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Why Did Manufacturing Firms Increase the Number of Non-regular Workers in the 2000s? Does international trade matter?*

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Abstract

This paper examines whether there is any link between export openness and the temporary workers ratio at firms. First, we investigate the effect of export openness on sales volatility using Japanese firm-level data. Next, we examine whether firms will increase the number of temporary workers as their sales volatility changes. Finally, we calculate to what extent changes in the temporary workers ratio are attributable to the sales volatility that is caused by exporting. We find statistically significant evidence that a foreign demand shock through exports affects the sales volatility at the firm level and that increases in the sales volatility induce the extensive use of temporary workers. Indeed, we find that those firms that incur a higher fixed employment cost make extensive use of temporary workers when the sales growth volatility rises. However, quantitative evaluation of the effects of exporting on the temporary workers ratio shows that the magnitude of these effects is quite small. We conclude that the impacts of firms' exporting status and export share on the temporary workers ratio are statistically significant but economically negligible in size. Thus, it is not appropriate to attribute the cause of increases in the temporary workers ratio to increased foreign shocks that occur because of exporting.

Keywords: Export; Uncertainty; Temporary workers, Firm-level data

JEL classification: J2, J3, F1, F6

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1. Introduction

In Japan, the number of temporary workers gradually increased in both the 1990s and the 2000s. For example, the share of temporary workers increased from 21% to 34% between 1995 and 2010 (Table 1). Although this trend was significant for service sectors in the 1990s, such as wholesale, retail and restaurants, manufacturing firms began to replace their regular workers with temporary workers during this period; thus, they gradually increased the temporary worker ratio from 23.5% to 30.9% between 1999 and 2006. However, after the financial crisis in 2008, foreign sales by manufacturing firms drastically decreased, and as a result, a large number of temporary workers lost their jobs. Figure 1 presents the growth rate of GDP, exports, and the number of workers by employment status from 2002 to 2009 in the manufacturing sector. As the growth rate of exports decreased from 8.4% in 2007 to -23.9% in 2009, the GDP growth rates after 2008 also became negative. Furthermore, whereas manufacturing firms tended to reduce their numbers of permanent workers in the 2000s, they increased their temporary workers by roughly 3% annually until 2007. However, after the financial crisis in 2008, firms launched massive lay-offs of their temporary workers, and hence, 16.2% of them lost their jobs in 2009. Since then, policymakers in the Japanese government have started a debate about whether or not the use of temporary workers in the manufacturing sector should be restricted.

<Table 1>

<Figure 1>

It is important to understand why manufacturing firms started to make extensive use of temporary workers in the 2000s. One reason is the relaxation of the restrictions on the use of temporary workers in manufacturing firms in 2004. However, as we see in table 1, the temporary worker ratio has been increasing since the 1990s. Thus, the institutional factor is not the sole cause of the rise of the temporary worker ratio. Instead, some researchers argue that globalization may have contributed to the increases in temporary workers. In addition, openness to foreign trade is often seen as a source of economic volatility or uncertainty. Due to the foreign sales expansion, firms will face higher uncertainty and experience increased sales volatility. Because it is costly to adjust the number of regular workers in response to higher sales volatility, firms will face the need for a workforce that can be spontaneously adjusted to the fluctuation of their sales; therefore, they will increase the temporary worker ratio. In fact, Nippon Keidanren (Japan Business Federation), which is the largest lobbyist group

in Japan, claims that because many Japanese firms have faced severe international competition and experienced increases in sales volatility, there is an absolute need for an additional regulatory reform in the labor market. Specifically, they believe that this reform should include relaxing the regulations that were enacted under the Worker Dispatching Law. (Nippoin Keidanren, 2004)

In this paper, we examine whether there is any link between export openness and the temporary worker ratio at the firm level. First, we investigate the effect of export openness on sales volatility using Japanese firm-level data. Our original data contain more than 10,000 firms annually and cover the period from 1994 to 2009. We construct the sales growth volatility measure at the firm level by means of a rolling regression with five-year windows. Then, we examine the impact of the exporting status and export share on the sales volatility at the firm level. Next, we examine whether firms will increase their temporary workers based on changes in the sales volatility; if they do, we examine to what extent the changes in the temporary worker ratio are attributable to those increases in sales volatility that are caused by exporting. We find statistically significant evidence that through exports, the foreign demand shock affects the sales volatility at the firm level and that increases in the sales volatility induce the extensive use of temporary workers. However, based on a quantitative evaluation of the effects of exporting on the temporary worker ratio, the magnitude of the impact is quite small. Lastly, we conclude that the impacts of exporting status and export share on the temporary worker ratio are statistically significant but economically negligible in size.

This paper is related to different strands of the literature. First, there is a large body of research that has empirically examined the link between globalization and economic volatility. For example, di Giovanni and Levchenko (2006) demonstrate how output volatility is related to trade openness using cross-country industry-level panel data. Recent works by Buch et al. (2009) and Vannoorenberghe (2012) have disaggregated several levels of analysis, in particular, firm behavior to access the precise transmission mechanics of trade related shocks. Buch et al. (2009) present a simple model of firm-level sales volatility and trade openness and suggest that there is an ambiguous relationship between these items. Indeed, exporters are exposed to external foreign shock, and as a result, the sales volatility for exporters becomes higher over time. However, because exporters are able to interchange their domestic and foreign customers with more flexibility, exporters can reduce their sales volatility through this diversification. Buch et al. (2009) use a German firm-level dataset and show that whereas the sales volatility for exporters is smaller than it is for non-exporters, the effect of a rise in the export share is not significant.

