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Multinationals, Intrafirm Trade, and Employment Volatility

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Abstract

This paper examines the theoretically ambiguous relationship between the volatility of employment growth and the foreign exposure of firms. We employ unique Japanese firm-level data over the period 1994–2012. This allows us to investigate any differences in this relationship across multinational firms and trading and nontrading firms, manufacturing and wholesale trade, and intrafirm and interfirm trade. One major finding is that in manufacturing, employment volatility increases as the share of intrafirm exports to total sales increases. In contrast, in wholesale trade, employment volatility declines as the share of intrafirm imports to total imports increases. One possible interpretation of these results is that the transmission of foreign supply and demand shocks could be through not only manufacturing, but also wholesale trade firms. Further, a higher share of intrafirm trade could magnify foreign demand shocks in manufacturing, and could mitigate foreign supply shocks in wholesale trade.

Key words: Employment volatility; Multinational firm; Intrafirm trade; Wholesale trade

JEL classification codes: F1; F16; L25; L81

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"In an economy that is more open to foreign trade and investment, the demand for labor will generally be more responsive to changes in the price of labor, or more elastic. ... The flattening of labor demand curves as a consequence of globalization results in greater instability in labor market outcomes." – Rodrik (1997, p. 16 and p. 19)

1 Introduction

Increased labor demand elasticities have important labor market consequences. As Rodrik (1997) noted, one of the main concerns is the relationship between foreign exposure and employment volatility, such that firms exposed to foreign demand and/or supply are expected to have higher labor demand elasticities. For example, trade liberalization could result in greater product market competition, which results in higher labor demand elasticities (e.g., Rodrik, 1997). Offshoring could also increase the substitution between foreign and domestic workers, which further flattens the labor demand curve (e.g., Senses, 2010). Thus, it is widely believed by the public that employment in firms with greater foreign exposure tends to be more volatile than the employment of domestic firms.

If firms are risk neutral, whether employment volatility is high or not does not seem to be a problem, providing that there are no labor adjustment costs. However, when firms face high labor adjustment costs, higher employment volatility will certainly be an issue because it will generate large adjustment costs to the economy as a whole. Indeed, OECD (2005) featured labor adjustment costs as one of its concerns related to the expansion of international trade and foreign direct investment (FDI). Therefore, the adjustment of labor in response to foreign exposure is then an important concern for policymakers.

Despite this, the relationship between foreign exposure and employment volatility is theoretically ambiguous. For exports, employment volatility will be higher for exporters than for nonexporters if the volatility of the shocks is significantly higher for the trading partners than for the home country, or if the export activity itself is volatile owing to changes in the exchange rate, for example. Conversely, exporters may be able to absorb demand shocks in one country by diversifying their activities across other countries.

Similarly, for imports, a firm that sources inputs from many countries can more easily absorb shocks to a particular input by switching its sources to another country compared with a firm that sources inputs only from the domestic market. In contrast, importers could have higher employment volatility if imported intermediate inputs are easily substitutable for labor inputs. A similar argument applies to the case of FDI. Because the relationship between foreign exposure and employment volatility is theoretically ambiguous, a need exists for empirical analysis to clarify the relationship that appears strongest in reality.

A number of studies have examined the causes and effects of sales volatility.[1] For example, Comin et al. (2009) examined the relationship between sales and wage volatilities among U.S. firms and found a positive relationship. However, they did not distinguish between domestic sales and exports. Elsewhere, Buch et al. (2009) examined the relationship between export openness and output volatility using firm-level data on

[1] Another related strand of study is the estimation of labor demand functions, usually by focusing on the differences between multinational and domestic firms (e.g., Barba Navaretti et al., 2003; Fabbri et al., 2003; Kiyota and Matsuura, 2006; Murakami and Fukao, 2007; Buch and Lipponer, 2010). However, it should be noted that increases in labor demand elasticity are not necessarily sufficient to explain increases in employment volatility because high output volatility (for instance, through productivity shocks) could also result in high employment volatility.

German manufacturing firms for the period 1980–2011. They found that exporters had a lower volatility of sales than nonexporters, although they did not focus on employment volatility. Lastly, Vannoorenberghe (2012) examined the relationship between sales volatility and the export intensity of firms, as measured by the share of exports to total sales. Using French firm-level data, they found that export intensity had a positive and substantial effect on sales volatility. Nevertheless, they did not address the labor market consequences.

To our knowledge, only Kurz and Senses (2016) have examined the relationship between foreign exposure and employment volatility. Using firm- and transaction-level data from U.S. manufacturing firms between 1991 and 2005, they found that the employment of exporters was less volatile than that of domestic firms, whereas that of importers was more volatile. Their study also identified a nonmonotonic relationship between export intensity and employment volatility, such that the effects of exports could be more or less volatile, depending on the share of exports to total sales. On this basis, they concluded that "as long as a firm's overall exposure is not too large, exporting affords firms the ability to diversify their demand sources across countries and products" (p. 174).

Building on Kurz and Senses (2016), this paper examines the relationship between FDI and employment volatility and between international trade and employment volatility using large-scale, firm-level data from Japan. The major contributions of the paper are threefold. First, we distinguish among multinational firms, trading and nontrading firms when analyzing the relationship between foreign exposure and employment volatility. Although Kurz and Senses (2016) made significant contributions to this literature, the scope of their study is limited in that they did not consider the relationship with FDI, even though it is an important globalization channel for most firms. Indeed, a recent study by Dobbelaere and Kiyota (2018) used firm-level data in Japan and found that exporters and multinational enterprises (MNEs) face a different type and degree of labor market imperfection. Therefore, our study clarifies the heterogenous relationship between the mode of foreign exposure and employment volatility in a much more comprehensive manner.

Second, we expand the industry coverage of the analysis. Our data cover not only manufacturing, but also wholesale trade firms. As Bernard et al. (2010b) emphasized, not only producers, but also wholesale traders engage in international trade. In addition, they found that wholesale traders behaved differently from producers. For example, trade by wholesale traders was less sensitive to market size compared with trade by manufacturing firms. Similarly, Comin et al. (2009) found that the relationship between sales and wage volatility was stronger in services firms than in manufacturing firms. This is because in the service sector, it can be difficult to monitor or assess performance, which makes it difficult to relate a worker's individual performance and incentives to firm goals. As a result, when firms set wages, they need to relate wages to observable firm-level performance (i.e., sales). The distinction between these types of firms is important for a deeper understanding of international trade.

Third, we consider the difference between intrafirm and interfirm trade. The relationship between intrafirm trade and employment volatility is also ambiguous. On the one hand, because intrafirm trade is, by definition, a transaction within a firm, we expect intrafirm trade uncertainty to be weaker than that of interfirm trade. As a result, firms with a greater intensity of intrafirm trade could experience less employment volatility, all else being equal.[2] On the other hand, if intrafirm trade depends on the

[2] Kiyota et al. (2008) found that the intrafirm trade of Japanese MNEs increased as exchange rate uncertainty increased. This suggests that intrafirm trade helps make adjustments within the firm so it is able to absorb exchange rate shocks.

supply chain of certain specific products, the firm could lack flexibility when unexpected shocks affect foreign demand or the supply chain itself. For example, when severe flooding affected the Thai economy in 2011, Honda needed to halve its production in its Japanese and North American plants. This was not because the floods directly influenced these plants, but because the affected plants in Thailand disrupted its global supply of parts and components (*Toyokeizai*, Japanese version, November 14, 2011). Thus, distinguishing between intrafirm and interfirm trade allows us to examine the precise channel that transmits foreign shocks to domestic employment.

These extensions are simple but nontrivial because, as we will see, these extensions enable us to identify the possible transmission mechanisms of foreign shocks through international trade. In addition to these contributions, this paper is the first to addresses the relationship between foreign exposure and the employment volatility of firms in Japan.[3] Thus, our study contributes to the literature by adding another national perspective to the available evidence.

Our major findings are summarized as follows. First, in manufacturing, the relationship between exports and employment volatility varies depending on the share of intrafirm exports to total sales (intrafirm export intensity). In contrast, in wholesale trade, exports and employment generally have no significant relationship. Second, in both manufacturing and wholesale trade, employment volatility tends to become higher as the share of imports to total purchases increases. In wholesale trade, however, intrafirm imports tend to offset such shocks.

Third, MNEs exhibit higher employment volatility in manufacturing while, in wholesale trade, MNEs do not necessarily exhibit higher employment volatility. Fourth, employment adjustments by trading firms are more likely to occur through temporary workers. Finally, we find negative correlations between the contractibility index and intrafirm export intensity and between the contractibility index and employment volatility. The implication of these results is discussed in more detail in the following sections.

The remainder of the paper is organized as follows. Section 2 explains the analytical framework and the data used. We present the baseline regression results in Section 3. Section 4 discusses the robustness of our results and Section 5 presents more detailed discussions on part-time/temporary workers and intrafirm/interfirm trade. Section 6 provides concluding remarks.

2 Analytical Framework

2.1 Methodology

To measure employment volatility, following Kurz and Senses (2016), we employ a "residual" approach. Let i, j, and t denote the firm, industry, and year, respectively. Let γ_{ijt} denote the growth of employment E_{it}. We define γ_{ijt} as the conditional (residual) growth rate of employment estimated from the following specification:

$$\gamma_{ijt} = \ln(E_{it}) - \ln(E_{it-1}) = \phi_i + \mu_{jt} + \upsilon_{ijt}, \tag{1}$$

where ϕ_i are the firm fixed effects that capture the unobserved firm-specific characteristics, including the employment system used, μ_{jt} are the industry and year fixed

[3]Using firm-level data for Japan from the *Basic Survey of Japanese Business Structure and Activities* (BSJBSA), Tanaka (2013) examined the effects of trade on sales volatility but not employment volatility. Similarly, Yokoyama et al. (2019) utilized BSJBSA firm-level data to examine the effects of the exchange rate on employment. However, they did not explicitly focus on employment volatility.

effects, that capture industry-year-specific shocks, and υ_{ijt} is the deviation of employment from the firm-average and the industry-average in year t. The volatility σ can be interpreted as the standard deviation of the residual growth rates for a window of length w:[4]

$$\sigma_{ij}^{w} = \sqrt{\frac{1}{w-1}\sum_{t}\upsilon_{ijt}^{2}}. \tag{2}$$

To formally test the linkage between the firm's foreign exposure and its employment volatility, Kurz and Senses (2016) employed the following specification:

$$\begin{aligned}\ln\sigma_{ij}^{w} &= \beta_0 + \beta_1 Both_i^w + \beta_2 X_i^w + \beta_3 M_i^w + \beta_4 x_i^w + \beta_5 m_i^w \\ &\quad + \alpha Z_i^w + \theta Y_j^w + \varepsilon_{ij}^w,\end{aligned} \tag{3}$$

where $Both_i^w$ is an importer and exporter dummy, X_i^w is an exporter (but not importer) dummy, M_i^w is an importer (but not exporter) dummy, x_i^w is the share of exports relative to sales, m_i^w is the share of imports relative to purchases, Z_i^w and Y_j^w are the firm and industry control variables, respectively, and ε_{ij}^w is the error term. The firm and industry control variables are calculated as the average over w, the window of interest. The trade status dummy variables along with the share of exports and imports are included to capture the nonmonotonic relationship between trade and volatility (e.g., Kurz and Senses, 2016; Vannoorenberghe, 2012).

Our study addresses the heterogenous relationship between the mode of foreign exposure and employment volatility by extending equation (3) to the following specification:

$$\begin{aligned}\ln\sigma_{ij}^{w} &= \beta_0 + \beta_1 Both_i^w + \beta_2 X_i^w + \beta_3 M_i^w + \beta_4 x_i^w + \beta_5 m_i^w \\ &\quad + \beta_6 Both_i^{int,w} + \beta_7 X_i^{int,w} + \beta_8 M_i^{int,w} + \beta_9 x_i^{int,w} + \beta_{10} m_i^{int,w} \\ &\quad + \beta_{11} MNE_i^w + \alpha Z_i^w + \theta Y_j^w + \varepsilon_{ij}^w,\end{aligned} \tag{4}$$

where $Both_i^{int,w}$ is an intrafirm importer and exporter dummy, $X_i^{int,w}$ is an intrafirm exporter (but not intrafirm importer) dummy, $M_i^{int,w}$ is an intrafirm importer (but not intrafirm exporter) dummy, $x_i^{int,w}$ is the intrafirm export intensity, $m_i^{int,w}$ is the intrafirm import intensity (i.e., the share of intrafirm imports to total purchases), and MNE_i^w is a dummy for firms that either engage in FDI or are foreign-owned firms. Other variables are the same as those in equation (4).

