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Abstract

Japan experienced rapid growth in non-regular workers under globalization in the 2000s. This study seeks to identify the causal effects of exporting on the growth in labor and the share of non-regular workers in the Japanese manufacturing and wholesale sectors using extensive firm-level data. I employed a propensity score matching technique and investigated whether firms that start exporting experience higher growth in labor and the share of non-regular workers than do non-exporters. I found positive effects of exporting on labor growth in manufacturing, but, in general, there was little evidence for the effects on the share of non-regular workers in both sectors, although exporting to single regions had positive effects on the share of dispatched workers.

*Keywords*: exporting; non-regular workers; firm heterogeneity
*JEL classification*: F16, J31, L81

# 1 Introduction

Japan has experienced rapid growth in the share of non-regular workers in the 2000s under globalization.[*1] The share of non-regular workers has grown rapidly from 26.0% in 2000 to 33.7% in 2010.[*2] Some have argued that this rapid growth of non-regular workers was partly caused by globalization.

To examine this argument, this study seeks to identify the causal effect of exporting on the share of non-regular workers using extensive Japanese firm-level data. I employ a propensity score matching technique and investigate whether firms that start exporting experience an increase in the share of non-regular workers compared with non-exporters. Unlike previous studies, this work examines the effects of exporting in not only manufacturing but also the wholesale sector, in which many firms conduct exporting.[*3]

Countering the above argument, I find little evidence that export-starters in either sector have a greater growth in the share of non-regular workers than do non-exporters. Japanese manufacturing firms that started exporting between 2003 and 2005 experienced a greater labor growth, but not a greater growth in the share of non-regular workers, than did non-exporters. In contrast to manufacturing, the wholesale sector did not experience higher labor growth. Wholesale firms have increased their share of non-regular workers more than non-exporters did, but the effects of exporting disappeared three years after starting exporting.

The remainder of this paper is divided into six sections. In Section 2, I discuss a possible link between exporting and the share of non-regular workers under the current situation in the Japanese labor market. In Section 3, I introduce my empirical strategy. In Section 4, I briefly describe the data and variables used in this paper and present descriptive statistics of the data. In Section 5, I present the estimation result of firms' decisions to start exporting. In Section 6, I report the causal effects of exporting. The summary and conclusion are presented in the final section.

[*1] According to the World Bank's *World Development Indicators 2010*, in Japan, the share of exports in GDP grew to 17.60% in 2007 from 10.99% in 2000.

[*2] *Labour Force Survey* by the Japanese Statistics Bureau of the Ministry of Internal Affairs and Communications.

[*3] Bernard et al. (2010) revealed that wholesalers accounted for 10% of the 2002 U.S. exports.

## 2 Japanese labor market and the effects of exporting

In Japan, firms can employ both regular and non-regular workers. Non-regular workers consist of part-time and dispatched workers. Firms can employ dispatched workers, even in manufacturing after deregulation in 2004.[*4] Average wage of non-regular workers is lower than that of regular workers. Hiring costs are also relatively low for both types of non-regular workers as compared with regular workers. Firms can easily fire non-regular workers because such workers have short employment terms. Thus, the labor market for the non-regular workers can be regarded as less frictional as compared with the market for regular workers.

Dispatched workers differ from part-time workers in several ways. The most important difference is that dispatched workers are employed indirectly via intermediary agents by firms that pay fees to the agents,[*5] while part-time workers are employed directly by firms. Another difference is that dispatched workers work more hours per day than do part-time workers. In some firms, dispatched workers perform the same tasks as regular workers do but earn much lower wages.

The relationship between exporting and the share of non-regular workers has yet to be examined. Several theoretical studies, such as Helpman et al. (2010), consider the relationship between exporting and workers at home, assuming an imperfect labor market.[*6] However, those studies did not consider the relationship between exporting and the share of non-regular workers. In addition, no studies examine the effects of exporting in the wholesale sector. This study attempts to provide the first evidence of a relationship between exporting and the share of non-regular workers in both the manufacturing and wholesale sectors.

The relationship between exporting and the share of non-regular workers is unclear. Exporting may decrease the ratio of non-regular workers to total labor because it requires skilled workers, and non-regular workers are less skilled than regular workers.[*7]

[*4] Asano et al. (2011) provide a more detailed explanation.

[*5] The agents pay wages to dispatched workers from the fee. The average ratio of the fee to the wage received by the workers was approximately 1.47 in 2008, which is calculated based on the Japanese Ministry of Health, Labor and Welfare's *General Survey on Dispatched Workers*.

[*6] Research on the relationship between trade and wage has a long tradition. Harrison et al. (2010) surveys recent developments.

[*7] The average wages of non-regular workers are much lower than those of regular work-

On the other hand, exporting firms may require a higher ratio of non-regular workers because they face the high volatility of export sales. These firms may prefer non-regular workers because they can fire non-regular workers easily once their export sales drop.[*8] In addition, firms that export their products to low-wage countries may need non-regular workers because their wage is lower than regular workers.

The effects of exporting on the growth of labor are also unclear. Exporting may bring about an increase in labor as a whole in manufacturing simply because exporting firms require more labor to produce products for foreign markets. However, I cannot predict whether exporting increases labor in the wholesale sector. Most wholesale firms may not require additional labor for exports because they do not produce products themselves but instead procure and export products produced by manufacturing firms.

