.050	0.139
	[0.146]	[0.153]	[0.147]	[0.149]	[0.163]	[0.152]	[0.141]
IT capital-labor ratio	−0.001	−0.002	−0.002	−0.001	0.001	−0.001	−0.002
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Year 2006 dummy	0.050**	0.060**	0.049**	0.049**	0.056**	0.051**	0.042**
	[0.006]	[0.005]	[0.006]	[0.006]	[0.007]	[0.006]	[0.006]
Year 2004 dummy	0.042**	0.051**	0.043**	0.044**	0.047**	0.045**	0.040**
	[0.005]	[0.005]	[0.005]	[0.006]	[0.006]	[0.006]	[0.005]
Year 2001 dummy	0.014**	0.019**	0.015**	0.014**	0.016**	0.013**	0.012**
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
R2	0.964	0.962	0.966	0.968	0.960	0.968	0.974
N	168	168	168	168	168	168	168

Notes: The top three industries in terms of the ratio of temporary workers in 2006, processed food, fish products, and meat products, are excluded. The dependent variable is the ratio of temporary workers to total labor input. All regressors lagged one-year. The baseline year is 1999. The standard errors are in brackets. + significant at 10%; * significant at 5%; ** significant at 1%.

Source: Establishment and Enterprise Census, JIP database 2009, and UNIDO Industrial Statistics Database (INDSTAT).

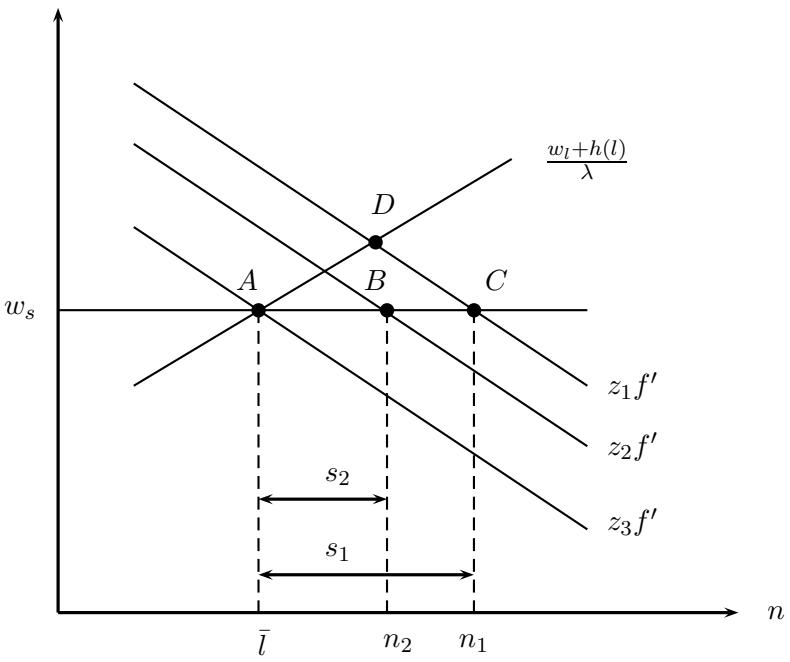

Figure 1: Determination of Employment

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

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

B Appendix: Supplementary Table

Table 7: Appendix: The Impact of Globalization on the Ratio of Temporary Workers (trend)

Panel regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FDI/Outsourcing							
Ratio of foreign labor input	0.249**		0.227**				0.198**
	[0.067]		[0.066]				[0.061]
Share of imported input		0.320**	0.262*				0.466**
		[0.119]	[0.116]				[0.139]
Product market competition							
Export share				0.298**		0.332**	0.254**
				[0.064]		[0.066]	[0.064]
Growth of export price				−0.055+		−0.053+	−0.050+
				[0.028]		[0.028]	[0.026]
World share of value added				−0.122	−0.100	−0.131	−0.190*
				[0.084]	[0.090]	[0.083]	[0.081]
Import share					−0.020	−0.137+	−0.354**
					[0.086]	[0.082]	[0.093]
Industry characteristics							
Output growth rate	0.096	0.142	0.137	0.076	0.122	0.059	0.144
	[0.089]	[0.093]	[0.089]	[0.090]	[0.098]	[0.090]	[0.087]
Growth of value added	0.030	0.046	0.029	0.063*	0.049	0.071*	0.056*
	[0.029]	[0.030]	[0.029]	[0.028]	[0.031]	[0.028]	[0.027]
TFP growth	−0.038	−0.032	−0.046	−0.048	−0.041	−0.021	−0.012
	[0.088]	[0.090]	[0.086]	[0.087]	[0.096]	[0.087]	[0.081]
IT capital share	0.376**	0.297*	0.325*	0.095	0.372*	0.141	0.235+
	[0.141]	[0.147]	[0.141]	[0.146]	[0.155]	[0.147]	[0.138]
IT capital-labor ratio	0.000	−0.002	−0.002	−0.001	0.001	−0.001	−0.003
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Year	0.007**	0.009**	0.007**	0.008**	0.008**	0.008**	0.007**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
R2	0.980	0.979	0.981	0.982	0.978	0.982	0.985
N	180	180	180	180	180	180	180

Notes: The dependent variable is the ratio of temporary workers to total labor input. All regressors lagged one-year. The standard errors are in brackets. + significant at 10%; * significant at 5%; ** significant at 1%.
Source: Establishment and Enterprise Census, JIP database 2009, and UNIDO Industrial Statistics Database (INDSTAT).