Vannoorenberghe (2012) proposes a more comprehensive theoretical model and derives several notable hypotheses from it. In his model, he assumes that firms face market-specific shocks and a short-run convex cost of production. In this framework, he shows that the sales volatility for domestic sales and exports at the firm level are negatively correlated and that exporters are able to reduce their total sales volatility due to the diversification effect of domestic and foreign shock. However, exporters' total sales volatility will increase as their export share rises if the variation of the foreign demand shock is larger than the variation of the domestic demand shock. As a result, Vannoorenberghe shows that there is a non-linear relationship between the sales volatility and the export share: when firms start exporting, their sales volatility will decrease due to the diversification effect. However, as these firms' export share rises, their sales volatility will increase and there is an export share above which exporters have more volatile sales than non-exporters. Vannoorenberghe uses a French firm-level dataset and presents consistent empirical evidence. Because the decision to export is assumed to affect the output volatility in his framework, he also takes endogenous bias into consideration and estimates his model with instrumental variable (IV) estimation, which demonstrates the robustness of his results.

Second, the relationship between sales volatility and the temporary worker ratio has been explored by several previous studies. Ono and Sullivan (2006) present a simple dynamic model of labor demand for both regular workers and temporary workers and they try to quantify the link between the sales growth volatility and the temporary worker ratio using US plant-level data. In their theoretical model, they assume that while the unit labor cost for a permanent worker is smaller than it is for a temporary worker, firms incur a firing cost if they reduce their numbers of permanent workers. Furthermore, Ono and Sullivan demonstrate that firms will extensively use temporary workers when the expected output growth rate is lower. In addition, when the firing cost is higher, firms that face greater uncertainty over their future output level make greater use of temporary workers. For empirical analyses, Ono and Sullivan use the US plant-level Capacity Utilization Survey and construct both the sales growth volatility and its predicted values as proxies for their future output uncertainty and the expected output growth rate. Thus, they find that both factors are key determinants of the temporary worker ratio. In the case of Japan, Morikawa (2010), Asano et al. (2011) and Matsuura et al. (2011) examine the relationship between the sales volatility and the temporary worker ratio and find similar results to those of Ono and Sullivan (2008).

Third, a number of recent works examine the effect of exporting on the wage and skill composition of workers at the firm level. For example, Bernard and Jensen

(1997) use US plant-level data to demonstrate that exporters hire more skilled worker than non-exporters. Similarly, Schnebel and Wanger (2007) use employer-employee matched data and revealed that exporters offer higher wages than non-exporters, even when employees' characteristics are controlled for. Because temporary workers are generally low-wage and are less likely to require on- or off-the-job training, exporters may make use of more regular workers than temporary workers when they start to export.

Our contribution to the economics literature is threefold. First, this paper empirically analyzes the link between the export status and the temporary worker ratio at the firm level. Whereas several previous studies examine the impact of exports on changes in the wage and skill composition of workers, few studies focus on the effect of exports on the temporary worker ratio[1]. Second, this paper takes advantage of the availability of panel data, as we employ a panel fixed-effect model to account for unobserved firm heterogeneity. Although there are several related studies that address the above issues, most of these previous studies use cross-section data, probably due to the limited availability of data[2]. Third, this paper also addresses the quantitative evaluation of the effects of exporting on temporary workers to answer policymakers' questions concerning whether the use of temporary workers should be restricted or even prohibited.

Analysis on the Japanese economy might be enlightening because Japanese manufacturing firms face severe international competition from surrounding low-wage countries such as China. In addition, because the labor market in Japan is known to have very rigid institutions, firms in Japan may respond to foreign shock and adjust their employment differently than firms from countries with a flexible labor market.

The rest of our paper is structured as follows: section 2 briefly explains our data and presents an overview. After explaining the empirical strategies and variable definitions in section 3, the estimation results are presented in section 4. Finally, we conclude our paper in section 5.

2. Data description and overview

[1] One exception is Tanaka (2012). He investigates the link between exporting and the temporary worker ratio by using propensity score matching and finds little evidence for an effect of exporting on the temporary worker ratio. However, his study focuses only on new exporters and does not examine the overall impact of exporting.

[2] Buch et al. (2009) use German panel data, but they focus exclusively on the relationship between exporting and sales volatility.

2.1 Data source

Our data come from the confidential micro database of the Kigyou Katsudou Kihon Chousa Houkokusho (the Basic Survey of the Japanese Business Structure and Activities: BSJBSA), which is prepared annually by the Research and Statistics Department of the Ministry of the Economy, Trade, and Industry (METI). This survey was first conducted in 1991 and has been conducted annually since 1994. The main purpose of the survey is to statistically capture the overall picture of Japanese corporate firms in light of their activities that pertain to diversification, globalization and strategies for both research and development and information technology. The strengths of this survey are the sample coverage and the reliability of its information. Indeed, the survey is compulsory for firms with more than 50 employees and with capital of more than 30 million yen in both manufacturing and non-manufacturing industries (although some non-manufacturing industries, such as construction, medical services and transportation services, are not included). One limitation is that some information on firms' financial and institutional features is not available; another issue is that small firms with fewer than 50 workers are excluded.