In sum, the Japanese labor market consists of different types of workers, and the effects of exporting on Japanese workers are theoretically unclear. Thus, the impact of exporting on labor and the share of non-regular workers in Japan are empirical issues requiring the analysis of disaggregate firm-level data.

# 3 Empirical strategy: propensity score matching

To evaluate the causal effects of exporting on the growth of labor and the growth of the share of non-regular workers, I use propensity score matching. Many previous studies in trade literature have employed this technique, including Wagner (2002) and Girma et al. (2004).

The causal effects of firm $i$'s exporting on the outcome variables, $\Delta y$, can be written as follows:

$$\Delta y^1_{i,t+s} - \Delta y^0_{i,t+s} \tag{1}$$

where $y$ are log of labor and the share of non-regular workers in my analysis. Superscript 0 refers to the non-treatment (non-exporting) case, and 1 refers to the treatment (switching to exporting) case. $t$ is the year of switching.

The fundamental problem of the causal inference is that $\Delta y^0_{i,t+s}$ is unobservable. I adopt propensity score matching techniques to construct an appropriate counterfactual that can be used instead of $\Delta y^0_{i,t+s}$. Using such

ers, as shown in Section 4.

[*8] Indeed, exporting firms fired many dispatched workers in Japan during the Great Recession from 2008 to 2009. This trend became an object of public concern.

techniques, I examine the average effect of treatment on the treated (ATT) as

$$\begin{aligned} \delta &= E(\Delta y^1_{i,t+s} - \Delta y^0_{i,t+s} | D_{it} = 1) \\ &= E(\Delta y^1_{i,t+s} | D_{it} = 1) - E(\Delta y^0_{i,t+s} | D_{it} = 1), \end{aligned} \tag{2}$$

where $D_{it}$ indicates whether firm $i$ started exporting for the first time in year $t$. Using propensity score matching techniques, I construct the counterfactual for the last term, $E(\Delta y^0_{i,t+s} | D_{it} = 1)$.

To construct the counterfactual, I first estimate the propensity score to start exporting:

$$\begin{aligned} P(D_{it} = 1) = F(&\ln TFP_{i,t-2}, \ln KAPINT_{i,t-2}, RDINT_{i,t-2}, \\ &\ln AGE_{i,t-2}, FOREIGN_{i,t-2}, MNE_{i,t-2}, \\ &\ln L_{i,t-2}, year, industry), \end{aligned} \tag{3}$$

where $F$ is a logistic cumulative distribution function. $TFP$, $KAPINT$, $RDINT$, $AGE$, $FOREIGN$, $MNE$, and $L$ are total factor productivity, capital intensity (capital-labor ratio), R&D intensity (R&D-sales ratio), firm age, share of foreign owners in stock, indicator variable for multinational enterprise, and labor, respectively. *year* and *industry* are year and industry fixed effects. The choice of explanatory variables follows from previous studies such as Hijzen et al. (2007) and Ito (2007).

Firms are matched with several matching methods. In the case of the nearest-neighbor (one-to-one) matching method with replacement, the non-exporter $c(i)$ that has the closest propensity score to start exporting is selected for each export starter $i$ as follows:

$$c(i) = \min_{j \in \{D_{jt}=0\}} ||\hat{P_{it}} - \hat{P_{jt}}||. \tag{4}$$

Firms are matched separately for each year and each two-digit industry. After constructing the control group by this matching, the ATT is estimated.

# 4 Data

I use firm-level data from *the Basic Survey of Japanese Business Structure and Activities* (BSJBSA) by the Japanese Ministry of Economy, Trade, and Industry (METI). In this study, I refer to this survey as "the METI survey." The survey covers both manufacturing and non-manufacturing industries. The targets of the METI survey are firms with more than 50 employees

Table 1: Firm types in Japan (2003–2005 cohorts)

| | Non-Exporters | Starters | Exporters | Others | Total |
|---|---|---|---|---|---|
| Manufacturing | 16,382 | 318 | 6940 | 15699 | 39,339 |
| Wholesale | 7623 | 80 | 2211 | 7548 | 17462 |
| Total | 24,005 | 398 | 9,151 | 23,247 | 56,801 |

Notes: The number of firms is based on three years balanced panel of cohort, which was originally constructed from Japanese firms' panel data for the period 2001 to 2008. Starters are defined a firms that started exporting between 2003 and 2005. Non-exporters are firms that did not export during the any of the six years, $[t-2, t+3]$, while exporters are firms that exported during all six years.

and more than 30 million yen in capital. The survey, therefore, excludes small firms. Nevertheless, it is the most comprehensive survey available for the purposes of my study, and it has been used by many studies including Nishimura et al. (2005), Kimura and Kiyota (2006), and Wakasugi et al. (2008).

### 4.1 Panel of cohort

Following Hijzen et al. (2011), I construct a three-year panel of cohort of switchers (i.e., firms that start exporting) and non-switchers from Japanese firms' panel data for the period of 2001 to 2008. Cohorts are defined as six-year windows, $[t-2, t+3]$, where $t$ is the year in which domestic non-exporters may start exporting. In my data, the switch year $t$ is in the range $[2003, 2005]$. I impose the condition that within a six-year window the panel is balanced.