2.2 Data

2.2.1 Source and industry classification

Our data are from the *Basic Survey of Japanese Business Structure and Activities* (BSJBSA) compiled by the Ministry of Economy, Trade, and Industry (METI), Japan. The purpose of this survey is to capture an overall picture of Japanese corporate activities, including globalization and diversification, along with basic corporate characteristics, including sales, costs, profits, employment, trade, and FDI. The strength of this survey is its coverage and reliability. As evidence, the survey is compulsory for firms in both manufacturing and nonmanufacturing industries with more than 50 employees and

[4]Our measure of employment volatility is based on employment growth at the firm level. Therefore, the employment volatility caused by the entry and exit of firms is beyond the scope of our analysis, although it is an important aspect of employment volatility at the aggregate level.

with capital exceeding 30 million yen.[5]

The weakness of this survey is that some nonmanufacturing industries, such as construction, medical services, and transportation services, are not included. Small firms with less than 50 employees or with capital less than 30 million yen are also not covered. In addition, the information on exports and imports is disaggregated by neither destination country nor product. In this analysis, we focus on manufacturing and the wholesale trade industry because data for these industries are available throughout our sample period.[6]

In the BSJBSA, a three-digit industry classification code is assigned to each firm based on their main activities. For example, suppose that a firm engages in both manufacturing and wholesale trade. If its largest revenue is from wholesale trade, the BSJBSA classifies it as a wholesale trade firm, implying that firms in the wholesale trade industry do not always specialize in wholesale trade activities. Moreover, some firms switched from one industry to another during our sample period. Although firms' switching behavior is an important issue in itself, we assign each firm the industry classification to which it belongs most frequently during our sample period.[7]

2.2.2 Sample selection

We use the BSJBSA covering the period 1994–2012. Following Kurz and Senses (2016), we first delete outlier observations from the top and bottom first percentiles of employment level and growth rate. We then restrict the sample to firms that report employment for at least five consecutive years to obtain sufficient observations to calculate firm-level volatility. The BSJBSA as a whole has 36,074 manufacturing and wholesale trade firms. We exclude 12,518 firms that report employment for less than five years. As a result, our final sample consists of 23,556 firms (15,978 manufacturing and 7,578 wholesale trade firms). Since the data for 1994 are used to calculate the employment growth rate for 1995, the volatility measure is available from 1995 to 2012, an 18-year window.

2.2.3 Employment

The number of permanent workers measures employment. In the BSJBSA, permanent workers are those with a contract period that extends for one month or longer, or an employee who worked for 18 days or more in each of the last two months in the previous fiscal year. Accordingly, permanent workers comprise regular workers (i.e., *Seishain* or *Seikishokuin* in Japanese) and part-time workers (i.e., *Pāto* or *Arubaito* in Japanese), but not daily workers (i.e., *Hiyatoi* in Japanese) and dispatched workers (i.e., *Haken* in Japanese).[8]

Other than regular and part-time workers, there are two additional worker classifications, namely daily and dispatched workers. As noted, daily workers are not in-

[5] In 2012, the BSJBSA covered approximately 13.4 million permanent workers and 112.7 trillion yen of value added, which is approximately 50.1 percent and 82.2 percent of total permanent workers and value added, respectively. Total numbers come from the Japanese Economic Census in 2012.

[6] Some manufacturing firms own subsidiaries that engage in wholesale activities to distribute their products. Different from independent wholesale trade firms, these wholesale trade firms may react to foreign shocks as do their parent manufacturing firms. However, we confirmed that these firms are not the majority in our sample. Specifically, we found out of 7,585 wholesale trade firms, 1,368 firms are subsidiaries of manufacturing firms, of which 625 firms are wholly owned subsidiaries.

[7] For firms' product-switching behavior, see Bernard et al. (2010c), Kawakami and Miyagawa (2010), and Bernard and Okubo (2013).

[8] The use of permanent and regular workers in this paper follows Yokoyama et al. (2019). In Section 5.1, we discuss the employment volatility of part-time workers in more detail.

cluded as permanent workers because their contract period is shorter than one month. We also exclude dispatched workers because they have no direct employment contract with the firm, but do so with temporary worker agencies. We refer to daily and dispatched workers as temporary workers.[9] Importantly, although we can disaggregate the number of workers by sector for a firm, such as the research and development and manufacturing sectors, wage bills are only available at the firm level.

2.2.4 Trade and multinational enterprise (MNE) status

From the BSJBSA, we obtain variables for trade status, MNE status, and export and import intensity. Trade status includes four categories: firms that do not engage in trade (*Nontrader*), firms that engage only in exports (*Exports only*), firms that engage only in imports (*Imports only*), and firms that engage in both exports and imports (*Both*). We define *Imports only* (*Exports only*) firms as those that engage in importing (exporting) in at least one year during our sample period, but do not engage in exporting (importing). *Both* firms are defined as those that engage in exporting and importing in at least one year during an 18-year window.[10] The remaining firms are *Nontraders*. Export and import intensities are defined as the ratio of exports to total sales and the ratio of imports to total purchases (i.e., total costs of intermediate inputs), respectively.[11]

One could ask which wholesale trade firms engage in exports and/or imports. A typical example in wholesale trade is trading companies. Note also that firms could engage in both manufacturing and wholesale trade activities. We classify firms that engage in both manufacturing and wholesale trade activities as wholesale trade firms if their primary sales are from wholesale trade activity.

In the BSJBSA, MNEs comprise two types of firms: foreign-owned firms and Japanese firms that engage in FDI, which we refer to as Japanese FDI firms. A foreign-owned firm has a share of foreign capital greater than 50 percent and headquarter outside of Japan. A Japanese FDI firm that engages in FDI is a firm that has at least one foreign affiliate.[12] In our sample, the share of foreign-owned firms is rather small, just 1.3 percent of firms in manufacturing and 3.0 percent in wholesale trade. Given this, and to ensure consistency with the existing literature, we combine these two types of firms.[13] We classify the remaining firms as non-MNEs. We define MNE status similarly as trade status. Japanese FDI firms are then firms with foreign subsidiaries for at least one year in the 18-year window. Similarly, foreign-owned firms have foreign parent firms at least once during 18 years. The remaining firms are *non-MNEs*.

The other feature of this survey is the availability of the data for intrafirm trade. The BSJBSA reports between exports and imports to/from firms' majority-owned foreign affiliates. To distinguish between intrafirm and interfirm trade, we construct intrafirm

[9] The number of dispatched workers is available after 2000. In Section 5.1, we discuss the employment volatility of temporary workers (i.e., daily and dispatched workers) in more detail.

[10] *Both* then includes firms that export in one year and import in another year.

[11] For 1995 and 1996, the value of exports and imports is not available. Instead, we obtain sales to and purchases from foreign countries. These variables include transactions between foreign branches and foreign sales or purchases through trading companies along with conventional exports and imports. As both export and foreign sales (imports and purchases from foreign countries) are available for 1997, we adjust the value of foreign sales (purchases from foreign countries) in 1995 and 1996 using the ratio of exports to foreign sales (imports to purchases from foreign countries) at the industry level. We modify intrafirm export and import intensity in the same manner.

[12] If foreign-owned firms also have foreign affiliates outside Japan, they are classified not as Japanese FDI firms, but as foreign-owned firms. In the BSJBSA, a Japanese foreign affiliate is an affiliate with a capital share of more than 20 percent.

[13] For example, Bernard et al. (2009) defined firms that have a related-party transaction during a particular year as multinationals.

export and import intensity variables (*Intrafirm export intensity* and *Intrafirm import intensity*, respectively) and intrafirm trade status variables (*Intrafirm both, Intrafirm exports only, and Intrafirm imports only*). Intrafirm export and import intensities are the ratios of intrafirm exports to total sales and intrafirm imports to total procurement, respectively. Firms that engage in intrafirm trade are a subset of MNEs and trading firms (either exporters or importers).

2.2.5 Control variables

To control for firm characteristics (i.e., Z_i^w in equation (4)), we use the log of the number of employees (*Employment*), the log of the number of establishments (*Number of establishments*), the R&D–sales ratio (*R&D–sales ratio*), firm age (*Age*), and the share of nonproduction workers (*Share of nonproduction workers*). We define the share of nonproduction workers as the ratio of nonproduction workers to total employees at the firm level.[14]

The industry control variables (i.e., Y_j^w in equation (4)) include the industry-level share of nonproduction workers (*Industry nonproduction worker share*), the size of the industry (*Industry size*), the import penetration ratio (*Import penetration*), and the capital–labor ratio (*Industry capital–labor ratio*). We calculate the industry skill share by aggregating the firm-level share of nonproduction workers. The size of the industry is the log of the aggregate number of employees by industry. The import penetration ratio and the capital–labor ratio are from the Japan Industry Productivity (JIP) database.[15] The import penetration ratio is the ratio of imports to total domestic demand. The capital–labor ratio is the ratio of net capital stock to person-hour labor inputs. We calculate these control variables as an average over the 18-year window.[16]

2.3 Descriptive statistics

Table 1 provides basic descriptive statistics for the 18-year window from 1994 to 2012 for the full sample of firms and by trade and MNE status for all industries.[17] Column (1) provides the number of firms. Column (2) shows the shares of firms, in terms of the number of firms, by trade and MNE status. Column (3) indicates the average employment size. Columns (5) and (6) detail the mean and standard deviation of employment volatility, respectively, as measured by equation (2). Our sample consists of 23,556 firms, of which 52.3 percent (12,324 firms) engage in international trade and 28.9 percent (6,814 firms) are MNEs.

Four findings stand out from Table 1. First, there is a systematic relationship between firm size and trade status. Firms that engage in either exports or imports are larger than those that do not. Moreover, firms that engage in both exports and imports

[14] To calculate the share of nonproduction workers, we first obtain the number of employees who work in the manufacturing plant or engage in manufacturing activities at the firm headquarters. We then subtract this from the total number of employees, which implies the number of nonproduction workers. The share of nonproduction workers is the ratio of this figure to the total number of employees.

[15] In the JIP database, industry cannot be disaggregated within the wholesale trade industry. We thus use industry control variables only for manufacturing firms. The database is downloadable from http://www.rieti.go.jp/en/database/JIP2014/index.html. For more details about the JIP database, see Fukao et al. (2007).

[16] For the log value, we first compute the period average of each control variable and then take the logarithm.

[17] Table A1 in the Appendix presents the number of firms, by sector and year. The summary statistics of the variables used in the regression analysis are provided in Table A2. We take each two-digit industry category (i.e., SNA intermediate level classification) as representing a "sector", whereas each three-digit industry category (i.e., JIP industry classification) is an "industry". All industry characteristics are at the industry (three-digit) level.

Table 1: Basic Statistics, by Trade and MNE Status: All Industry

	(1) # of firms	(2) Share (%)	(3) Average employment size	(4) Employment volatility Mean	(5) S.D.
Total	23,556	100.0	265	0.083	0.044
Non-trader	11,232	47.7	185	0.083	0.045
Both	7,898	33.5	397	0.084	0.044
Exports only	2,016	8.6	251	0.078	0.042
Imports only	2,410	10.2	218	0.089	0.045
Non-MNEs	16,742	71.1	182	0.083	0.044
MNEs	6,814	28.9	470	0.085	0.044

Source: Authors' calculation based on the BSJBSA.

are even larger than those that engage in either exports or imports. Second, there is a systematic relationship between firm size and MNE status. On average, MNEs are approximately two-and-a-half times larger than other firms. This indicates that the firms that engage in international trade and MNEs are generally larger.

Third, the employment volatility of firms that import only is larger than that of firms that do not trade. In contrast, the employment volatility of firms that engage in exports only is smaller than that of firms that do not trade. These results suggest that the relationship between imports and employment volatility is different from that between exports and employment volatility. Finally, the employment volatility of MNEs is larger than that of non-MNEs. This implies that employment volatility could also vary by MNE status.[18]

Table 2 decomposes these statistics by manufacturing and wholesale trade. Our sample consists of 15,978 manufacturing and 7,578 wholesale trade firms. Interestingly, while 54.1 percent (8,646 firms) of firms engage in international trade in manufacturing, 48.5 percent (3,678 firms) of firms do so in wholesale trade. Similarly, the share of MNEs is 30.9 percent (4,939 firms) in manufacturing, whereas it is 24.7 percent (1,875 firms) in wholesale trade. These figures indicate that the share of firms that engage in international trade or as MNEs are comparable for manufacturing and wholesale trade, although wholesale trade firms are more likely than manufacturing firms to focus their sales only on the domestic market.