The BSJBSA survey also provides the number of employees by their types of employment status, such as regular workers, part-time workers and day workers. After 2000, the number of temporary agency workers becomes available. Regular workers tend to continue working for the same company for longer periods of time; thus, firms often provide them opportunities to participate in on- and off-the-job training programs. In contrast, part-time workers, day workers, and temporary-agency workers are not expected to continue working for long periods and do not have enough opportunities to take training programs. The distinction among part-time workers, day workers, and temporary-agency workers is reflected in their contracts: whereas part-time workers and day workers are hired directly by a firm, temporary-agency workers are employed indirectly via temporary staffing agencies. For temporary-agency workers, firms do not have to negotiate their contracts individually; therefore, temporary-agency workers' positions are less stable and they are more likely to be laid-off[3].

2.2Data overview

In this subsection, we present some preliminary findings on the temporary worker ratio, the export participation ratio and the sales volatility. First, Table 2 presents

[3] The Cabinet Office (2009) reports the hypothetically calculated unemployment rate by employment status and points out that the unemployment rate for temporary-agency workers is higher and fluctuates more than the unemployment rates of regular workers and other non-regular workers.

the part-time worker ratio, the day worker ratio and the temporary-agency worker ratio. Because the information on temporary-agency workers is only available after 2000, we calculate the ratio from 2000 to 2009. Whereas the part-time worker ratio and the day worker ratio do not fluctuate very much, the temporary-agency worker ratio has an upward trend until 2007 and decreases from 2007 to 2009. Although these three kinds of workers are often collectively called temporary workers, we focus exclusively on temporary-agency workers in our econometric analysis.

<Table 2>

Table 3 presents the export participation ratio, the share of exports in total sales and the temporary-agency worker ratio by export status. Column (1) and column (2) in table 3 present the export participation ratio and the share of export sales[4]. Both statistics have an upward trend, which suggests that exports' extensive margin and intensive margin have been increasing in the 2000s. A comparison of the temporary-agency worker ratio by exporting status shows that exporters have increased their overall temporary-agency worker ratio at a faster pace. Whereas the temporary-agency worker ratios for non-exporters and exporters in 2000 are both 2.3%, those ratios in 2007 are 8.4% and 9.1%, respectively.

<Table 3>

Next, to link the evidence from macro-level findings to the evidence from micro-data, we decompose the temporary-agency worker ratio (Tmp_t) as a weighted average of the micro-level temporary-agency worker ratio (Tmp_{it}); to accomplish this decomposition, we emulate the method of Bernard and Jensen (1997). We define the macro-level temporary-agency worker ratio as follows:

$$Tmp_t = \sum_i s_{it} \cdot Tmp_{it},$$

where s_{it} is the market share in terms of employment for firm *i* in year *t*. Then, the change in the macro-level temporary-agency worker ratio from *t*-1 to *t*, which is denoted$\Delta\ Tmp_t$, is decomposed into the following three factors:

[4] Note that the export participation ratio is relatively high compared to other previous studies that use plant-level data, such as Bernard and Jensen (1997) and Matsuura et al. (2010), because our data do not include firms with fewer than 50 employees.

$$\Delta\, Tmp_t = \sum_i s_{it-1}\, \Delta\, Tmp_{it} + \sum_i Tmp_{it-1}\, \Delta\, s_{it} + \sum_i \Delta\, Tmp_{it}\, \Delta\, s_{it}.$$

The first term on the right-hand side of the above equation is a weighted average of each firm's change in its temporary-agency worker ratio, and the second term on the same side is the effect of the share change weighted by the initial market share. Finally, the third term is the cross product of the change in both shares; this term will increase if there are many firms that have increases in both their temporary-agency worker ratios and their market shares. These three terms are usually called the within effect, the between effect and the cross effect, respectively. Moreover, each term can be further decomposed into subgroups that contain the contributions from exporters and non-exporters, as follows:

$$\begin{aligned}\Delta\, Tmp_t = &\sum_{i\in non-exporter} s_{it-1}\, \Delta\, Tmp_{it} + \sum_{i\in exporter} s_{it-1}\, \Delta\, Tmp_{it} \\ &+ \sum_{i\in non-exporter} Tmp_{it-1}\, \Delta\, s_{it} + \sum_{i\in exporter} Tmp_{it-1}\, \Delta\, s_{it} \\ &+ \sum_{i\in non-exporter} \Delta\, Tmp_{it}\, \Delta\, s_{it} + \sum_{i\in exporter} \Delta\, Tmp_{it}\, \Delta\, s_{it}\end{aligned}$$

Table 4 presents the results of the decomposition of the change in the macro-level temporary-agency worker ratio. We calculate the decomposition in two periods before and after the Lehman shock, namely, from 2000 to 2007 and from 2007 to 2009. Two things are noteworthy: first, a large part of the changes in the macro-level temporary-agency worker ratio can be explained by the within effect in both periods. For the period from 2000 to 2007, the within effect accounts for 5.2% of the total change, which amounted to 6.5%. Similarly, after the Lehman shock, almost all of the changes can be explained by the within effect. These findings suggest that within-firm changes in the share of temporary-agency workers are the main driver for the recent macro-level increases in the temporary-agency worker ratio. Thus, it is vital to focus on the within-firm changes in the regression analysis.

Second, after a close examination of the exporter and non-exporter decomposition, it is clear that more than half of the within effect can be explained by exporters both before and after the Lehman shock. For example, for the periods before

the Lehman shock, 67% of the within effect (0.67 = 3.5% point/5.2% point) is attributable to exporters. This result implies that there may be some links between the changes in the temporary-agency worker ratio and firms' exporting status.