Table 1 reports the total number of non-exporters, switchers, and exporters in my data. Switchers are firms that started exporting between 2003 and 2005. Non-exporters are firms that did not export during any of the six years, $[t-2, t+3]$, while exporters are firms that exported during all six years.

Exporting and first-time exporting are prevalent in manufacturing and wholesale sectors. I therefore restrict my analysis to these two sectors. My data set includes a total of 318 export-starters in manufacturing and 80 in wholesale.

Table 2: Country average of wage and hours worked in Japan (2008)

| | (A) wage per hour | (B) hours worked per year | (B) / 260 days hours worked per day |
|---|---|---|---|
| Regular worker | 2,712.1 | 1,995.1 | 7.7 |
| Part-time worker | 1,082.0 | 1,167.1 | 4.5 |
| Dispatched worker | 1,290.0 | 1,829.5 | 7.0 |

Notes: The data on regular and part-time workers are from the *Monthly Labour Survey*, while the data on dispatched workers are from the *General Survey on Dispatched Workers*.

### 4.2 Labor variables

As already mentioned, in Japan, firms can employ three types of workers: (i) regular workers, (ii) part-time workers, and (iii) dispatched workers. The wages of and hours worked by these three types of workers differ substantially. Table 2 reports the country average wage and hours worked of the three types of workers. It shows that regular workers work for longer hours than do part-time or dispatched workers and obtain more than twice the hourly wages. The difference between part-time and dispatched workers is that dispatched workers work for much longer hours than part-time workers. Regular workers, in turn, work for longer hours than dispatched workers.

I use total hours worked by all types of workers in Japan as a firm-level measure of labor, $L$. Labor does not include hours worked by employees in foreign affiliates. I use hours worked rather than the number of workers because hours worked vary substantially across the three types of workers.

I define the firm-level total hours worked ($L$) as the number of each type of workers multiplied by its average yearly hours worked as follows:

$$L = N_r \times H_r + N_p \times H_p + N_d \times H_d, \tag{5}$$

where $N$ and $H$ are the number of workers and the yearly total hours worked, respectively. The subscripts $r$, $p$, and $d$ indicate regular, part-time, and dispatched workers, respectively. The industry average yearly hours worked for regular employees and part-time workers are provided by the Japanese Ministry of Health, Labor and Welfare's *Monthly Labor Survey*, while the country average hours worked for dispatched workers are calculated as yearly wage divided by hourly wage, both of which are taken from the Ministry's *General Survey on Dispatched Workers*.

Tables 3 and 4 present the descriptive statistics of wage, labor, and workforce composition in manufacturing and wholesale for 2005. $NONREGR$,

Table 3: Descriptive statistics of labor variables in manufacturing (2005)

| | | $W_r$ (yen) | $L$ | $NONREGR$ (%) | $DISPATCHR$ (%) | $PARTR$ (%) |
|---|---|---|---|---|---|---|
| Non-exporter | Mean | 2804.4 | 548552.3 | 13.1 | 5.2 | 8.0 |
| | SD | 1201.9 | 1877998.0 | 16.3 | 9.6 | 13.7 |
| | N | 5412 | 5451 | 5451 | 5451 | 5451 |
| Export-starter | Mean | 3103.2 | 621310.2 | 11.8 | 6.3 | 5.6 |
| | SD | 1299.1 | 822760.9 | 12.2 | 10.4 | 8.1 |
| | N | 95 | 95 | 95 | 95 | 95 |
| Exporter | Mean | 3578.4 | 1991312.0 | 11.1 | 5.8 | 5.3 |
| | SD | 1364.8 | 6713637.0 | 11.6 | 8.7 | 8.6 |
| | N | 2311 | 2364 | 2364 | 2364 | 2364 |
| Total | Mean | 3036.8 | 980612.4 | 12.5 | 5.4 | 7.1 |
| | SD | 1301.8 | 4042340.0 | 15.0 | 9.4 | 12.4 |
| | N | 7818 | 7910 | 7910 | 7910 | 7910 |

Table 4: Descriptive statistics of labor variables in wholesale (2005)

| | | $W_r$ (yen) | $L$ | $NONREGR$ (%) | $DISPATCHR$ (%) | $PARTR$ (%) |
|---|---|---|---|---|---|---|
| Non-exporter | Mean | 2707.0 | 422859.8 | 10.0 | 2.0 | 8.0 |
| | SD | 825.2 | 870287.9 | 13.8 | 5.1 | 13.0 |
| | N | 2512 | 2516 | 2516 | 2516 | 2516 |
| Export-starter | Mean | 3276.2 | 735634.7 | 7.9 | 3.0 | 4.9 |
| | SD | 1084.8 | 2390070.0 | 7.9 | 4.9 | 7.2 |
| | N | 28 | 28 | 28 | 28 | 28 |
| Exporter | Mean | 3365.2 | 859055.1 | 7.2 | 3.7 | 3.6 |
| | SD | 995.7 | 3679521.0 | 8.6 | 5.3 | 7.3 |
| | N | 723 | 726 | 726 | 726 | 726 |
| Total | Mean | 2857.7 | 522381.4 | 9.4 | 2.4 | 7.0 |
| | SD | 910.7 | 1914609.0 | 12.9 | 5.2 | 12.1 |
| | N | 3263 | 3270 | 3270 | 3270 | 3270 |