We highlight three main findings. First, in manufacturing, we observe a similar relationship between firm size and trade status to the relationship for all industries. On average, firms that engage in both exports and imports are largest, followed by those that engage in either exports or imports only. Firms that do not engage in international trade tend to be smaller in terms of employment. We confirm a similar relationship in wholesale trade. These results indicate that a relationship between trade status and firm size is common in both manufacturing and wholesale trade.

Second, in both manufacturing and wholesale trade, the employment volatility of firms that import only is higher than that of firms that do not trade, and the employment volatility of firms that engage in exports only is smaller than that of firms that do not trade. Third, employment volatility is almost identical for MNEs and non-MNEs

[18] Another interesting finding is that, on average, employment volatility is smaller in Japan (0.08 for full sample) than in the United States (0.35 for full sample in Kurz and Senses (2016)). Part of this may be because job mobility remains considerably lower in Japan than in the United States (Ono, 2010). Although caution may be needed given the differences in the coverage of the data in Japan and the United States, this suggests an interesting difference between Japanese and U.S, labor markets.

Table 2: Basic Statistics, by Trade and MNE Status: Manufacturing and Wholesale Trade

	(1) # of firms	(2) Share (%)	(3) Average employment size	(4) Employment volatility Mean	(5) S.D.
Manufacturing					
Total	15,978	100.0	289	0.081	0.041
Non-trader	7,332	45.9	186	0.082	0.042
Both	5,552	34.7	450	0.081	0.040
Exports only	1,629	10.2	257	0.077	0.040
Imports only	1,465	9.2	231	0.085	0.042
Non-MNEs	11,039	69.1	187	0.081	0.041
MNEs	4,939	30.9	517	0.082	0.041
Wholesale trade					
Total	7,578	100.0	215	0.088	0.050
Non-trader	3,900	51.5	184	0.084	0.050
Both	2,346	31.0	272	0.091	0.050
Exports only	387	5.1	226	0.081	0.048
Imports only	945	12.5	198	0.095	0.049
Non-MNEs	5,703	75.3	173	0.086	0.050
MNEs	1,875	24.7	345	0.093	0.051

Source: Authors' calculation based on the BSJBSA.

in manufacturing. In contrast, MNEs' employment volatility is higher than that of non-MNEs in wholesale trade. Moreover, employment volatility is generally higher in wholesale trade than in manufacturing. Together, these results suggest that the relationship between trade, MNEs, and employment volatility differs between manufacturing and wholesale trade.

Note that export or import status does not necessarily infer a high degree of foreign exposure because, in some cases, export or import intensities may be very small. Thus, examining the export and import intensities of the firms may be useful.[19] The upper part of Table 3 presents the export and import intensities. Table 3 shows that the average export and import intensities are small, amounting to about three percent for exports and five percent for imports in all industries. We also report the shares of intrafirm exports and imports to total sales. These are also small, amounting to approximately one percent for intrafirm exports and two percent for intrafirm imports in all industries.[20]

One could argue that the existence of zero trade affects these results in that the figures in Table 1 confirmed that nearly half of the firms do not trade, as a result, the average share of exports and imports is zero. Therefore, we compute the export and import intensities, conditional on positive exports and imports, respectively. The re-

[19] For the definition of export and import intensity, see Section 2.2. In this sense, we could argue that not only the intensity of trade, but also the share of foreign production to total production may affect employment volatility. While this may be true, it is difficult to obtain such information for foreign-owned firms. Even if we were to focus only on Japanese multinationals, the sample size would decline substantially given the limited data availability. For this reason, we do not further pursue this topic.

[20] The proportion of MNEs that engage in intrafirm trade is high. In both manufacturing and wholesale trade, 78 percent of firms (3,876 firms in manufacturing and 1,496 firms in wholesale trade) engage in intrafirm trade.

Table 3: Export and Import Intensity, by Trade Status and by Industry

	All industry		Manufacturing		Wholesale trade	
Unonditional intensity	# of firms	Intensity	# of firms	Intensity	# of firms	Intensity
Exports	23,556	0.03	15,978	0.04	7,578	0.02
Imports	23,556	0.05	15,978	0.04	7,578	0.07
Intrafirm exports	23,556	0.01	15,978	0.01	7,578	0.00
Intrafirm imports	23,556	0.02	15,978	0.02	7,578	0.02
	All industry		Manufacturing		Wholesale trade	
Conditional intensity	# of firms	Intensity	# of firms	Intensity	# of firms	Intensity
Exports	9,914	0.08	7,181	0.08	2,733	0.06
Imports	10,308	0.11	7,017	0.10	3,291	0.15
Intrafirm exports	9,914	0.02	7,181	0.02	2,733	0.01
	(5,619)		(4,187)		(1,432)	
Intrafirm imports	10,308	0.04	7,017	0.04	3,291	0.05
	(5,423)		(3,836)		(1,587)	

Notes: Intensities are average over the firms. Conditional intensity shows the averages for firms with non-zero exports or imports. Figures in parentheses indicate the number of firms with non-zero intrafirm exports (or imports).
Source: Authors' calculation based on the BSJBSA.

sults are shown in the lower part of Table 3. If we exclude zero-trade firms, the average share of exports and imports is slightly higher, in all industries, approximately eight percent for exports and 11 percent for imports. Similar results are confirmed when we focus on manufacturing and wholesale trade. Thus, how exports and imports affect employment volatility is not clear. To better test the linkage between firm foreign exposure and its employment volatility, we now turn to the regression analysis.

3 Globalization and Employment Volatility in Japan

3.1 Preliminary analysis

Before presenting our baseline results, we begin by estimating equation (3) to compare our results with those of Kurz and Senses (2016). Columns (1) and (2) in Table 4 presents the results, estimated using ordinary least squares.[21] For the categorical variables, the coefficients for trade status (i.e., *Both*, *Exports only*, and *Imports only*) are relative to *Nontrader*. As pointed out by Guadalupe and Wulf (2010), this is a standard difference-in-differences specification that exploits the foreign exposure where exports and imports (the "treatment") are continuous. We estimate employment volatility using the residual approach over the 18-year window, as in equation (2).[22]

We highlight two main findings. First, for manufacturing in column (1), our results are similar to the results presented in Kurz and Senses (2016). We find a significantly

[21] Table 4 includes firm- and industry-level control variables but their coefficients are not reported. The full results for manufacturing and wholesale trade are provided in Tables A3 and A4 in the Appendix, respectively.

[22] While the industry characteristic variables are at the industry (i.e., three-digit) level, the sector-window fixed effect is at the sector (i.e., two-digit) level because of the perfect collinearity between them. Note also that we control for industry–year-specific shocks in computing employment volatility.

Table 4: Regression Results

	Kurz and Senses (2016) specification		Baseline specification	
	(1)	(2)	(3)	(4)
	Manufacturing	Wholesale trade	Manufacturing	Wholesale trade
Both	0.001	0.057***	-0.014	0.010
	(0.011)	(0.017)	(0.014)	(0.021)
Exports only	-0.042***	-0.017	-0.047***	-0.032
	(0.014)	(0.029)	(0.015)	(0.030)
Imports only	0.030**	0.111***	0.027*	0.091***
	(0.014)	(0.020)	(0.015)	(0.021)
Export intensity	0.115**	0.178*	-0.045	0.049
	(0.048)	(0.096)	(0.059)	(0.122)
Import intensity	0.182***	0.179***	0.136**	0.324***
	(0.040)	(0.040)	(0.057)	(0.057)
MNEs			0.038***	0.019
			(0.013)	(0.022)
Intrafirm both			0.001	0.056*
			(0.018)	(0.028)
Intrafirm exports only			0.010	0.057*
			(0.018)	(0.035)
Intrafirm imports only			0.004	0.052*
			(0.021)	(0.030)
Intrafirm export intensity			0.486***	0.304
			(0.134)	(0.288)
Intrafirm import intensity			0.026	-0.379***
			(0.094)	(0.089)
N	15,978	7,578	15,978	7,578
R^2	0.041	0.045	0.043	0.048
Characteristics				
Firm	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes

Notes: Standard errors clustered by firm are in parentheses. ***, **, and * indicate statistically significant at 1%, 5%, and 10% levels, respectively. Firm-level control variables are the log of the number of employees, the log of the number of establishments, the R&D–sales ratio, firm age, and the share of nonproduction workers. The industry-level control variables are the industry-level share of nonproduction workers, the size of the industry, the import penetration ratio, and the capital–labor ratio. For the log value, we first compute the period average of each control variable and then take the logarithm. Firm- and industry-level control variables are included but not reported in this table. The full results for manufacturing and wholesale trade are provided in Tables A3 and A4 in the Appendix, respectively.
Sources: Authors' calculation based on the BSJBSA and the JIP database.

negative coefficient for *Exporter only* and significantly positive coefficients for *Export Intensity* and *Import Intensity*. The only difference is the coefficient for *Both* that is insignificant in our study while significantly negative in Kurz and Senses (2016). Thus, our results for Japanese manufacturing firms are generally consistent with the results for U.S. manufacturing firms.

Second, the coefficient for wholesale trade is similar to those for manufacturing except for *Both* and *Exports only*. The coefficient for *Both* becomes significantly positive whereas that of *Exports only* turns insignificant. Because Kurz and Senses (2016) focused only on manufacturing firms, we cannot directly compare our results with theirs. Nevertheless, our results suggest that the relationship between foreign exposure and employment volatility is different between manufacturing and wholesale trade. We now turn to our baseline results of equation (4).

3.2 Baseline results

Columns (3) and (4) in Table 4 present our baseline results for manufacturing and wholesale trade, respectively, based on equation (4). For the categorical variables, the coefficients for trade status (i.e., *Both*, *Exports only*, *Imports only*, *Intrafirm both*, *Intrafirm exports only*, and *Intrafirm imports only*) are relative to *Nontrader* as in the preliminary analysis. The coefficient for MNE status is relative to that of *Non-MNEs*. We first examine the results for manufacturing and then discuss the results for wholesale trade.

For manufacturing, four findings are evident from the baseline results in Table 4. First, the estimated coefficient for *Exports only* is significantly negative. This implies that the employment of firms that engage in exports only is less volatile than that of firms that do not engage in international trade. This result is consistent with the finding of Kurz and Senses (2016), for which the number of products and destination countries for exports display negative relationships with employment volatility. This result also suggests that the diversification of products and/or destinations occurs in Japan, even though the firm-level data cannot identify the number of products or the destination countries.

Second, the coefficient for *Intrafirm export intensity* is significantly positive. This finding may imply that products exported from Japanese parent firms to their foreign affiliates are relation specific; therefore, shocks are transmitted through intrafirm rather than interfirm trade.[23] These results together indicate that the relationship between exports and employment volatility depends on intrafirm export intensity.

Third, the coefficients for both *Imports only* and *Import intensity* are significantly positive. This implies that employment volatility becomes higher as import intensity increases. Note that the coefficient for *Intrafirm import intensity* is insignificant. Accordingly, unlike exports, the relationship between imports and employment volatility becomes evident regardless of interfirm or intrafirm trade. This result implies that the imported intermediate inputs are generally not easy to substitute with domestic intermediate inputs. Finally, the coefficient for *MNEs* is significantly positive, suggesting that the employment of MNEs is more volatile than that of non-MNEs.

For wholesale trade, we highlight four main findings. First, none of the coefficients for *Both*, *Exports only*, *Export intensity*, or *Intrafirm exports only*, is statistically significant. This implies that, unlike manufacturing, exports do not relate significantly with employment volatility in general. This is probably because wholesale trade firms do not have a production facility and do not have to adjust their domestic employment worker. Second, the coefficients for *Imports only*, *Import intensity*, *Intrafirm both*, and

[23] In Section 5.2, we discuss the relationship between intrafirm trade and relationship-specificity in more detail.

Intrafirm imports only are significantly positive. However, it should be noted that the coefficient for *Intrafirm import intensity* is significantly negative. Consequently, employment volatility increases alongside import intensity, but somewhat offsets as intrafirm import intensity increases. This result may suggest importing wholesale trade firms adjust their domestic sales staff depending on import demand. In contrast, multinational wholesalers that engage in intrafirm imports are able to absorb shocks within subsidiaries and mitigate the impact on employment.

Third, the coefficient for *MNEs* is insignificant. This indicates that there is no significant difference in employment volatility between MNEs and non-MNEs. Note that, in Table 2, we confirmed the higher employment volatility of MNEs in wholesale trade. Once we control for various firm and industry characteristics, the employment volatility of MNEs is almost the same as that of non-MNEs in wholesale trade. Finally, the coefficient for *Intrafirm import intensity* is significantly negative. This indicates that employment volatility decreases as intrafirm import intensity increases.