<Table 4>

Finally, we check the trends in sales volatility at the firm level. For the definition of sales volatility, we follow the approaches proposed by previous studies, such as Comin and Mulani (2006), Comin and Philippon (2006), Morikawa (2010), Ono and Sullivan (2008) and Asano et al. (2011). We assume that the sales growth, which is denoted gs_{it}, follows a first-order autoregressive process and estimate the following equation:

$$gs_{it} = \alpha + \rho gs_{i,t-1} + \gamma_t + \mu_i + \upsilon_{it}, \qquad (1)$$

where γ_t denotes the time-fixed effect and μ_i captures the firm-specific time trends. As a sales growth volatility measure, Vol_{it} is calculated as the standard deviation of the residual of the growth equation. We estimate equation (1) by a rolling regression with a five-year window. Because our original data covers the period from 1994 to 2009, we are able to calculate the sales growth volatility measure at the firm level from 1999 to 2000. Figure 2 compares the sales volatility by firms' sizes. Two aspects of this figure are noteworthy: first, the levels of sales volatility differ substantially among the firms' size categories: whereas the sales volatility for firms with fewer than 300 employees is the highest, firms with more than 1000 employees have a smaller sales volatility. Second, smaller firms and larger firms have different trends in their sales volatility in our sample period. Smaller firms' sales volatility fluctuated around 12-13%. However, larger firms have significant upward trends in their sales volatility.

<Figure 2>

Panel (A) in Table 5 compares the sales growth volatility of exporters and non-exporters and shows that both the levels and the trends of sales growth volatility do not differ by export status. However, after closely examining the sales growth volatility by export share category in panel (B) of table 5, a different pattern emerges. Whereas firms with smaller export shares face smaller sales growth volatility than non-exporters, their sales growth volatility will increases as their export share rises. For example, the

sales growth volatility of exporters with an export share that is less than 25% is 0.121, which is smaller than the same volatility for non-exporters (0.128). However, the sales growth volatility for exporters with an export share that is greater than 25% exceeds the level of sales growth volatility for non-exporters. This finding seems consistent with the prediction made by Vannoorenberghe (2012).

<Table 5>

3. The empirical strategy and variable definitions

To assess the relationship between the sales growth volatility and the temporary-agency worker ratio, we use two approaches in this paper. First, to investigate the effect of exports on the sales volatility, we perform a regression on the sales volatility of firm *j* on an exporter dummy, the export share, and various other firm characteristics. The equation to be estimated is as follows:

$$Vol_{it} = \beta_0 + \beta_1 Exp_{it-1} + \beta_2 ES_{it-1} + X_{it-1}\gamma + \mu_i + \upsilon_{it}, \quad (2)$$

where Vol_{it} is the sales growth volatility measure for firm *i* in year *t*. Additionally, *Exp* and *ES* are the exporter dummy and the share of exports in the total sales of firm *i* in year *t*, respectively, and X_{it-1} is a vector of firm-specific controls. The signs of β_1 and β_2 will be negative and positive, respectively, because, as we discuss in section 2, exporters are able to interchange domestic sales and foreign sales. As a result, exporters' sales volatility will decrease when they start exporting. However, as the export intensity increases, firms face greater foreign demand shock and the total sales volatility will increase. Thus, we expect β_1 to become negative and β_2 to become positive. For the other explanatory variable, namely, X_{it-1}, we include the number of employees, the average wage, the capital-labor ratio, the number of establishments and the firm's age. We also control for the year-fixed effects. All of the independent variables are logged and taken lag one year. In our framework, it is possible that firms adjust their export share to reduce the effect of the total demand shock. Therefore, the coefficients for the exporting status and the export share may suffer from an endogenous bias. To account for concerns of reverse causality, we use the lagged exporting status, the export share and the firm-level effective exchange ratio[5] as instrument variables.

[5] The firm-level effective exchange ratio is calculated as follows: first, we use the exchange rate by country and the industry-level export share to calculate the effective exchange rate by industry and by region; the regions are East Asia, North America and Europe. Second, using the share of exports in each region and at the firm level, we construct the firm-level effective exchange rate.

Second, to explore the relationship between the temporary-agency worker ratio and the sales volatility, we perform a regression on the temporary-agency worker ratio, on various firm characteristics and on the expected sales growth ratio and sales volatility.

$$Tmp_{it} = \beta_0 + \beta_1 Egs_{it} + \beta_2 Vol_{it-1} + X_{it-1}\gamma + \mu_i + \upsilon_{it} \qquad (3)$$

where $Egs_{it}(= E[gs_{it}])$ is the expected sales growth rate, which is defined as the predicted value of equation (1). We expect β_1 to become negative, as firms hire more temporary agency workers when their expected sales growth ratio *Egs* is lower to avoid future lay-offs of regular workers. In contrast, β_2, which is the coefficient of the sales growth volatility, is expected to be positive, as firms that face a higher sales volatility tend to use temporary-agency workers. As Ono and Sullivan (2008) suggest, the sales growth volatility will significantly affect the temporary-agency worker ratio when the firing cost is high. This effect implies that those firms that have higher fixed employment costs tend to use more temporary-agency workers as their sales growth volatility increases. To test this prediction, we restrict our sample to those firms that have a high fixed employment cost. Following Yamamoto and Matsuura (2012), we assume that firms with higher fixed employment costs do not change their regular workers as often. We define high-fixed-employment-cost firms as those firms that are at least 30 years old and that have a relative volatility indicator for regular employees[6] that is below the median. As for the detailed definition of variables and their basic statistics, see Table A1 in the Appendix. However, we would like to note is that due to the data availability of the temporary-agency worker ratio and the sales growth volatility, our sample periods range from 2000 to 2009.