$DISPATCHR$, and $PARTR$ are defined as

$$\begin{aligned} NONREGR &= \frac{N_p \times H_p + N_d \times H_d}{L} \times 100, \\ DISPATCHR &= \frac{N_d \times H_d}{L} \times 100, \text{ and} \\ PARTR &= \frac{N_p \times H_p}{L} \times 100, \end{aligned} \tag{6}$$

respectively. Assuming that both part-time and dispatched workers' wages are determined by the labor market outside any individual firm,[*9] I construct the firm-level hourly real wage of regular workers, $W_r$, as follows:

$$W_r = \frac{WC - N_p \times H_p \times W_p}{N_r \times H_r} \tag{7}$$

where $WC$ is the real wage cost of a firm from the METI survey and $W_p$ is the industry average hourly real wage of part-time workers from the *Monthly Labor Survey*. $WC$ only includes the real wage cost of regular and part-time workers.[*10]

In both sectors, wage of regular workers is on average highest in exporters, followed by export-starters. The wage is lowest in non-exporters. Similarly, exporters are on average the largest in terms of labor, export-starters are the second largest, and non-exporters are the smallest. Both results are consistent with the firm heterogeneity model of export but do not imply the causal effects of exporting on wage and labor.

As for the share of non-regular workers, the standard deviation is too large to determine any ordering, but on average, the share of dispatched workers is lower and share of part-time workers is higher in non-exporters than in export-starters and exporters in both sectors. This tendency results in a higher average share of non-regular workers in non-exporters than in export-starters and exporters.

### 4.3 The measurement of firm productivity

Next, I explain the measure of total factor productivity (TFP) used later in this study. I obtain Japanese parent firms' TFP from an estimated two-digit

[*9] This assumption is plausible, but it is well known that the hourly wages of part-time workers vary across regions in Japan. I, however, cannot control this region-effect because of a lack of the data.

[*10] Wages and wage cost are deflated by the industry deflator, which is taken from the Cabinet Office's *System of National Accounts (SNA) Statistics*.

industry-specific production function, using techniques from Levinsohn and Petrin (2003). I use transportation and package costs to proxy unobserved productivity shocks.[*11] For output, I use Japanese parent firms' real value added, which is deflated using the industry-level deflator. The value added in my data reflects a parent firm's domestic and export sales but not foreign affiliates' sales in host countries. I employ Japanese parent firms' hours worked (L) and fixed tangible assets (K) as inputs.

Following Arnold and Hussinger (2010), I use the relative TFP obtained by dividing the TFP estimates by the average TFP in the corresponding industry and year because I use TFP from various industries.

# 5 Decision to start exporting

To construct the control group, I first estimate the propensity score to start exporting using a sample of non-exporters and export-starters. Table 5 shows the estimation result of equation (3).

In both manufacturing and wholesale, R&D intensity and multinational status have large impacts on the decision to start exporting. As for productivity, the positive coefficients on TFP are statistically significant in wholesale, but not in manufacturing against the standard firm heterogeneity model. The insignificant coefficient of TFP in manufacturing is surprising, but it can be interpreted that R&D intensity and multinational status reflect the technological advantage required for exporting.

In wholesale, both the capital-labor ratio and firm size, measured as labor, have negative coefficients. This result suggests that smaller and labor-intensive firms are more likely to start exporting in wholesale.

# 6 Causal effects of exporting

## 6.1 Growth of labor

Constructing the counterfactual based on an estimated propensity score, I examine the causal effects of exporting. I present the results from the one and three nearest neighbor matching and the kernel matching. [*12] First, I investigate the effects on the growth of labor. Tables 6 and 7 report the results in manufacturing and wholesale, respectively. The results present a striking contrast between the two sectors. In manufacturing, I find positive

[*11] My data do not contain the costs of electricity, materials, or fuels.

[*12] The balancing property is satisfied for all matching.

Table 5: Decision to start exporting

| | (1) Manufacturing | (1) Wholesales |
|---|---|---|
| ln TFP (t-2) | 0.045 | 0.952*** |
| | [0.151] | [0.266] |
| ln KAPINT (t-2) | 0.036 | -0.220*** |
| | [0.069] | [0.082] |
| RDINT (t-2) | 12.060*** | 42.737*** |
| | [2.441] | [14.259] |
| ln AGE (t-2) | 0.135 | 0.058 |
| | [0.113] | [0.301] |
| FOREIGN (t-2) | 0.081 | 0.611 |
| | [0.493] | [0.645] |
| MNE (t-2) | 1.508*** | 1.151** |
| | [0.183] | [0.466] |
| ln L (t-2) | 0.083 | -1.015*** |
| | [0.173] | [0.336] |
| Year FE | Yes | Yes |
| Industry FE | Yes | Yes |
| Observations | 15876 | 7589 |
| Pseudo-R-squared | 0.108 | 0.077 |

Notes: Standard errors are shown in brackets. Constants are suppressed. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

effects of exporting on labor growth in the three years after starting exporting. On the other hand, in wholesale, I find no significant effects on labor growth.