Among these findings, the distinction between interfirm and intrafirm trade seems particularly interesting because it is entirely new in the literature on employment volatility and trade. Therefore, it is worth discussing in more detail. However, before continuing on the discussion, we examine the robustness of these results to test their credibility.

4 Robustness check

4.1 Issues

There could be some concern that our results are sensitive to the measurement of employment volatility, trade and MNE status, sample period, etc. To confirm the robustness of our results, we address six issues. The first is the measurement of employment volatility. Following Kurz and Senses (2016), we employ two alternative measures of employment volatility. One utilizes shorter windows, as we split the original 18-year sample period into three 6-year subperiods. We then calculate the employment volatility for each subperiod, which implies that the analysis focuses on shorter-run relationships relative to the baseline model. The other measure of employment volatility utilizes the actual rather than the residual growth rate (i.e., equation (1)). Here, we measure employment volatility as the standard deviation of actual employment growth, where the employment growth rate is the log difference in employment between years t and $t-1$:

$$\sigma_{ijt}^{w} = \left[\frac{1}{w-1} \sum_{\tau=0}^{w} (\gamma_{ij,t+\tau} - \bar{\gamma}_{ij})^2 \right]^{1/2}, \tag{5}$$

where w is the length of the window and $\bar{\gamma}_{ij}$ is the average growth rate over window w.

The second is the measurement of trade and MNE status. Trade and MNE status take values of one if firms engage in trade and multinational activities for at least one year during our sample period. This implies that some exporters or MNEs may engage in trade or multinational activities only once during the 18 years. We follow Kurz and Senses (2016) when using this definition. However, our results might change with an alternative indicator of trade and MNE status. To address this possibility, we measure trade and MNE status based on the mode of the status. For example, if a firm is an MNE in only one year during the sample period, it is now a domestic firm. In contrast, if a firm is an MNE during most of the sample period, it remains an MNE. We apply this measure to all trade and MNE status firms and re-estimate equation (3).[24]

[24] In this connection, we also examined the year-to-year transition of trade and MNE status. Table A5 in

The third issue is the effects of productivity shocks and output growth. Productivity shocks and output change may also affect employment. Although we include industry–year fixed effects to measure employment volatility (as in equation (2)), such productivity shocks and output changes could be heterogeneous across firms. To address this issue, we include the volatility of total factor productivity (TFP) and output as additional control variables. The volatility of TFP is calculated using the same methodology as that used to calculate the employment volatility (i.e., equation (2)). To estimate TFP, we employ the Wooldridge–Levinsohn–Petrin method (Wooldridge, 2009).

The fourth issue is related to the sample period. There is the possibility shocks caused by the global financial crisis in 2009, the 2011 Great East Japan earthquake, and the 2011 Thailand floods affect our results. Employment volatility may then increase purely or in part because of these unexpected domestic and foreign shocks. Thus, our results may be sensitive to the choice of the sample period. To address this concern, we rerun the regression for the period 1994–2008, prior to these events.

The fifth is attrition: the entry and exit of firms. The relationship between foreign exposure and employment volatility may also be sensitive to the period of firm survival because a firm's employment could be less volatile conditional on survival. Note, however, that it is impossible to distinguish the difference between a firm that dropped below the threshold employment level of the BSJBSA (i.e., 50 workers) and that exited from the market in a precise manner. As a short cut, we employ two approaches to address this issue. First, we include in the regression equation as an additional control variable the number of years in which the firm is in the sample. Second, we change the threshold employment level from 50 workers as set by the BSJBSA to 60 workers to be able to confirm how the results are sensitive to the threshold employment level.

The last issue is concerning the unobserved industry heterogeneity. Our baseline analysis includes the industry characteristics variables, and it may be more appropriate for the industry fixed effects to control for the unobserved industry heterogeneity. Thus, we include the three-digit industry fixed effects, dropping the industry characteristics variables.[25]

4.2 Results of the robustness check

Tables 5–8 present the results of the robustness check. Tables 5 and 6 present the results for manufacturing and Tables 7 and 8 indicate the results for wholesale trade.

In Tables 5 and 7, column (1) presents the results for the 6-year windows for manufacturing and wholesale trade, respectively. Column (2) in these tables shows the results for actual employment growth. Column (3) indicates the results of alternative trade and MNE status whereas columns (4)–(5) present the results in which the volatility of productivity and output is included as an additional control variable, respectively.

In Tables 6 and 8, column (1) shows the results for the period before 2009 for manufacturing and wholesale trade, respectively. Columns (2) and (3) present the results that include the number of years of survival as an additional control variable and the

the Appendix presents the results and indicates that 72.9–98.3 percent of firms are of the same status. The result suggests that both trade and MNE status are relatively stable throughout the period.

[25]Table A6 in the Appendix presents the number of firms, by three-digit industry. In this connection, it is also possible to include firm fixed effects when we split the original 18-year sample period into three 6-year subperiods. However, once we include firm fixed effect, most of the coefficients for the trade and MNE dummies become insignificant. Noting that all time-invariant effects are absorbed by the firm fixed effect, this result implies that significant coefficients are mainly obtained for firms that continue as exporters, importers, and/or MNEs rather than firms that switch their trade and/or MNE status.

Table 5: Robustness Check 1: Manufacturing

	(1) 6-year window	(2) Actual growth	(3) Alternative trade / MNE status	(4) Adds TFP shocks	(5) Adds output growth
Both	-0.003	-0.002	-0.124***	-0.019	-0.026*
	(0.015)	(0.001)	(0.016)	(0.014)	(0.014)
Exports only	-0.020	-0.003***	-0.095***	-0.054***	-0.057***
	(0.015)	(0.001)	(0.016)	(0.015)	(0.014)
Imports only	0.043***	0.001	-0.056***	0.022	0.018
	(0.016)	(0.001)	(0.020)	(0.016)	(0.015)
Export intensity	-0.018	-0.002	0.112*	-0.129**	-0.257***
	(0.057)	(0.005)	(0.061)	(0.061)	(0.060)
Import intensity	0.019	0.014***	0.294***	0.110*	0.168***
	(0.052)	(0.005)	(0.060)	(0.060)	(0.056)
MNEs	0.043***	0.003***	-0.008	0.024*	0.034***
	(0.014)	(0.001)	(0.014)	(0.013)	(0.013)
Intrafirm both	0.020	-0.000	0.096***	0.000	-0.004
	(0.020)	(0.001)	(0.018)	(0.018)	(0.017)
Intrafirm exports only	0.001	-0.000	0.042***	0.017	0.009
	(0.020)	(0.001)	(0.015)	(0.019)	(0.018)
Intrafirm imports only	-0.027	-0.001	0.058***	-0.003	0.001
	(0.025)	(0.002)	(0.018)	(0.022)	(0.021)
Intrafirm export intensity	0.297***	0.045***	0.367***	0.533***	0.692***
	(0.114)	(0.013)	(0.135)	(0.146)	(0.130)
Intrafirm import intensity	0.196**	-0.006	-0.111	0.050	0.005
	(0.086)	(0.008)	(0.097)	(0.100)	(0.092)
N	31,174	15,978	15,978	14,213	15,496
R^2	0.048	0.045	0.046	0.073	0.082
Characteristics					
Firm	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
Sector (2-digit) window-fixed effect	Yes	No	No	No	No

For notes and sources, see those of Table 4.

Table 6: Robustness Check 2: Manufacturing

	(1) Before 2009	(2) Adds number of years	(3) Different size threshold	(4) Three-digit fixed effect
Both	-0.008	-0.002	-0.013	-0.003
	(0.015)	(0.014)	(0.015)	(0.014)
Exports only	-0.042***	-0.040***	-0.043***	-0.036**
	(0.016)	(0.015)	(0.017)	(0.015)
Imports only	0.043**	0.032**	0.019	0.021
	(0.017)	(0.015)	(0.018)	(0.015)
Export intensity	-0.098	-0.059	-0.051	-0.017
	(0.069)	(0.059)	(0.063)	(0.060)
Import intensity	0.219***	0.107*	0.150**	0.142**
	(0.064)	(0.056)	(0.066)	(0.058)
MNEs	0.050***	0.037***	0.044***	0.046***
	(0.014)	(0.013)	(0.014)	(0.013)
Intrafirm both	-0.018	0.001	-0.003	0.001
	(0.020)	(0.017)	(0.019)	(0.017)
Intrafirm exports only	-0.002	0.008	-0.003	0.019
	(0.021)	(0.018)	(0.020)	(0.018)
Intrafirm imports only	-0.031	0.004	0.004	0.001
	(0.025)	(0.021)	(0.023)	(0.021)
Intrafirm export intensity	0.595***	0.498***	0.483***	0.360***
	(0.149)	(0.133)	(0.138)	(0.132)
Intrafirm import intensity	-0.029	0.031	0.052	-0.037
	(0.107)	(0.093)	(0.102)	(0.094)
N	14,493	15,978	12,886	15,978
R^2	0.041	0.052	0.050	0.073
Characteristics				
Firm	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes

For notes and sources, see those of Table 4.

Table 7: Robustness Check 1: Wholesale Trade

	(1) 6-year window	(2) Actual growth	(3) Alternative trade / MNE status	(4) Adds TFP shocks	(5) Adds output growth
Both	-0.020	0.000	-0.096***	-0.007	-0.008
	(0.023)	(0.002)	(0.024)	(0.023)	(0.021)
Exports only	-0.040	-0.003	-0.116***	-0.045	-0.052*
	(0.031)	(0.003)	(0.037)	(0.031)	(0.030)
Imports only	0.116***	0.006***	0.018	0.083***	0.090***
	(0.022)	(0.002)	(0.024)	(0.022)	(0.021)
Export intensity	-0.125	0.008	0.234*	0.070	-0.203
	(0.119)	(0.012)	(0.124)	(0.126)	(0.131)
Import intensity	0.245***	0.030***	0.394***	0.356***	0.341***
	(0.062)	(0.006)	(0.060)	(0.062)	(0.057)
MNEs	0.051**	0.001	0.001	-0.002	0.006
	(0.024)	(0.002)	(0.025)	(0.023)	(0.022)
Intrafirm both	0.078**	0.004	0.095***	0.049	0.042
	(0.033)	(0.003)	(0.031)	(0.030)	(0.029)
Intrafirm exports only	0.074*	0.003	0.090***	0.048	0.056
	(0.039)	(0.003)	(0.030)	(0.036)	(0.035)
Intrafirm imports only	0.024	0.003	0.127***	0.078**	0.061**
	(0.037)	(0.003)	(0.027)	(0.031)	(0.030)
Intrafirm export intensity	0.247	0.029	0.285	0.288	0.655**
	(0.299)	(0.029)	(0.289)	(0.323)	(0.292)
Intrafirm import intensity	-0.280***	-0.035***	-0.461***	-0.454***	-0.477***
	(0.095)	(0.009)	(0.089)	(0.096)	(0.086)
N	13,856	7,578	7,578	6,454	7,279
R^2	0.035	0.050	0.049	0.076	0.074
Characteristics					
Firm	Yes	Yes	Yes	Yes	Yes
Sector (2-digit) window-fixed effect					
	Yes	No	No	No	No

For notes and sources, see those of Table 4.

Table 8: Robustness Check 2: Wholesale Trade

	(1) Before 2009	(2) Adds number of years	(3) Different size threshold	(4) Three-digit fixed effect	(5) "Pure" wholesale trade
Both	0.031	0.021	0.007	0.017	0.027
	(0.023)	(0.021)	(0.025)	(0.021)	(0.029)
Exports only	-0.055*	-0.021	-0.038	-0.021	-0.026
	(0.033)	(0.030)	(0.037)	(0.029)	(0.039)
Imports only	0.114***	0.088***	0.096***	0.065***	0.107***
	(0.023)	(0.021)	(0.024)	(0.021)	(0.028)
Export intensity	-0.017	0.022	-0.157	0.191	0.154
	(0.136)	(0.121)	(0.139)	(0.121)	(0.169)
Import intensity	0.341***	0.305***	0.325***	0.258***	0.346***
	(0.068)	(0.056)	(0.068)	(0.057)	(0.072)
MNEs	0.010	0.019	0.007	0.015	0.049*
	(0.025)	(0.022)	(0.024)	(0.022)	(0.029)
Intrafirm both	0.033	0.056**	0.071**	0.079***	0.019
	(0.033)	(0.028)	(0.032)	(0.028)	(0.038)
Intrafirm exports only	0.039	0.058*	0.050	0.073**	0.030
	(0.040)	(0.035)	(0.039)	(0.034)	(0.046)
Intrafirm imports only	0.020	0.059**	0.093***	0.036	0.045
	(0.034)	(0.030)	(0.035)	(0.030)	(0.042)
Intrafirm export intensity	0.539*	0.332	0.569*	0.242	-0.173
	(0.316)	(0.287)	(0.314)	(0.286)	(0.587)
Intrafirm import intensity	-0.393***	-0.389***	-0.428***	-0.246***	-0.485***
	(0.106)	(0.089)	(0.102)	(0.089)	(0.114)
N	6,877	7,578	5,666	7,578	4,773
R^2	0.044	0.058	0.046	0.071	0.049
Characteristics					
Firm	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes

For notes and sources, see those of Table 4.

results for firms with more than 60 workers for manufacturing and wholesale trade, respectively. Column (4) presents the results with three-digit industry fixed effect.