4. Estimation Result

4.1 The impact of foreign shock on the sales growth volatility

Table 6 presents the estimation result for equation (2). Whereas the columns from (1) through (4) are OLS estimates, columns (5) and (6) are estimated by the IV fixed-effect model. Four things in Table 6 are noteworthy. First, whereas the export status has a negative and significant coefficient, the export share has a positive impact on the sales growth volatility. This result does not change even when we control for the

[6] A firm's relative volatility indicator for regular workers is calculated as the ratio of the standard deviation for regular employees to the amount of total sales. A smaller relative volatility indicator implies that a firm does not change the number of its employees.

firm-fixed effects, as in column (2), and other firm characteristics, as in column (3). The signs of these coefficients are consistent with our hypothesis: a negative coefficient for the export status dummy implies that the sales growth volatility will decrease due to substitution between domestic sales and foreign sales, and as a result, the sales growth volatility will decrease. Meanwhile, as the export intensity increases, exporters are exposed to greater foreign demand shock; thus, their sales growth volatility will increase. Second, based on the coefficients in column (3), the export share, above which exporters are more volatile than non-exporters, is roughly 17% (0.17=0.005/0.028). In fact, the average export share for exporters is around 12.9%, and there were 566 firms among the 2198 exporters in 2005 whose export share was above 17%, which suggests that only 25% of exporters have higher sales growth volatility than non-exporters. Third, after closely examining the IV estimates in column (5), the OLS estimates are found to be consistent with the IV estimates and robust even when we consider the exporting status and export share as endogenous variables. Finally, we check whether our results are robust or not by restricting our sample period from 2000 to 2007, as in columns (4) and (6). We determine that our major findings do not change very much.

<Table 6>

4.2 The relationship between the sales growth volatility and the use of the temporary-agency worker ratio

The estimation results for equation (3) are presented in table 7. Whereas column (1) contains only the year-fixed effects, both the firm-fixed effects and the year dummies are included in column (2). The coefficients for the expected sales growth *Egs* and the sales growth ratio *Vol* for both specifications are significantly negative and positive, respectively. These results are consistent with our prediction: whereas firms with higher sales growth volatility use more regular workers, firms that face higher sales volatility tend to depend on temporary-agency workers. However, we obtain contrasting results for the effect of foreign exposure with or without the firm-fixed effects. In column (1), which only controls for the year-fixed effects, both the export status and the export share have positive and significant effects. However, once the fixed effects are included as in column (2), the coefficients for both the export status and the export share become insignificant. These results imply that neither the export status nor the export intensity directly affect the temporary-agency worker ratio. The effect of foreign exposure on the use of temporary-agency workers may appear only through increases in the sales growth volatility. These findings do not change when

other firm characteristics are controlled for, as in column (3). In column (4), we restrict those firms with higher fixed employment costs. In comparison with the results in column (2) or column (3), the impact of *Vol* on the temporary-agency worker ratio becomes larger. This result suggests that because firms with higher fixed employment costs have higher firing costs, those firms extensively use temporary-agency workers as their sales growth volatility increases. In columns (5) and (6), we remove the samples that were taken after the financial crisis, as in Table 6. Although the coefficients of *Egs* and *Vol* become smaller in absolute value, the signs of these coefficients are consistent with our other results.

<Table 7>

4.3 Discussion

Finally, based on our estimation results, we conduct a quantitative evaluation of the effects of exporting on temporary-agency workers in order to answer the policy-makers' questions concerning whether the use of temporary agency workers should be restricted or even prohibited. To this point, we have discussed the links between the foreign demand shock through exports and the sales volatility and between the sales volatility and the temporary-agency worker ratio at the firm level. We confirm that there are significant statistical relationships between these factors. However, it is also important to determine whether there is a sizable effect. Using our regression estimates, we calculate to what extent exporting affects the use of temporary-agency workers. As we confirm in Table 2, the temporary agency worker ratio reached a peak in 2007; thus, we focus on the period from 2000 to 2007 in this subsection. Panel A in Table 8 shows that the magnitude of the impact of changes in the export share on the sales growth volatility is 0.0008, which explains only 12% (0.0008/0.007) of the average changes in the sales growth volatility for exporters. In Panel B, we calculate the impact of the changes in volatility on the temporary-agency worker ratio, which is 0.03% point. Compared with the changes in the temporary-agency worker ratio, which amounted to 6.7% point, the contribution of the changes in volatility is negligibly small at only 0.4% (0.0003/0.067). These results suggest that although there is a statistically significant link between the export share and the temporary-agency worker ratio that is caused by volatility, this link's impact is economically negligible.

<Table 8>

5. Conclusion

This paper examines whether there is any link between export openness and the temporary-agency worker ratio at the firm level. Initially, we investigate the effect of export openness on sales volatility using Japanese firm-level data. Next, we examine whether firms will increase their temporary-agency workers based on changes in the sales volatility; finally, we calculate to what extent changes in the temporary-agency worker ratio are attributable to the sales volatility that is caused by exporting. We find statistically significant evidence that the foreign demand shock, which affects firms through their exports, affects the sales volatility at the firm level. Furthermore, we find that increases in the sales volatility induce the extensive use of temporary-agency workers. For the latter relationship, we find that those firms that incur higher employment-fixed costs make extensive use of temporary-agency workers when the sales growth volatility rises. However, based on a quantitative evaluation of the effects of exporting on the temporary-agency worker ratio, the magnitude of the impact is quite small. Indeed, changes in the export share explain only 12% of the changes in volatility for exporters, and changes in the volatility account for only 0.4% of the changes in the temporary-agency worker ratio. We conclude that the impacts of firms' exporting status and export share on the temporary-agency worker ratio are statistically significant but economically negligible in size. Thus, it is not appropriate to assume that the cause of increases in the temporary-agency worker ratio is attributable to foreign shock through exporting.