Table 6: The causal effect of exporting on growth of labor in manufacturing

| Matching | | (1) Treated | (2) Controls | (3) ATT | (4) t-value | | (5) Bootstrapped t-value | | (6) Balancing property |
|---|---|---|---|---|---|---|---|---|---|
| One nearest neighbor | t+1 | 0.080 | 0.034 | 0.046 | 3.14 | ** | 2.58 | ** | Yes |
| | t+2 | 0.117 | 0.056 | 0.062 | 3.57 | ** | 2.82 | ** | Yes |
| | t+3 | 0.113 | 0.050 | 0.063 | 2.93 | ** | 2.51 | ** | Yes |
| Three nearest neighbors | t+1 | 0.080 | 0.037 | 0.042 | 3.51 | ** | 3.16 | ** | Yes |
| | t+2 | 0.117 | 0.066 | 0.051 | 3.62 | ** | 3.07 | ** | Yes |
| | t+3 | 0.113 | 0.058 | 0.055 | 3.18 | ** | 2.86 | ** | Yes |
| Kernel matching (bwith = 0.01) | t+1 | 0.080 | 0.034 | 0.046 | 3.14 | ** | 2.58 | ** | Yes |
| | t+2 | 0.117 | 0.056 | 0.062 | 3.57 | ** | 2.82 | ** | Yes |
| | t+3 | 0.113 | 0.050 | 0.063 | 2.93 | ** | 2.51 | ** | Yes |
| Kernel matching (bwith = 0.03) | t+1 | 0.080 | 0.034 | 0.046 | 3.14 | ** | 2.58 | ** | Yes |
| | t+2 | 0.117 | 0.056 | 0.062 | 3.57 | ** | 2.82 | ** | Yes |
| | t+3 | 0.113 | 0.050 | 0.063 | 2.93 | ** | 2.51 | ** | Yes |

Notes: The figures in columns (1) and (2) are the change from t-1 in the log of the variables. The number of treated firms is 315. The common support condition is imposed. ATT is the average treatment effect on the treated; bootstrapped t-values are based on 100 replications. Kernel matching uses the Epanechnikov kernel. ** and * indicate significance at the 5% and 10% levels, respectively.

Table 7: The causal effect of exporting on the growth of labor in wholesale firms

| Matching | | (1) Treated | (2) Controls | (3) ATT | (4) t-value | (5) Bootstrapped t-value | (6) Balancing property |
|---|---|---|---|---|---|---|---|
| One nearest neighbor | t+1 | 0.050 | 0.016 | 0.034 | 1.34 | 1.14 | Yes |
| | t+2 | 0.061 | 0.060 | 0.001 | 0.03 | 0.02 | Yes |
| | t+3 | 0.061 | 0.058 | 0.003 | 0.08 | 0.07 | Yes |
| Three nearest neighbors | t+1 | 0.050 | 0.046 | 0.004 | 0.20 | 0.17 | Yes |
| | t+2 | 0.061 | 0.077 | -0.017 | -0.64 | -0.51 | Yes |
| | t+3 | 0.061 | 0.089 | -0.028 | -1.03 | -0.70 | Yes |
| Kernel matching (bwith = 0.01) | t+1 | 0.050 | 0.016 | 0.034 | 1.34 | 1.14 | Yes |
| | t+2 | 0.061 | 0.060 | 0.001 | 0.03 | 0.02 | Yes |
| | t+3 | 0.061 | 0.058 | 0.003 | 0.08 | 0.07 | Yes |
| Kernel matching (bwith = 0.03) | t+1 | 0.050 | 0.016 | 0.034 | 1.34 | 1.14 | Yes |
| | t+2 | 0.061 | 0.060 | 0.001 | 0.03 | 0.02 | Yes |
| | t+3 | 0.061 | 0.058 | 0.003 | 0.08 | 0.07 | Yes |

Notes: The figures in columns (1) and (2) are the change from t-1 in the log of variables. The number of treated firms is 80. The common support condition is imposed. ATT is the average treatment effect on the treated; bootstrapped t-values are based on 100 replications. Kernel matching uses the Epanechnikov kernel. ** and * indicate significance at the 5% and 10% levels, respectively.

This sharp contrast between the two sectors in the effect of exporting on labor growth can be explained by the fundamental difference between manufacturing firms and wholesale ones. Basically, pure wholesale firms export goods purchased from manufacturing firms, while pure manufacturing ones export goods they produce themselves. Thus, manufacturing firms require additional labor to produce goods for exports, while wholesale firms do not require such additional labor for production. This narrative is consistent with the result that the significantly positive effects of exporting on labor growth are found only in manufacturing.

### 6.2 Share of non-regular workers

Next, I examine causal effects of exporting on the share of non-regular workers. First, Tables 8 and 9 report the effects on the share of dispatched workers in manufacturing and wholesale, respectively. In manufacturing, I do not find any effects of exporting on the share of dispatched workers. In wholesale, the effects of exporting on the share of dispatched workers are found to be positive in some cases two years after starting exporting. However, the statistical significance level is low and the effects disappeared the following year.