For manufacturing, we find that the coefficient for *Exports only* is significantly negative in eight out of nine specifications, whereas the coefficient for *Intrafirm export intensity* is significantly positive in all specifications. In addition, the coefficient for *Import intensity* continues to be significantly positive in eight out of nine specifications, although the relationship between *Imports only* and employment volatility is not necessarily robust. These results together suggest that the relationship between trade and employment volatility in the baseline results for manufacturing mostly continue to hold in these specifications.

Moreover, the coefficient for *MNEs* is significantly positive in eight out of nine specifications. This implies that employment volatility is higher for MNEs than for non-MNEs. Note that firms that engage in intrafirm trade are a subset of MNEs; therefore, not only whether firms engage in multinational activities, but also the degree to which they engage in intrafirm exports (relative to their total exports) is important when discussing MNEs' employment volatility.

For wholesale trade, regarding the baseline results, the coefficients for *Both*, *Exports only*, *Export intensity*, and *Intrafirm export intensity* continue to be insignificant in most specifications. Besides, the coefficients for both *Imports only* and *Import intensity* are significantly positive in eight and all specifications, respectively. While the coefficient for *Intrafirm imports only* is insignificant in most specifications, the coefficient for *Intrafirm import intensity* continues to be significantly negative in all specifications. These results together suggest that the relationship between trade and employment volatility in the baseline results for wholesale trade is mostly robust in these specifications. Furthermore, the coefficient for *MNEs* is insignificant in eight out of nine specifications. This implies that MNEs do not necessarily exhibit higher employment volatility.

As noted, we classify firms that engage in both manufacturing and wholesale trade activities as wholesale trade firms if their primary sales are from wholesale trade. One may question how the results would change if we focus on wholesale trade firms that do *not* engage in manufacturing activities, which we refer to as "pure" wholesale trade firms. Column (5) in Table 8 presents the results. Even when we focus on wholesale trade firms that do not employ manufacturing workers, we continue to find qualitatively the same results as the baseline model. Exports and employment volatility have no significant relationship. Employment volatility is higher for importers and increases as import intensity increases and lower when intrafirm import intensity increases. Our main messages are mostly unchanged even when we focus only on "pure" wholesale trade firms.

4.3 Summary of the robustness check

In sum, the relationship between trade and employment volatility in the baseline results mostly continues to hold for both manufacturing and wholesale trade. More specifically, our main findings are threefold. First, in manufacturing, the relationship between exports and employment volatility varies depending on intrafirm export intensity. One possible interpretation is that the transmission of foreign demand shocks appears through intrafirm exports. In wholesale trade, there is no significant relationship between exports and employment volatility in general. Unlike manufacturing, foreign demand shocks may not be significantly related to domestic employment volatility.

Second, in both manufacturing and wholesale trade, employment volatility tends to increase alongside the share of imports to total purchases. In contrast, in wholesale

trade, intrafirm imports tend to offset these shocks. This possibly implies that the transmission of foreign supply shocks to domestic employment appears through interfirm imports for wholesale trade.

Finally, MNEs exhibit higher employment volatility for manufacturing. Therefore, multinational activities could account for higher employment volatility. In contrast, in wholesale trade, MNEs do not necessarily exhibit higher employment volatility. Note that firms that engage in intrafirm trade are a subset of MNEs. In wholesale trade, MNEs may successfully mitigate the transmission of foreign supply shocks by intrafirm trade.

5 Discussions

5.1 Adjustment through part-time/temporary workers or wages

We measure employment as the number of permanent workers. Because the definition of permanent workers does not include temporary workers, but includes part-time workers, it may be a concern that employment volatility could vary if we include temporary workers or exclude part-time workers (i.e., if we focus on regular workers only).[26] Indeed, regular and nonregular workers have different degrees of employment protection (OECD, 2014, Chapter 4).[27] As a result, employment could be less volatile in response to foreign exposure for regular than for nonregular workers.

It is interesting to examine the employment volatility of regular workers (= permanent workers − part-time workers), that of part-time workers, and that of temporary workers separately. However, some firms employ neither part-time nor temporary workers. Moreover, the information on temporary workers is available only after 2000 in the BSJBSA. As a compromise, we utilize two alternative measures of employment: the number of permanent and temporary workers, and the number of regular workers, which excludes part-time workers from the permanent worker category. We then compute the employment volatility and run the same regression as the baseline model.

In Tables 9 and 10, column (1) provides the results whereby employment excludes part-time workers for manufacturing and wholesale trade, respectively. For manufacturing, we continue to find a significantly negative coefficient for *Exports only* and significantly positive coefficients for *Imports only*, *Import Intensity*, and *Intrafirm export intensity*. One notable difference is that the coefficient of *MNEs* turns out to be insignificant. This result implies that employment adjustments by MNEs occur mainly among part-time workers. For wholesale trade, we continue to find a significantly positive coefficients for *Imports only* and *Import Intensity* and significantly negative coefficients for *Intrafirm import intensity*. The results suggest that, for wholesale trade, both part-time and regular workers face similar employment adjustments as a result of imports.

Column (2) presents the results whereby employment includes temporary workers for manufacturing and wholesale trade, respectively. Even though the sample period changed from 1995–2012 to 2000–2012, the results are qualitatively similar to the baseline results.

Note, however, that even if employment volatility is similar whether or not temporary workers are included, their magnitudes may differ. To further address this issue, we investigate the volatility of the ratio of temporary workers to the total number of

[26] For the definition of temporary and part-time workers, see Section 2.2.3.

[27] In this connection, Sala et al. (2012) examined differences in the employment protection registration between permanent worker and temporary worker and their impact on employment volatility. Similarly, Jahn and Weber (2016) found that temporary workers decreased the employment volatility of incumbent workers in Germany between 1999 and 2012.

Table 9: Temporary Workers and Wages: Manufacturing

	(1) Excluding part-time workers	(2) Including temporary workers	(3) Ratio of temporary workers	(4) Volatility of wages
Both	-0.049***	-0.014	0.153***	0.054***
	(0.015)	(0.017)	(0.028)	(0.016)
Exports only	-0.083***	-0.050***	0.075***	0.030*
	(0.016)	(0.018)	(0.029)	(0.017)
Imports only	0.042**	0.033*	0.137***	0.045**
	(0.018)	(0.019)	(0.036)	(0.019)
Export intensity	-0.178***	-0.090	0.024	0.231***
	(0.063)	(0.060)	(0.089)	(0.063)
Import intensity	0.225***	-0.028	-0.295***	0.153**
	(0.062)	(0.061)	(0.109)	(0.067)
MNEs	0.019	0.036**	-0.020	0.028*
	(0.014)	(0.015)	(0.026)	(0.014)
Intrafirm both	-0.005	0.034	0.164***	-0.000
	(0.019)	(0.022)	(0.034)	(0.020)
Intrafirm exports only	-0.000	0.019	0.108***	-0.013
	(0.020)	(0.023)	(0.036)	(0.021)
Intrafirm imports only	0.027	-0.002	0.069	0.002
	(0.024)	(0.026)	(0.047)	(0.024)
Intrafirm export intensity	0.508***	0.496***	0.488**	0.075
	(0.152)	(0.116)	(0.190)	(0.133)
Intrafirm import intensity	-0.066	0.203**	0.147	-0.126
	(0.106)	(0.093)	(0.159)	(0.110)
N	15,974	13,137	13,394	14,936
R^2	0.060	0.081	0.167	0.027
Characteristics				
Firm	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes

For notes and sources, see those of Table 4.

Table 10: Temporary Workers and Wages: Wholesale Trade

	(1) Excluding part-time workers	(2) Including temporary workers	(3) Ratio of temporary workers	(4) Volatility of wages
Both	0.024	-0.007	0.320***	0.009
	(0.022)	(0.025)	(0.049)	(0.021)
Exports only	-0.013	0.035	0.219***	0.026
	(0.030)	(0.035)	(0.067)	(0.029)
Imports only	0.103***	0.062**	0.146***	0.020
	(0.021)	(0.026)	(0.053)	(0.021)
Export intensity	-0.024	0.011	0.093	0.033
	(0.130)	(0.123)	(0.253)	(0.114)
Import intensity	0.241***	0.292***	0.003	0.268***
	(0.056)	(0.065)	(0.127)	(0.055)
MNEs	0.018	0.039	0.008	0.048**
	(0.022)	(0.026)	(0.051)	(0.022)
Intrafirm both	0.046	0.047	0.295***	-0.007
	(0.028)	(0.035)	(0.065)	(0.028)
Intrafirm exports only	0.060*	0.092**	0.205**	0.046
	(0.034)	(0.042)	(0.082)	(0.037)
Intrafirm imports only	0.031	0.006	0.229***	0.022
	(0.030)	(0.040)	(0.076)	(0.030)
Intrafirm export intensity	0.305	0.050	-0.843	0.387
	(0.290)	(0.295)	(0.528)	(0.295)
Intrafirm import intensity	-0.269***	-0.279***	0.609***	-0.475***
	(0.084)	(0.100)	(0.173)	(0.091)
N	7,456	5,812	5,924	6,966
R^2	0.045	0.043	0.102	0.034
Characteristics				
Firm	Yes	Yes	Yes	Yes

For notes and sources, see those of Table 4.

workers. If the magnitude of the adjustment is the same between temporary and permanent workers, the estimated coefficients will be insignificant.

Column (3) indicates the results. Significantly positive coefficients are confirmed for *Both*, *Exports only*, *Imports only*, *Intrafirm both*, and *Intrafirm exports only* commonly in both manufacturing and wholesale trade. The results suggest that employment adjustments by trading firms are more likely to occur through temporary workers.

In this connection, one could also be interested in wage volatility along with employment volatility. When foreign shocks hit firms, firms could adjust through employment and/or wages. Thus, firms with lower employment volatility may have higher wage volatility. To address this issue, we use wages rather than employment to compute the volatility and estimate the same regression equation as the baseline model. We define wages as the total wage bill divided by the number of permanent workers.

Column (4) presents the results. We highlight two main results. First, in manufacturing, the coefficient for *Exports only* is significantly positive. Noting that *Exports only* shows consistently negative and significant coefficients in Tables 4–6, one possible interpretation is that firms that engage in *Exports only* absorb foreign shocks through wage adjustments while reducing employment adjustments. Second, for wholesale trade, the signs of the coefficients are generally the same as those in the baseline model although their significance levels change slightly. One notable difference is that the coefficient for *MNEs* is now significantly positive. Combined with the insignificant relationship between *MNEs* and the employment volatility of regular workers, this positive coefficient might imply that MNEs in wholesale trade absorb foreign shocks through changes in the wages of regular workers rather than through changes in employment.

5.2 Intrafirm trade and contractibility

In Table 4, we found that the relationship between exports and employment volatility depended on the intrafirm export intensity for manufacturing. We interpret this result that the transmission of foreign demand shocks appears through intrafirm exports for manufacturing. This result complements and corroborates the result of Bems et al. (2010), who show that the international fragmentation of the production process can amplify the impact of demand shocks.

In this context, it may be interesting to ask how our results are related to product contractibility or relationship-specificity because some studies found a positive relationship between intrafirm trade and product contractibility.[28] For example, Bernard et al. (2010a) focused on the costs associated with writing contracts for specialized inputs. Using detailed firm-product-level trade data, they found that high product contractibility was associated with less intrafirm trade.