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Table 1. Trends in the Temporary worker ratio by industry

	Whole Industry	Manufacturing	Finance	Wholesale and Retail	Restaurant	Hotel
1995	20.8%					
1996	21.5%	21.5%	14.3%	36.5%	57.7%	39.8%
1997	23.1%					
1999	23.5%	23.5%	14.9%	43.1%	71.6%	45.4%
2000	24.8%					
2001	25.8%	26.0%	19.7%	46.8%	75.0%	53.2%
2002	27.1%					
2003	29.4%					
2004	30.4%	29.6%	22.1%	49.1%	72.2%	51.2%
2005	31.4%					
2006	32.6%	30.9%	25.0%	49.7%	73.3%	52.8%
2007	33.0%					
2008	33.5%					
2009	34.1%					
2010	33.7%					

Source: The temporary worker ratios for the whole industry come from the Monthly Labor Survey (which is conducted by the Ministry of Health and Labor), and those ratios by industry are obtained from the Census of Establishment and Enterprises (Ministry of Internal Affairs and Communications)

Table 2. The temporary worker ratio by employment status in the manufacturing sector

Year	Part-time worker	Day worker	Temporary-agency worker	Total
2000	6.4%	0.9%	2.3%	9.7%
2001	6.4%	1.1%	2.5%	10.1%
2002	6.5%	1.0%	3.4%	10.9%
2003	6.7%	0.8%	4.2%	11.7%
2004	6.8%	0.7%	5.2%	12.7%
2005	6.6%	0.6%	6.5%	13.6%
2006	7.1%	0.7%	7.9%	15.7%
2007	7.2%	0.7%	8.8%	16.7%
2008	7.4%	0.5%	5.6%	13.6%
2009	7.4%	0.5%	4.4%	12.3%

Source: The author's calculation, which is based on the Basic Survey of the Japanese Business Structure and Activity (METI).

Table 3. The export participation ratio and the share of the export and temporary-agency worker ratios by export status

	Export participation ratio	Share of Export in Total Sales	Temporary-agency worker ratio	
			Non-exporters	Exporters
1999	29.7%	9.9%	N.A	N.A
2000	31.1%	11.0%	2.3%	2.3%
2001	31.5%	12.5%	2.7%	2.4%
2002	32.1%	13.1%	3.6%	3.4%
2003	32.9%	13.3%	4.2%	4.1%
2004	33.7%	13.4%	5.0%	5.3%
2005	33.9%	13.0%	6.1%	6.7%
2006	33.9%	12.7%	7.4%	8.1%
2007	34.0%	11.6%	8.4%	9.1%
2008	34.3%	12.2%	5.5%	5.7%
2009	35.0%	14.6%	4.5%	4.4%

Source: The author's calculation, which is based on the Basic Survey of the Japanese Business Structure and Activity (METI).

Table 4. The decomposition of changes in the macro-level temporary-agency worker ratio

		Changes in ratio temporary worker ratio	Within effect	Between effect	Cross effect
2000-2007		6.5%	5.2%	0.1%	1.2%
	Exporers		3.5%	0.0%	0.5%
	Non-exporter		1.7%	0.1%	0.6%
2007-2009		-4.4%	-4.5%	-0.7%	0.7%
	Exporers		-2.9%	-0.3%	0.3%
	Non-exporter		-1.5%	-0.4%	0.4%

Source: The author's calculation, which is based on the Basic Survey of the Japanese Business Structure and Activity (METI).

Table 5. The average sales volatility by export status and export share

Panel A. The average sales volatility by export status

	Non-exporters	Exporters
1999	0.107	0.099
2000	0.116	0.110
2001	0.126	0.125
2002	0.130	0.131
2003	0.133	0.133
2004	0.132	0.134
2005	0.129	0.130
2006	0.127	0.127
2007	0.119	0.116
2008	0.124	0.122
2009	0.147	0.146

Panel B. The average sales volatility by export share category

Non-exporters	0.128
0%< Export Share <=25%	0.121
25%< Export Share <=50%	0.144
50%< Export Share <=75%	0.187
75%< Export Share <=100%	0.200

Note: The sales growth volatility is the standard deviation of the residual of the growth equation.

Source: The author's calculation, which is based on the Basic Survey of the Japanese Business Structure and Activity (METI).