Table 8: The causal effect of exporting on growth of share of dispatched workers in manufacturing

| Matching | | (1) Treated | (2) Controls | (3) ATT | (4) t-value | (5) Bootstrapped t-value | (6) Balancing property |
|---|---|---|---|---|---|---|---|
| One nearest neighbor | t+1 | 1.563 | 1.255 | 0.308 | 0.47 | 0.40 | Yes |
| | t+2 | 1.942 | 1.999 | -0.057 | -0.08 | -0.07 | Yes |
| | t+3 | 1.685 | 2.268 | -0.582 | -0.77 | -0.59 | Yes |
| Three nearest neighbors | t+1 | 1.563 | 1.237 | 0.327 | 0.61 | 0.51 | Yes |
| | t+2 | 1.942 | 1.922 | 0.020 | 0.03 | 0.03 | Yes |
| | t+3 | 1.685 | 2.251 | -0.565 | -0.91 | -0.70 | Yes |
| Kernel matching (bwith = 0.01) | t+1 | 1.563 | 1.255 | 0.308 | 0.47 | 0.40 | Yes |
| | t+2 | 1.942 | 1.999 | -0.057 | -0.08 | -0.07 | Yes |
| | t+3 | 1.685 | 2.268 | -0.582 | -0.77 | -0.59 | Yes |
| Kernel matching (bwith = 0.03) | t+1 | 1.563 | 1.255 | 0.308 | 0.47 | 0.40 | Yes |
| | t+2 | 1.942 | 1.999 | -0.057 | -0.08 | -0.07 | Yes |
| | t+3 | 1.685 | 2.268 | -0.582 | -0.77 | -0.59 | Yes |

Notes: The figures in columns (1) and (2) are the change from t-1 in the variables (percentage). The number of treated firms is 315. The common support condition is imposed. ATT is the average treatment effect on the treated; bootstrapped t-values are based on 100 replications. Kernel matching uses the Epanechnikov kernel. ** and * indicate significance at the 5% and 10% levels, respectively.

Table 9: The causal effect of exporting on growth of share of dispatched workers in wholesale

| Matching | | (1) Treated | (2) Controls | (3) ATT | (4) t-value | | (5) Bootstrapped t-value | (6) Balancing property |
|---|---|---|---|---|---|---|---|---|
| One nearest neighbor | t+1 | 0.367 | -0.106 | 0.474 | 0.97 | | 0.73 | Yes |
| | t+2 | 0.903 | -0.151 | 1.054 | 1.95 | * | 1.34 | Yes |
| | t+3 | 0.709 | 0.064 | 0.644 | 0.89 | | 0.74 | Yes |
| Three nearest neighbors | t+1 | 0.367 | 0.437 | -0.070 | -0.16 | | -0.13 | Yes |
| | t+2 | 0.903 | 0.641 | 0.262 | 0.54 | | 0.40 | Yes |
| | t+3 | 0.709 | 0.666 | 0.043 | 0.06 | | 0.06 | Yes |
| Kernel matching (bwith = 0.01) | t+1 | 0.367 | -0.106 | 0.474 | 0.97 | | 0.73 | Yes |
| | t+2 | 0.903 | -0.151 | 1.054 | 1.95 | * | 1.34 | Yes |
| | t+3 | 0.709 | 0.064 | 0.644 | 0.89 | | 0.74 | Yes |
| Kernel matching (bwith = 0.03) | t+1 | 0.367 | -0.106 | 0.474 | 0.97 | | 0.73 | Yes |
| | t+2 | 0.903 | -0.151 | 1.054 | 1.95 | * | 1.34 | Yes |
| | t+3 | 0.709 | 0.064 | 0.644 | 0.89 | | 0.74 | Yes |

Notes: The figures in columns (1) and (2) are the change from t-1 in the variables (percentage). The number of treated firms is 80. The common support condition is imposed. ATT is the average treatment effect on the treated; bootstrapped t-values are based on 100 replications. Kernel matching uses the Epanechnikov kernel. ** and * indicate significance at the 5% and 10% levels, respectively.

Second, Tables 10 and 11 report the effects of exporting on the share of part-time workers. Again, I do not find any effects of exporting on the share of part-time workers in both sectors. The share of part-time workers in total labor in export starters did not show a statistically significant relative increase after the export-starting year as compared with those in the non-exporting control group.

To summarize, there is little evidence to suggest that exporting causes the increase in the share of non-regular workers in both the manufacturing and wholesale sectors. This result suggests that export-starters require highly skilled workers even under the high volatility of export sales; therefore, they do not increase the share of non-regular workers.

Table 10: The causal effect of exporting on growth of share of part-time workers in manufacturing

| Matching | | (1) Treated | (2) Controls | (3) ATT | (4) t-value | (5) Bootstrapped t-value | (6) Balancing property |
|---|---|---|---|---|---|---|---|
| One nearest neighbor | t+1 | 0.393 | -0.294 | 0.687 | 1.41 | 1.20 | Yes |
| | t+2 | 0.327 | 0.002 | 0.325 | 0.58 | 0.44 | Yes |
| | t+3 | 0.847 | 0.220 | 0.627 | 1.01 | 0.84 | Yes |
| Three nearest neighbors | t+1 | 0.393 | 0.231 | 0.162 | 0.40 | 0.31 | Yes |
| | t+2 | 0.327 | 0.430 | -0.102 | -0.21 | -0.17 | Yes |
| | t+3 | 0.847 | 0.565 | 0.281 | 0.61 | 0.46 | Yes |
| Kernel matching (bwith = 0.01) | t+1 | 0.393 | -0.294 | 0.687 | 1.41 | 1.20 | Yes |
| | t+2 | 0.327 | 0.002 | 0.325 | 0.58 | 0.44 | Yes |
| | t+3 | 0.847 | 0.220 | 0.627 | 1.01 | 0.84 | Yes |
| Kernel matching (bwith = 0.03) | t+1 | 0.393 | -0.294 | 0.687 | 1.41 | 1.20 | Yes |
| | t+2 | 0.327 | 0.002 | 0.325 | 0.58 | 0.44 | Yes |
| | t+3 | 0.847 | 0.220 | 0.627 | 1.01 | 0.84 | Yes |