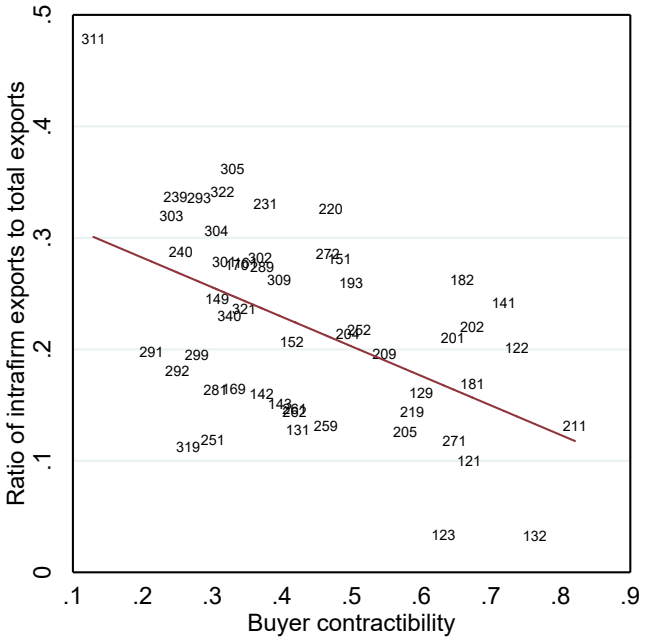
However, such detailed firm-product trade data are not available in Japan because, as previously mentioned, the information on firm-level trade cannot be disaggregated at the country and/or product level. Nonetheless, we can at least examine the relationship between contractibility, intrafirm trade intensity, and employment volatility at the industry level. For contractibility, we use the index employed by Antràs (2015). This index measures the buyer's contractibility and takes the value between 0 (low contractibility) and 1 (high contractibility).[29] Given limited data availability, we focus only on manufacturing.[30] We expect that the higher the contractibility, the lower the

[28] High relationship-specificity means low contractibility.

[29] For more detail about the contractibility index, see Appendix.

[30] For wholesale trade, we found that employment volatility decreases as intrafirm import intensity increases. Because the relationship between intrafirm imports and employment volatility for wholesale trade itself is entirely new in the literature, a more detailed investigation is needed for further discussion.

Figure 1: Contractibility and Intrafirm Export Ratio: Manufacturing Industries



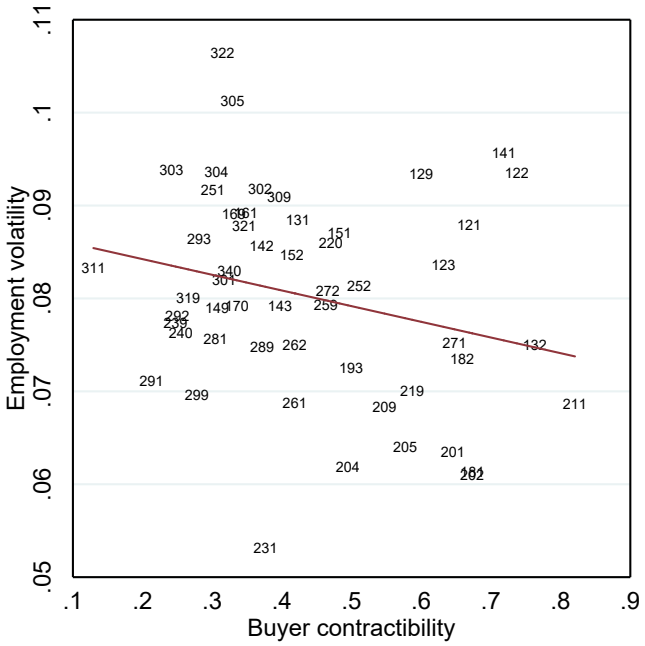
Notes: Each figure indicates the three-digit industry code. The solid line indicates the fitted value: $\hat{y} = 0.335(0.036) - 0.265(0.072)x$, where $\hat{y}$ is the ratio of intrafirm exports to total exports (industry average) and x is the contractibility index, and figures in parentheses are heteroskedasticity robust standard errors. $N = 53$ and $R^2 = 0.249$.
Source: The intrafirm export ratio is the authors' calculation based on the BSJBSA. Contractibility is obtained from Antràs (2015).

intrafirm export intensity and employment volatility because the high contractibility implies low contractual frictions in international trade.

Figures 1 and 2 describe the relationship between contractibility, intrafirm export intensity, and employment volatility. As expected, we find negative correlations between the contractibility index and intrafirm export intensity (-0.50) and between contractibility index and employment volatility (-0.25). We also estimate the baseline equation (i.e., equation (4)), splitting the sample between industries with a high and a low contractibility. Table 11 presents the regression results. Columns (1) and (2) indicate the results for industries with contractibility index above and below median, respectively. Columns (3) and (4) present the results based on mean rather than median.[31] Table 11 indicates that the significantly positive coefficient of *Intrafirm export intensity* is confirmed only for firms with below median and below mean. The results imply that the correlation between the intrafirm export intensity and employment volatility tends to be low in industries with high contractibility (i.e., low relationship-specificity). While only indicative, this result suggests that contractibility plays an important role in intrafirm trade and employment volatility.

[31] Table 11 includes firm- and industry-level control variables but their coefficients are not reported. The full results are provided in Table A7 in the Appendix.

Figure 2: Contractibility and Employment Volatility: Manufacturing Industries



Notes: Each figure indicates the three-digit industry code. The solid line indicates the fitted value: $\hat{y} = 0.087(0.004) - 0.017(0.009)x$, where $\hat{y}$ is employment volatility (industry average) and x is the contractibility index, and figures in parentheses are heteroskedasticity robust standard errors. $N = 53$ and $R^2 = 0.064$.
Source: The intrafirm export ratio is the authors' calculation based on the BSJBSA. Contractibility is obtained from Antràs (2015).

Table 11: Regression Results, by Contractibility

	(1) Above median	(2) Below median	(3) Above mean	(4) Below mean
Both	0.012	-0.020	0.008	-0.017
	(0.022)	(0.018)	(0.024)	(0.017)
Exports only	-0.029	-0.051**	-0.001	-0.065***
	(0.022)	(0.020)	(0.025)	(0.019)
Imports only	0.062***	-0.006	0.063***	-0.001
	(0.022)	(0.022)	(0.023)	(0.020)
Export intensity	-0.012	-0.067	0.057	-0.074
	(0.153)	(0.063)	(0.154)	(0.063)
Import intensity	0.084	0.242***	0.139	0.205***
	(0.085)	(0.077)	(0.088)	(0.075)
MNEs	0.065***	0.025	0.068***	0.024
	(0.020)	(0.016)	(0.022)	(0.016)
Intrafirm both	-0.069**	0.040*	-0.046	0.026
	(0.029)	(0.022)	(0.031)	(0.021)
Intrafirm exports only	0.003	0.022	0.006	0.023
	(0.030)	(0.023)	(0.032)	(0.022)
Intrafirm imports only	0.006	-0.002	0.012	-0.005
	(0.032)	(0.028)	(0.034)	(0.027)
Intrafirm export intensity	0.480	0.421***	0.340	0.450***
	(0.365)	(0.144)	(0.371)	(0.144)
Intrafirm import intensity	0.156	-0.089	0.113	-0.051
	(0.155)	(0.120)	(0.158)	(0.118)
N	7,028	8,950	6,237	9,741
R^2	0.058	0.043	0.068	0.038
Characteristics				
Firm	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Sector (2-digit) window-fixed effect				
	Yes	No	No	No

For notes and sources, see those of Table 4.

6 Concluding Remarks

In light of the increasing concerns over the relationship between globalization and labor market outcomes, this paper examines the relationship between international trade and employment volatility and that between FDI and employment volatility using large-scale, firm-level data from Japan. The major contributions of this paper are threefold. First, we distinguish among multinational firms, exporters, importers, and domestic firms. This enables us to examine the heterogeneous relationship between the mode of foreign exposure and employment volatility. Second, we expand the industry coverage of the analysis, covering not only manufacturing, but also wholesale trade firms. Third, we consider the difference between intrafirm trade and interfirm trade. This difference allows us to examine the mechanism through which foreign shocks transmit to domestic employment.

Our major findings are summarized as follows. First, in manufacturing, the relationship between exports and employment volatility varies depending on the share of intrafirm exports to total sales. One possible interpretation is that the transmission of foreign demand shocks to domestic employment is via intrafirm exports. In wholesale trade, exports and employment generally have no significant relationship. Unlike manufacturing, foreign demand shocks may not be significantly related to domestic employment.

Second, in both manufacturing and wholesale trade, employment volatility tends to become higher as the share of imports to total purchases increases. In wholesale trade, however, intrafirm imports tend to offset such shocks. This possibly implies that the transmission of foreign supply shocks to domestic employment appears through interfirm imports for wholesale trade.

Third, MNEs exhibit higher employment volatility in manufacturing. Therefore, multinational activities could invoke higher employment volatility. In wholesale trade, however, MNEs do not necessarily exhibit higher employment volatility. Note that firms that engage in intrafirm trade are a subset of MNEs. In wholesale trade, MNEs may successfully mitigate the transmission of foreign supply shocks through intrafirm trade. Fourth, employment adjustments by trading firms are more likely to occur through temporary workers. Finally, contractibility may play an important role in intrafirm trade and employment volatility.

For manufacturing, our results are similar to those of Kurz and Senses (2016), who found that, on average, firms that exported were less volatile. The explanation of their results becomes much richer if we consider intrafirm trade and if we extend the analysis to wholesale trade. Our results together suggest that the transmission of foreign supply and demand shocks could be through not only manufacturing, but also wholesale trade firms. Further, a higher share of intrafirm trade could magnify the foreign demand shocks in manufacturing and could mitigate the foreign supply shocks in wholesale trade. In identifying the potential risks from foreign demand and supply shocks, policymakers must be aware of the heterogeneity in manufacturing and wholesale trade and the possible transmission channels through intrafirm trade.

In conclusion, several possible future research topics exist that are worth mentioning. First, further investigation of FDI is an important extension. For example, employment volatility could vary between firms with production plants abroad and firms without such plants if the substitution of domestic and foreign workers causes higher employment volatility for MNEs. Second, it is also important to investigate the differences between regular and nonregular workers in more detail. As discussed in Section 3.2, the availability of information on temporary workers is limited. Moreover, some firms employ neither part-time nor temporary workers (Table A2 in the Appendix),

which prevents us from computing their employment volatility. However, nonregular workers are those that likely bear the brunt of the demand and supply shocks. These issues will be explored in the next stage of our research.

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Appendix A Contractibility Index

In Section 5.2, we use the contractibility index employed by Antràs (2015). This index measures the buyer's contractibility and takes a value between 0 (low contractibility) and 1 (high contractibility). This index is constructed as follows.

Let industry i purchases inputs from industry j. The buyer's contractibility for industry i (BS_i) is defined as follows:

$$BS_i = \sum_k s_{ik}(1 - S_k), \tag{A-1}$$

where s_{ik} is the ratio of the sales of industry i to industry k to the total sales of industry i; and S_k is the contract intensity developed by Nunn (2007). This contract intensity is defined as:

$$S_i = \sum_j v_{ij} I_j, \tag{A-2}$$

where v_{ij} is the share of inputs from industry j in industry i to total inputs in industry i; and I_j is the indicator variable that takes unity if industry j is an industry that produces differentiated goods. Whether the industry produces differentiated or homogeneous goods is based on the classification by Rauch (1999).

The index BS_i provided by Antràs (2015) is based on the industry classification of the 2002 U.S. input–output table compiled by Ministry of Economy, Trade and Industry of Japan. We convert BS_i to Japanese industry classification by using the 2005 Japan-U.S. input–output table to apply this contractibility index to Japanese data.

Appendix B Variable Construction Procedure for TFP

The variables used in production function estimation are constructed as follows: We use real value added as an output measure. It is defined as the difference between real sales and real intermediate input. Output and input deflators are obtained from the JIP database. We estimate capital stock with the perpetual inventory method. For initial capital stock, we use fixed tangible asset deflated by the investment goods price index, which is also obtained from the JIP database. Then, capital stock in the following years is constructed by using deflated net increase in fixed tangible asset and depreciation ratio. A deflator for net increase in fixed asset is investment goods price index. Both investment goods price index and depreciation ratio come from the JIP database. Labor input is defined as total employment.