Table 6. The determinants of sales growth volatility at the firm level

		(1)	(2)	(3)	(4)	(5)	(6)
		OLS	OLS	OLS	OLS	IV	IV
		2000-2009	2000-2009	2000-2009	2000-2007	2000-2009	2000-2007
Exp (Export Status), t-1		-0.014	-0.005	-0.005	-0.007	-0.009	-0.014
		[0.001]***	[0.001]***	[0.001]***	[0.002]***	[0.003]***	[0.004]***
ES (Export share), t-1		0.102	0.028	0.028	0.024	0.025	0.033
		[0.005]***	[0.007]***	[0.007]***	[0.008]***	[0.014]*	[0.018]*
ln *labor*, t-1				-0.0067	-0.0018	-0.0059	-0.001
				[0.002]***	[0.002]	[0.002]***	[0.002]
ln *wage*, t-1				0.005	0.006	0.005	0.006
				[0.001]***	[0.001]***	[0.001]***	[0.001]***
ln *# of establishment*, t-1				0.004	0.004	0.005	0.005
				[0.001]***	[0.001]***	[0.001]***	[0.001]***
ln *KL ratio*, t-1				-0.014	-0.013	-0.013	-0.013
				[0.001]***	[0.002]***	[0.001]***	[0.002]***
R&D intensity, t-1				0.041	0.054	0.041	0.055
				[0.019]**	[0.020]***	[0.019]**	[0.020]***
ln Age				-0.047	-0.011	-0.048	-0.011
				[0.007]***	[0.009]	[0.007]***	[0.009]
Const		0.116	0.117	0.331	0.172	0.332	0.167
		[0.001]***	[0.001]***	[0.029]***	[0.033]***	[0.029]***	[0.034]***
Year dummy		YES	YES	YES	YES	YES	YES
Firm Fixed Effect		NO	YES	YES	YES	YES	YES
F test for 1st	*Exp*					761.85	476.70
stage regression	*ES*					1009.22	620.83
R2		0.0132	0.0152	0.0183	0.0126		
Number of Sample		63095	63095	63095	50312	61890	49351

Note: The figures in brackets are the standard errors. ***,** and * indicates statistical significance at the 1%, 5% and 10% levels, respectively.

Table 7. The Determinants of the Temporary-agency worker ratio at the firm level

	(1)	(2)	(3)	(4)	(5)	(6)
	All firms	All firms	All firms	high fixed cost firms	All firms	high fixed cost firms
	2000-2009	2000-2009	2000-2009	2000-2009	2000-2007	2000-2007
Egs, t	-0.1268	-0.0566	-0.0607	-0.0517	-0.0307	-0.0235
	[0.010]***	[0.007]***	[0.007]***	[0.009]***	[0.007]***	[0.010]**
Vol, t-1	0.0589	0.0093	0.0097	0.0147	0.0049	0.0124
	[0.003]***	[0.003]***	[0.003]***	[0.004]***	[0.004]	[0.005]**
Exp (Export Status), t-1	0.0049	0.0017	0.0019	0.00	0.00	0.00
	[0.001]***	[0.001]	[0.001]	[0.002]	[0.001]	[0.002]
ES (Export share), t-1	0.0089	-0.0048	-0.0044	-0.0102	0.0004	-0.0027
	[0.003]***	[0.006]	[0.006]	[0.008]	[0.007]	[0.009]
ln *labor*, t-1			-0.0147	-0.0088	-0.0034	0.0122
			[0.002]***	[0.003]***	[0.002]*	[0.004]***
ln *wage*, t-1			0.0093	0.0114	0.0106	0.0113
			[0.001]***	[0.002]***	[0.001]***	[0.002]***
ln *# of establishment*, t-1			0.002	0.0002	0.0012	-0.0013
			[0.001]**	[0.001]	[0.001]	[0.001]
ln *KL ratio*, t-1			0.0042	0.0042	0.0057	0.0069
			[0.001]***	[0.001]***	[0.001]***	[0.002]***
R&D intensity, t-1			-0.001	-0.0124	-0.0022	-0.0074
			[0.015]	[0.030]	[0.017]	[0.036]
ln Age			0.0243	-0.01	0.0777	0.132
			[0.006]***	[0.024]	[0.007]***	[0.032]***
Const	0.0011	0.0216	-0.0222	0.0767	-0.2725	-0.5818
	[0.002]	[0.002]***	[0.024]	[0.098]	[0.029]***	[0.124]***
Year dummy	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	NO	YES	YES	YES	YES	YES
R2	0.073	0.1007	0.0718	0.0668	0.0886	0.0792
Number of Sample	63095	63095	63095	27906	50312	21972

Note: The figures in brackets are standard errors. ***,** and * indicates statistical significance at the 1%, 5% and 10% levels, respectively.

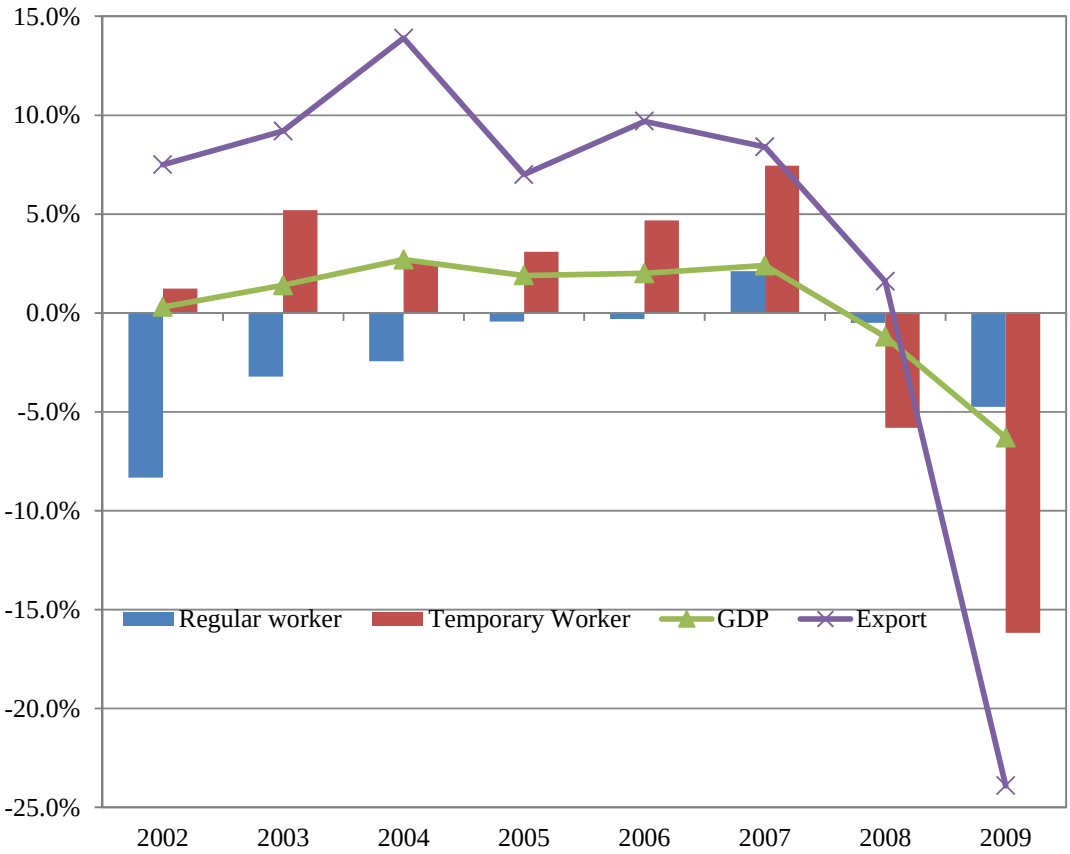
Table 8. The magnitude of the Impact of changes in the export share on the temporary worker ratio