Notes: The figures in columns (1) and (2) are the change from t-1 in the variables (percentage). The number of treated firms is 315. The common support condition is imposed. ATT is the average treatment effect on the treated; bootstrapped t-values are based on 100 replications. Kernel matching uses the Epanechnikov kernel. ** and * indicate significance at the 5% and 10% levels, respectively.

Table 11: The causal effect of exporting on growth of share of part-time workers in wholesale

| Matching | | (1) Treated | (2) Controls | (3) ATT | (4) t-value | (5) Bootstrapped t-value | (6) Balancing property |
|---|---|---|---|---|---|---|---|
| One nearest neighbor | t+1 | 0.088 | 0.640 | -0.552 | -0.72 | -0.51 | Yes |
| | t+2 | 0.214 | 0.921 | -0.707 | -0.87 | -0.62 | Yes |
| | t+3 | 0.779 | 0.996 | -0.217 | -0.28 | -0.17 | Yes |
| Three nearest neighbors | t+1 | 0.088 | 0.142 | -0.053 | -0.08 | -0.06 | Yes |
| | t+2 | 0.214 | 0.645 | -0.431 | -0.62 | -0.46 | Yes |
| | t+3 | 0.779 | 0.786 | -0.007 | -0.01 | -0.01 | Yes |
| Kernel matching (bwith = 0.01) | t+1 | 0.088 | 0.640 | -0.552 | -0.72 | -0.51 | Yes |
| | t+2 | 0.214 | 0.921 | -0.707 | -0.87 | -0.62 | Yes |
| | t+3 | 0.779 | 0.996 | -0.217 | -0.28 | -0.17 | Yes |
| Kernel matching (bwith = 0.03) | t+1 | 0.088 | 0.640 | -0.552 | -0.72 | -0.51 | Yes |
| | t+2 | 0.214 | 0.921 | -0.707 | -0.87 | -0.62 | Yes |
| | t+3 | 0.779 | 0.996 | -0.217 | -0.28 | -0.17 | Yes |

Notes: The figures in columns (1) and (2) are the change from t-1 in the variables (percentage). The number of treated firms is 80. The common support condition is imposed. ATT is the average treatment effect on the treated; bootstrapped t-values are based on 100 replications. Kernel matching uses the Epanechnikov kernel. ** and * indicate significance at the 5% and 10% levels, respectively.

Table 12: Export starters by destination in Japan (2003–2005 cohorts)

| | Asia | North America or Europe | Others | Total |
|---|---|---|---|---|
| Manufacturing | 59 | 55 | 17 | 318 |
| Wholesale | 11 | 6 | 3 | 80 |
| Total | 70 | 61 | 20 | 398 |

Notes: The number of firms is based on three years balanced panel of cohort, which was originally constructed from Japanese firms' panel data for the period 2001 to 2008. Starters are defined a firms that started exporting between 2003 and 2005. Non-exporters are firms that did not export during the any of the six years, $[t-2, t+3]$, while exporters are firms that exported during all six years.

### 6.3 Causal effects of exporting by destination

The effects of exporting can be different across export destinations. I, therefore, conduct analysis by destination. Table 12 presents the number of export-starters by destination: Asia, North (North America or Europe), and other regions. Total number of export-starters is larger than the sum of the number of export-starters to each destination since I exclude firms that started exporting to multiple regions from export-starters to each destination.

I present causal effects in manufacturing only, because the number of export-starters in wholesale is too small. I present results from one nearest neighbor matching only but results from other matching is qualitatively similar with those from one nearest neighbor matching.

Tables 13 and 14 report the effects of exporting to Asia and North regions. I do not find any effects of exporting on the growth of the share of part-time workers, while I find positive effects on the growth of labor for both regions. These results are consistent with previous ones.

I, however, find positive effects on the growth of the share of dispatched workers for both regions. These results are not consistent with previous results. This inconsistency can be partly explained by excluding firms that started exporting to multiple regions from the analysis. This implies that firms that started exporting to single regions need higher share of dispatched workers than non-exporters since they are highly vulnerable to volatility of exports sales.