Table A1. Number of Firms, by Industry and Year

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Manufacturing	**11,301**	**11,602**	**11,921**	**12,336**	**12,203**	**11,803**	**11,939**	**11,729**	**11,346**	**11,794**	**11,634**	**11,516**	**11,698**	**11,788**	**11,549**	**10,967**	**10,865**	**10,575**
Food products and beverages	1,326	1,343	1,392	1,440	1,464	1,408	1,440	1,433	1,388	1,451	1,424	1,429	1,454	1,469	1,472	1,382	1,387	1,356
Textiles	281	301	316	327	322	300	293	285	262	268	262	244	243	242	229	211	207	207
Pulp, paper and paper products	371	382	383	403	387	382	376	371	370	373	355	354	356	355	351	345	339	326
Chemicals	834	826	840	846	850	833	832	821	804	838	818	797	806	814	798	778	763	767
Petroleum and coal products	661	675	700	717	710	683	686	673	658	698	688	693	700	708	694	664	653	634
Non-metallic mineral products	512	522	537	552	530	507	488	463	439	448	441	429	428	413	416	383	376	371
Basic metal	639	647	656	685	668	666	660	655	635	663	676	669	687	696	698	666	665	641
Fabricated metal products	824	839	873	908	894	862	897	869	843	870	863	859	870	900	872	832	813	790
Machinery	1,360	1,415	1,434	1,487	1,466	1,413	1,450	1,441	1,400	1,469	1,474	1,459	1,497	1,512	1,491	1,436	1,410	1,389
Electrical machinery	1,598	1,656	1,695	1,764	1,747	1,723	1,725	1,704	1,654	1,712	1,679	1,671	1,686	1,656	1,614	1,518	1,496	1,426
Transport equipment	995	1,026	1,053	1,078	1,080	1,040	1,058	1,038	1,021	1,074	1,040	1,045	1,076	1,097	1,065	1,025	1,027	1,010
Precision instruments	132	140	143	152	149	150	151	152	156	159	154	154	158	159	158	141	148	143
Other manufacturing	1,768	1,830	1,899	1,977	1,936	1,836	1,883	1,824	1,716	1,771	1,760	1,713	1,737	1,767	1,691	1,586	1,581	1,515
Wholesale trade	**5,389**	**5,605**	**5,698**	**5,860**	**5,746**	**5,428**	**5,459**	**5,305**	**5,148**	**5,240**	**5,189**	**5,042**	**5,151**	**5,171**	**5,001**	**4,812**	**4,788**	**4,652**
Total	**16,690**	**17,207**	**17,619**	**18,196**	**17,949**	**17,231**	**17,398**	**17,034**	**16,494**	**17,034**	**16,823**	**16,558**	**16,849**	**16,959**	**16,550**	**15,779**	**15,653**	**15,227**

Note: Industry classification is based on sector (two-digit) level.

Source: Authors' calculation based on the BSJBSA.

Table A2. Summary Statistics

	All industries					Manufacturing					Wholesale trade				
	# of firms	Mean	S.D.	p25	p75	# of firms	Mean	S.D.	p25	p75	N	Mean	S.D.	p25	p75
Employment volatility	23,556	-2.618	0.523	-2.970	-2.252	15,978	-2.632	0.505	-2.968	-2.276	7,578	-2.588	0.558	-2.974	-2.191
Both	23,556	0.335	0.472	0.000	1.000	15,978	0.347	0.476	0.000	1.000	7,578	0.310	0.462	0.000	1.000
Exports only	23,556	0.086	0.280	0.000	0.000	15,978	0.102	0.303	0.000	0.000	7,578	0.051	0.220	0.000	0.000
Imports only	23,556	0.102	0.303	0.000	0.000	15,978	0.092	0.289	0.000	0.000	7,578	0.125	0.330	0.000	0.000
Export intensity	23,556	0.032	0.093	0.000	0.012	15,978	0.038	0.100	0.000	0.018	7,578	0.021	0.076	0.000	0.003
Import intensity	23,556	0.050	0.134	0.000	0.023	15,978	0.042	0.108	0.000	0.025	7,578	0.066	0.175	0.000	0.021
Intrafirm both	23,556	0.180	0.384	0.000	0.000	15,978	0.195	0.396	0.000	0.000	7,578	0.150	0.357	0.000	0.000
Intrafirm exports only	23,556	0.058	0.234	0.000	0.000	15,978	0.067	0.251	0.000	0.000	7,578	0.039	0.194	0.000	0.000
Intrafirm imports only	23,556	0.050	0.218	0.000	0.000	15,978	0.045	0.208	0.000	0.000	7,578	0.060	0.237	0.000	0.000
Intrafirm export intensity	23,556	0.009	0.040	0.000	0.000	15,978	0.011	0.045	0.000	0.000	7,578	0.005	0.029	0.000	0.000
Intrafirm import intensity	23,556	0.018	0.080	0.000	0.000	15,978	0.016	0.063	0.000	0.000	7,578	0.022	0.108	0.000	0.000
MNEs	23,556	0.289	0.453	0.000	1.000	15,978	0.309	0.462	0.000	1.000	7,578	0.247	0.432	0.000	0.000
Employment	23,556	5.075	0.851	4.419	5.519	15,978	5.136	0.876	4.457	5.596	7,578	4.949	0.780	4.354	5.342
Employment^2	23,556	26.480	9.553	19.530	30.460	15,978	27.140	9.932	19.860	31.310	7,578	25.100	8.537	18.960	28.530
Number of establishments	23,556	1.354	0.987	0.619	2.015	15,978	1.128	0.938	0.363	1.719	7,578	1.831	0.915	1.275	2.398
Age	23,556	41.740	17.690	30.000	53.350	15,978	41.870	17.670	30.500	53.500	7,578	41.490	17.740	29.500	53.110
Share of nonproduction workers	23,556	0.528	0.338	0.231	0.952	15,978	0.342	0.217	0.178	0.462	7,578	0.920	0.170	0.952	1.000
R&D-sales ratio	23,556	0.007	0.023	0.000	0.005	15,978	0.010	0.024	0.000	0.009	7,578	0.002	0.018	0.000	0.000
Import penetration	23,556	0.081	0.096	0.014	0.105	15,978	0.113	0.101	0.050	0.136	7,578	0.014	0.002	0.012	0.015
Industry skill share	23,556	0.703	0.214	0.550	0.936	15,978	0.589	0.165	0.511	0.666	7,578	0.943	0.022	0.926	0.950
Industry employment size	23,556	12.300	1.333	11.250	13.980	15,978	11.510	0.806	10.960	11.920	7,578	13.980	0.012	13.980	13.980
Industry capital-labor ratio	23,556	1.913	0.648	1.458	2.149	15,978	2.133	0.684	1.591	2.587	7,578	1.449	0.056	1.430	1.474
Share of temporary workers	18,949	0.043	0.065	0.001	0.058	13,137	0.050	0.070	0.002	0.069	5,812	0.028	0.058	0.000	0.035
Share of part-time workers	23,430	0.094	0.132	0.010	0.120	15,974	0.096	0.133	0.013	0.120	7,456	0.091	0.130	0.007	0.120

Notes: For the definition of variables, see the main text.

Source: Authors' calculation based on the BSJBSA and the JIP database.

Table A3. Regression Results: Manufacturing, All Coefficients

	(0) Kurz and Senses (2016) specification	(1) Baseline	(2) 6-year window	(3) Actual growth	(4) Alternative trade / MNE status	(5) Adds TFP shocks	(6) Adds output growth
Both	0.001	-0.014	-0.003	-0.002	-0.124***	-0.019	-0.026*
	(0.011)	(0.014)	(0.015)	(0.001)	(0.016)	(0.014)	(0.014)
Exports only	-0.042***	-0.047***	-0.020	-0.003***	-0.095***	-0.054***	-0.057***
	(0.014)	(0.015)	(0.015)	(0.001)	(0.016)	(0.015)	(0.014)
Imports only	0.030**	0.027*	0.043***	0.001	-0.056***	0.022	0.018
	(0.014)	(0.015)	(0.016)	(0.001)	(0.020)	(0.016)	(0.015)
Export intensity	0.115**	-0.045	-0.018	-0.002	0.112*	-0.129**	-0.257***
	(0.048)	(0.059)	(0.057)	(0.005)	(0.061)	(0.061)	(0.060)
Import intensity	0.182***	0.136**	0.019	0.014***	0.294***	0.110*	0.168***
	(0.040)	(0.057)	(0.052)	(0.005)	(0.060)	(0.060)	(0.056)
MNEs		0.038***	0.043***	0.003***	-0.008	0.024*	0.034***
		(0.013)	(0.014)	(0.001)	(0.014)	(0.013)	(0.013)
Intrafirm both		0.001	0.020	-0.000	0.096***	0.000	-0.004
		(0.018)	(0.020)	(0.001)	(0.018)	(0.018)	(0.017)
Intrafirm exports only		0.010	0.001	-0.000	0.042***	0.017	0.009
		(0.018)	(0.020)	(0.001)	(0.015)	(0.019)	(0.018)
Intrafirm imports only		0.004	-0.027	-0.001	0.058***	-0.003	0.001
		(0.021)	(0.025)	(0.002)	(0.018)	(0.022)	(0.021)
Intrafirm export intensity		0.486***	0.297***	0.045***	0.367***	0.533***	0.692***
		(0.134)	(0.114)	(0.013)	(0.135)	(0.146)	(0.130)
Intrafirm import intensity		0.026	0.196**	-0.006	-0.111	0.050	0.005
		(0.094)	(0.086)	(0.008)	(0.097)	(0.100)	(0.092)
Firm characteristics							
Employment	0.208***	0.213***	-0.053	0.020***	0.221***	0.172***	0.215***
	(0.046)	(0.046)	(0.047)	(0.004)	(0.046)	(0.047)	(0.045)
Employment^2	-0.020***	-0.021***	-0.001	-0.002***	-0.021***	-0.016***	-0.020***
	(0.004)	(0.004)	(0.004)	(0.000)	(0.004)	(0.004)	(0.004)
Number of establishments	0.006	0.004	0.003	0.000	0.011*	0.010*	0.022***
	(0.006)	(0.006)	(0.006)	(0.001)	(0.006)	(0.006)	(0.006)
Age	-0.003***	-0.003***	-0.003***	-0.000***	-0.003***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Share of nonproduction workers	-0.117***	-0.117***	-0.077***	-0.010***	-0.110***	-0.138***	-0.064***
	(0.023)	(0.023)	(0.022)	(0.002)	(0.023)	(0.023)	(0.022)
R&D-sales ratio	-0.594	-0.640	-1.113***	-0.036	-0.511	-1.650***	-1.571***
	(0.411)	(0.424)	(0.259)	(0.036)	(0.388)	(0.256)	(0.244)
Volatility of productivity / output						0.503***	1.537***
						(0.025)	(0.066)
Industry characteristics							
Import penetration	0.305***	0.308***	0.175***	0.024***	0.322***	0.317***	0.256***
	(0.042)	(0.042)	(0.055)	(0.003)	(0.042)	(0.043)	(0.041)
Industry skill share	-0.145***	-0.142***	-0.256***	-0.012***	-0.139***	-0.102***	-0.162***
	(0.029)	(0.029)	(0.074)	(0.002)	(0.029)	(0.030)	(0.029)
Industry size	0.040***	0.038***	0.012	0.003***	0.040***	0.042***	0.033***
	(0.005)	(0.005)	(0.008)	(0.000)	(0.005)	(0.005)	(0.005)
Industry capital-labor ratio	-0.033***	-0.034***	-0.039***	-0.003***	-0.032***	-0.042***	-0.039***
	(0.006)	(0.006)	(0.011)	(0.000)	(0.006)	(0.006)	(0.006)
Constant	-3.330***	-3.310***	-2.248***	0.019*	-3.367***	-3.416***	-3.504***
	(0.138)	(0.139)	(0.182)	(0.011)	(0.138)	(0.144)	(0.138)
Number of observations	15,978	15,978	31,174	15,978	15,978	14,213	15,496
R-squared	0.041	0.043	0.048	0.045	0.046	0.073	0.082

For notes and sources, see Table 4.