	Panel A		Panel B	
	The Impact of *ES* on *Vol*		The impact of *Vol* on *Tmp*	
	Vol	ES_{t-1}	*Tmp*	Vol_{t-1}
2000	0.110	9.9%	2.3%	0.098
2007	0.116	12.7%	9.1%	0.126
Difference	0.007	2.8%	6.7%	0.028
Coefficient		0.028		0.0097
Maginitude of Impact		0.0008		0.0003

Note.

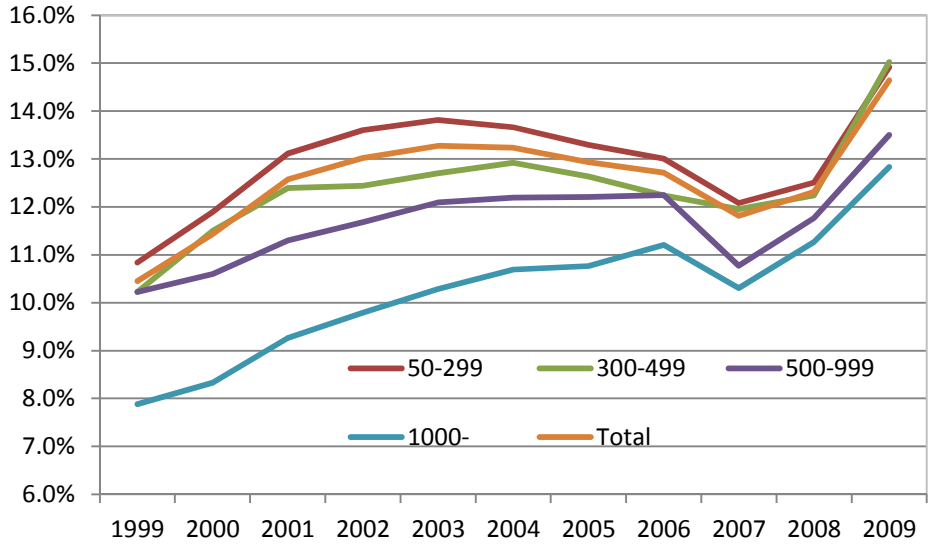
The coefficient for *ES* comes from column (3) in Table 6, and the coefficient for *Vol* comes from column (3) in Table 7. *Vol* and *Tmp* are the average values for exporters.

Figure 1. The growth rate of GDP, Exports, Regular workers and Temporary workers



Source: GDP and Export are obtained from the System of National Accounts (Cabinet Office), and the number of regular workers and temporary workers come from the Census of Manufacturers (METI).

Figure 2. Trends in the average sales growth ratio by firm size



Note: The sales growth volatility is the standard deviation of the residual of the growth equation.

Source: The author's calculation, which is based on the Basic Survey of the Japanese Business Structure and Activity (METI).

Table A1. Definitions of the variables and Basic statistics

Variables	Definition	N	mean	sd	p10	p90
Tmp	Temporary-agency worker ratio	63,095	0.139	0.164	0.000	0.362
Egs	Expected sales growth rate	63,095	-0.015	0.075	-0.134	0.052
Vol	Standard deviation of the residuals of the growth equation	63,095	0.124	0.113	0.039	0.240
Exp (Export Status)	Export dummy	63,095	0.329	0.470	0.000	1.000
ES (Export share)	Ratio of export to sales	63,095	0.041	0.114	0.000	0.134
ln *labor*	logged number of employees	63,095	5.333	1.027	4.290	6.680
ln *wage*	logged wage	63,095	1.602	0.375	1.143	2.032
ln *# of establishment*	logged number of establishment	63,095	1.261	1.048	0.000	2.639
ln *KL ratio*	logged capital-labor ratio	63,095	2.021	1.005	0.936	3.107
R&D intensity	Ratio of R&D expendisture to sales	63,095	0.011	0.026	0.000	0.036
ln Age	logged firm age	63,095	3.796	0.404	3.296	4.174