Table 13: The causal effect of exporting to Asia in manufacturing (One nearest neighbor matching)

| Outcome | | (1) Treated | (2) Controls | (3) ATT | (4) t-value | | (5) Bootstrapped t-value | | (6) Balancing property |
|---|---|---|---|---|---|---|---|---|---|
| labor | t+1 | 0.141 | 0.008 | 0.132 | 3.84 | ** | 2.91 | ** | Yes |
| | t+2 | 0.201 | 0.017 | 0.184 | 4.47 | ** | 3.59 | ** | Yes |
| | t+3 | 0.206 | -0.024 | 0.230 | 4.39 | ** | 3.99 | ** | Yes |
| share of dispatched workers | t+1 | 3.271 | 1.045 | 2.226 | 1.28 | | 1.01 | | Yes |
| | t+2 | 5.075 | 1.840 | 3.236 | 1.65 | | 1.23 | | Yes |
| | t+3 | 4.282 | 0.274 | 4.008 | 2.02 | ** | 1.55 | | Yes |
| share of part-time workers | t+1 | -0.044 | -1.630 | 1.585 | 1.38 | | 1.53 | | Yes |
| | t+2 | -0.011 | -0.102 | 0.091 | 0.07 | | 0.07 | | Yes |
| | t+3 | -0.057 | 0.070 | -0.127 | -0.12 | | -0.10 | | Yes |

Notes: The figures in columns (1) and (2) are the change from t-1 in the variables (percentage). The number of treated firms is 59. The common support condition is imposed. ATT is the average treatment effect on the treated; bootstrapped t-values are based on 100 replications. ** and * indicate significance at the 5% and 10% levels, respectively.

Table 14: The causal effect of exporting to North America or Europe in manufacturing (One nearest neighbor matching)

| Outcome | | (1) Treated | (2) Controls | (3) ATT | (4) t-value | | (5) Bootstrapped t-value | | (6) Balancing property |
|---|---|---|---|---|---|---|---|---|---|
| labor | t+1 | 0.139 | -0.003 | 0.142 | 3.73 | ** | 3.13 | ** | Yes |
| | t+2 | 0.190 | -0.009 | 0.199 | 4.99 | ** | 4.04 | ** | Yes |
| | t+3 | 0.212 | -0.031 | 0.243 | 4.05 | ** | 3.94 | ** | Yes |
| share of dispatched workers | t+1 | 3.591 | 0.839 | 2.752 | 1.62 | | 1.49 | | Yes |
| | t+2 | 5.122 | 0.704 | 4.418 | 2.42 | ** | 2.13 | ** | Yes |
| | t+3 | 5.012 | 1.244 | 3.768 | 1.73 | * | 1.82 | * | Yes |
| share of part-time workers | t+1 | -0.373 | 0.755 | -1.128 | -1.28 | | -0.86 | | Yes |
| | t+2 | -0.238 | 0.241 | -0.480 | -0.35 | | -0.31 | | Yes |
| | t+3 | -0.488 | 0.802 | -1.289 | -1.02 | | -0.90 | | Yes |

Notes: The figures in columns (1) and (2) are the change from t-1 in the log of variables. The number of treated firms is 54. The common support condition is imposed. ATT is the average treatment effect on the treated; bootstrapped t-values are based on 100 replications. ** and * indicate significance at the 5% and 10% levels, respectively.

# 7 Conclusion

This study investigates whether exporting increases the growth of labor and the share of non-regular workers in Japan. I employ a propensity score matching technique and investigate whether firms that started exporting experienced higher growth of labor and higher growth of the share of non-regular workers than did non-exporters, using extensive Japanese firm-level data. First, I find positive effects on the growth of labor in manufacturing but not in wholesale. Second, contrary public fears, I find little evidence that exporting results in the increase in the share of non-regular workers in both manufacturing and wholesale. Third, I, however, find relative increase in the growth of the share of dispatched workers for firms that started exporting to Asia or North regions (North America or Europe) only than non-exporters. This suggests that firms that started exporting to single region needs higher share of dispatched workers since they are sensitive to volatility of export sales.

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# Appendix 1: descriptive statistics

Table 15: Descriptive statistics for logit estimation in manufacturing (2003-2005)

| variable | mean | sd | N | min | max |
|---|---|---|---|---|---|
| ln TFP (t-2) | -1.274 | 1.070 | 16460 | -7.315 | 4.950 |
| ln KAPINT (t-2) | -5.726 | 1.138 | 16460 | -14.780 | -0.669 |
| RDINT (t-2) | 0.004 | 0.014 | 16460 | 0.000 | 0.593 |
| ln AGE (t-2) | 3.531 | 0.602 | 16460 | 0.000 | 4.625 |
| FOREIGN (t-2) | 0.011 | 0.103 | 16460 | 0.000 | 1.000 |
| MNE (t-2) | 0.057 | 0.233 | 16460 | 0.000 | 1.000 |
| ln L (t-2) | 12.626 | 0.799 | 16460 | 11.316 | 18.373 |

Table 16: Descriptive statistics for logit estimation in wholesale (2003-2005)

| variable | mean | sd | N | min | max |
|---|---|---|---|---|---|
| ln TFP (t-2) | -0.894 | 0.905 | 7633 | -6.590 | 4.106 |
| ln KAPINT (t-2) | -5.904 | 1.380 | 7633 | -12.886 | -1.145 |
| RDINT (t-2) | 0.001 | 0.003 | 7633 | 0.000 | 0.057 |
| ln AGE (t-2) | 3.576 | 0.589 | 7633 | 0.000 | 4.654 |
| FOREIGN (t-2) | 0.013 | 0.115 | 7633 | 0.000 | 1.000 |
| MNE (t-2) | 0.036 | 0.187 | 7633 | 0.000 | 1.000 |
| ln L (t-2) | 12.512 | 0.753 | 7633 | 11.306 | 17.186 |