Table A3. Regression Results: Manufacturing, All Coefficients (Continued)

	(1) Before 2009	(2) Adds number of years	(3) Over 60 workers	(4) Three-digit fixed effect	(5) Excluding part-time workers	(6) Including temporary workers	(7) Ratio of temporary workers	(8) Volatility of wages
Both	-0.008	-0.002	-0.013	-0.003	-0.049***	-0.014	0.153***	0.054***
	(0.015)	(0.014)	(0.015)	(0.014)	(0.015)	(0.017)	(0.028)	(0.016)
Exports only	-0.042***	-0.040***	-0.043***	-0.036**	-0.083***	-0.050***	0.075***	0.030*
	(0.016)	(0.015)	(0.017)	(0.015)	(0.016)	(0.018)	(0.029)	(0.017)
Imports only	0.043**	0.032**	0.019	0.021	0.042**	0.033*	0.137***	0.045**
	(0.017)	(0.015)	(0.018)	(0.015)	(0.018)	(0.019)	(0.036)	(0.019)
Export intensity	-0.098	-0.059	-0.051	-0.017	-0.178***	-0.090	0.024	0.231***
	(0.069)	(0.059)	(0.063)	(0.060)	(0.063)	(0.060)	(0.089)	(0.063)
Import intensity	0.219***	0.107*	0.150**	0.142**	0.225***	-0.028	-0.295***	0.153**
	(0.064)	(0.056)	(0.066)	(0.058)	(0.062)	(0.061)	(0.109)	(0.067)
MNEs	0.050***	0.037***	0.044***	0.046***	0.019	0.036**	-0.020	0.028*
	(0.014)	(0.013)	(0.014)	(0.013)	(0.014)	(0.015)	(0.026)	(0.014)
Intrafirm both	-0.018	0.001	-0.003	0.001	-0.005	0.034	0.164***	-0.000
	(0.020)	(0.017)	(0.019)	(0.017)	(0.019)	(0.022)	(0.034)	(0.020)
Intrafirm exports only	-0.002	0.008	-0.003	0.019	-0.000	0.019	0.108***	-0.013
	(0.021)	(0.018)	(0.020)	(0.018)	(0.020)	(0.023)	(0.036)	(0.021)
Intrafirm imports only	-0.031	0.004	0.004	0.001	0.027	-0.002	0.069	0.002
	(0.025)	(0.021)	(0.023)	(0.021)	(0.024)	(0.026)	(0.047)	(0.024)
Intrafirm export intensity	0.595***	0.498***	0.483***	0.360***	0.508***	0.496***	0.488**	0.075
	(0.149)	(0.133)	(0.138)	(0.132)	(0.152)	(0.116)	(0.190)	(0.133)
Intrafirm import intensity	-0.029	0.031	0.052	-0.037	-0.066	0.203**	0.147	-0.126
	(0.107)	(0.093)	(0.102)	(0.094)	(0.106)	(0.093)	(0.159)	(0.110)
Firm characteristics								
Employment	0.163***	0.278***	0.173***	0.166***	0.284***	0.468***	1.275***	0.167***
	(0.050)	(0.046)	(0.054)	(0.046)	(0.049)	(0.052)	(0.064)	(0.050)
Employment^2	-0.017***	-0.026***	-0.016***	-0.018***	-0.028***	-0.034***	-0.084***	-0.020***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)
Number of establishments	0.008	0.004	0.000	0.012*	0.020***	-0.085***	-0.245***	0.043***
	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)	(0.007)	(0.012)	(0.007)
Age	-0.003***	-0.003***	-0.004***	-0.003***	-0.003***	-0.005***	-0.005***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Share of nonproduction workers	-0.100***	-0.123***	-0.099***	-0.104***	-0.182***	0.099***	0.203***	0.106***
	(0.025)	(0.023)	(0.025)	(0.025)	(0.024)	(0.026)	(0.044)	(0.025)
R&D-sales ratio	-1.207***	-0.597	-1.373***	-0.595	-0.778**	-0.893**	-0.911***	0.654***
	(0.289)	(0.406)	(0.275)	(0.428)	(0.346)	(0.396)	(0.345)	(0.189)
Number of survival years		-0.010***						
		(0.001)						
Industry characteristics								
Import penetration	0.356***	0.304***	0.316***	-0.410	0.537***	0.239***	-0.264***	0.025
	(0.048)	(0.042)	(0.047)	(0.294)	(0.045)	(0.044)	(0.084)	(0.047)
Industry skill share	-0.204***	-0.140***	-0.157***	-0.059	-0.019	-0.287***	0.339***	0.141***
	(0.044)	(0.029)	(0.034)	(0.052)	(0.031)	(0.046)	(0.086)	(0.032)
Industry size	0.032***	0.038***	0.041***	-0.066	0.069***	0.070***	0.202***	0.007
	(0.006)	(0.005)	(0.006)	(0.135)	(0.006)	(0.006)	(0.010)	(0.006)
Industry capital-labor ratio	-0.034***	-0.030***	-0.042***	-0.025	-0.070***	-0.000	0.108***	-0.035***
	(0.006)	(0.006)	(0.006)	(0.092)	(0.006)	(0.007)	(0.013)	(0.007)
Constant	-3.108***	-3.411***	-3.250***	-2.130*	-3.716***	-4.372***	-10.600***	-2.500***
	(0.153)	(0.139)	(0.169)	(1.227)	(0.151)	(0.160)	(0.230)	(0.156)
Number of observations	14,493	15,978	12,886	15,978	15,974	13,137	13,394	14,936
R-squared	0.041	0.052	0.050	0.073	0.060	0.081	0.167	0.027

For notes and sources, see Table 4.

Table A4. Regression Results: Wholesale Trade, All Coefficients

	(0) Kurz and Senses (2016) specification	(1) Baseline	(2) 6-year window	(3) Actual growth	(4) Alternative trade / MNE status	(5) Adds TFP shocks	(6) Adds output growth
Both	0.057***	0.010	-0.020	0.000	-0.096***	-0.007	-0.008
	(0.017)	(0.021)	(0.023)	(0.002)	(0.024)	(0.023)	(0.021)
Exports only	-0.017	-0.032	-0.040	-0.003	-0.116***	-0.045	-0.052*
	(0.029)	(0.030)	(0.031)	(0.003)	(0.037)	(0.031)	(0.030)
Imports only	0.111***	0.091***	0.116***	0.006***	0.018	0.083***	0.090***
	(0.020)	(0.021)	(0.022)	(0.002)	(0.024)	(0.022)	(0.021)
Export intensity	0.178*	0.049	-0.125	0.008	0.234*	0.070	-0.203
	(0.096)	(0.122)	(0.119)	(0.012)	(0.124)	(0.126)	(0.131)
Import intensity	0.179***	0.324***	0.245***	0.030***	0.394***	0.356***	0.341***
	(0.040)	(0.057)	(0.062)	(0.006)	(0.060)	(0.062)	(0.057)
MNEs		0.019	0.051**	0.001	0.001	-0.002	0.006
		(0.022)	(0.024)	(0.002)	(0.025)	(0.023)	(0.022)
Intrafirm both		0.056*	0.078**	0.004	0.095***	0.049	0.042
		(0.028)	(0.033)	(0.003)	(0.031)	(0.030)	(0.029)
Intrafirm exports only		0.057*	0.074*	0.003	0.090***	0.048	0.056
		(0.035)	(0.039)	(0.003)	(0.030)	(0.036)	(0.035)
Intrafirm imports only		0.052*	0.024	0.003	0.127***	0.078**	0.061**
		(0.030)	(0.037)	(0.003)	(0.027)	(0.031)	(0.030)
Intrafirm export intensity		0.304	0.247	0.029	0.285	0.288	0.655**
		(0.288)	(0.299)	(0.029)	(0.289)	(0.323)	(0.292)
Intrafirm import intensity		-0.379***	-0.280***	-0.035***	-0.461***	-0.454***	-0.477***
		(0.089)	(0.095)	(0.009)	(0.089)	(0.096)	(0.086)
Firm characteristics							
Employment	0.591***	0.589***	0.311***	0.055***	0.591***	0.535***	0.638***
	(0.086)	(0.086)	(0.088)	(0.007)	(0.086)	(0.091)	(0.094)
Employment^2	-0.048***	-0.048***	-0.028***	-0.004***	-0.048***	-0.043***	-0.051***
	(0.008)	(0.008)	(0.008)	(0.001)	(0.008)	(0.008)	(0.009)
Number of establishments	-0.024***	-0.025***	-0.027***	-0.002**	-0.023**	-0.024**	-0.031***
	(0.009)	(0.009)	(0.009)	(0.001)	(0.009)	(0.010)	(0.009)
Age	-0.004***	-0.004***	-0.004***	-0.000***	-0.004***	-0.004***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Share of nonproduction workers	-0.094***	-0.097***	-0.161***	-0.006*	-0.105***	-0.062	-0.083**
	(0.036)	(0.036)	(0.038)	(0.003)	(0.036)	(0.039)	(0.037)
R&D-sales ratio	-0.142	-0.166	-0.112	-0.009	-0.098	-2.625**	-1.837*
	(0.252)	(0.253)	(0.367)	(0.028)	(0.269)	(1.287)	(1.085)
Volatility of productivity / output						0.737***	1.861***
						(0.056)	(0.136)
Constant	-4.043***	-4.026***	-3.246***	-0.050***	-4.024***	-4.115***	-4.399***
	(0.230)	(0.230)	(0.239)	(0.019)	(0.230)	(0.245)	(0.250)
Number of observations	7,578	7,578	13,856	7,578	7,578	6,454	7,279
R-squared	0.045	0.048	0.035	0.050	0.049	0.076	0.074

For notes and sources, see Table 4.

Table A4. Regression Results: Wholesale Trade, All Coefficients (Continued)

	(1) Before 2009	(2) Adds number of years	(3) Over 60 workers	(4) Three-digit fixed effect	(5) "Pure" wholesale trade	(6) Excluding part-time workers	(7) Including temporary workers	(8) Ratio of temporary workers	(9) Volatility of wages
Both	0.031	0.021	0.007	0.017	0.027	0.024	-0.007	0.320***	0.009
	(0.023)	(0.021)	(0.025)	(0.021)	(0.029)	(0.022)	(0.025)	(0.049)	(0.021)
Exports only	-0.055*	-0.021	-0.038	-0.021	-0.026	-0.013	0.035	0.219***	0.026
	(0.033)	(0.030)	(0.037)	(0.029)	(0.039)	(0.030)	(0.035)	(0.067)	(0.029)
Imports only	0.114***	0.088***	0.096***	0.065***	0.107***	0.103***	0.062**	0.146***	0.020
	(0.023)	(0.021)	(0.024)	(0.021)	(0.028)	(0.021)	(0.026)	(0.053)	(0.021)
Export intensity	-0.017	0.022	-0.157	0.191	0.154	-0.024	0.011	0.093	0.033
	(0.136)	(0.121)	(0.139)	(0.121)	(0.169)	(0.130)	(0.123)	(0.253)	(0.114)
Import intensity	0.341***	0.305***	0.325***	0.258***	0.346***	0.241***	0.292***	0.003	0.268***
	(0.068)	(0.056)	(0.068)	(0.057)	(0.072)	(0.056)	(0.065)	(0.127)	(0.055)
MNEs	0.010	0.019	0.007	0.015	0.049*	0.018	0.039	0.008	0.048**
	(0.025)	(0.022)	(0.024)	(0.022)	(0.029)	(0.022)	(0.026)	(0.051)	(0.022)
Intrafirm both	0.033	0.056**	0.071**	0.079***	0.019	0.046	0.047	0.295***	-0.007
	(0.033)	(0.028)	(0.032)	(0.028)	(0.038)	(0.028)	(0.035)	(0.065)	(0.028)
Intrafirm exports only	0.039	0.058*	0.050	0.073**	0.030	0.060*	0.092**	0.205**	0.046
	(0.040)	(0.035)	(0.039)	(0.034)	(0.046)	(0.034)	(0.042)	(0.082)	(0.037)
Intrafirm imports only	0.020	0.059**	0.093***	0.036	0.045	0.031	0.006	0.229***	0.022
	(0.034)	(0.030)	(0.035)	(0.030)	(0.042)	(0.030)	(0.040)	(0.076)	(0.030)
Intrafirm export intensity	0.539*	0.332	0.569*	0.242	-0.173	0.305	0.050	-0.843	0.387
	(0.316)	(0.287)	(0.314)	(0.286)	(0.587)	(0.290)	(0.295)	(0.528)	(0.295)
Intrafirm import intensity	-0.393***	-0.389***	-0.428***	-0.246***	-0.485***	-0.269***	-0.279***	0.609***	-0.475***
	(0.106)	(0.089)	(0.102)	(0.089)	(0.114)	(0.084)	(0.100)	(0.173)	(0.091)
Firm characteristics									
Employment	0.640***	0.689***	0.559***	0.567***	0.601***	0.730***	0.415***	0.891***	0.320***
	(0.101)	(0.086)	(0.115)	(0.085)	(0.114)	(0.102)	(0.096)	(0.140)	(0.099)
Employment^2	-0.053***	-0.057***	-0.043***	-0.049***	-0.050***	-0.063***	-0.031***	-0.058***	-0.028***
	(0.009)	(0.008)	(0.010)	(0.008)	(0.011)	(0.010)	(0.009)	(0.012)	(0.009)
Number of establishments	-0.026***	-0.025***	-0.036***	0.010	-0.026**	-0.040***	-0.029***	-0.042**	0.035***
	(0.010)	(0.009)	(0.010)	(0.010)	(0.011)	(0.009)	(0.011)	(0.021)	(0.009)
Age	-0.004***	-0.004***	-0.004***	-0.005***	-0.004***	-0.004***	-0.004***	-0.007***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Share of nonproduction	-0.093**	-0.104***	-0.069	-0.080**		-0.194***	-0.147***	-0.325***	-0.317***
workers	(0.040)	(0.036)	(0.043)	(0.037)		(0.037)	(0.044)	(0.094)	(0.038)
R&D-sales ratio	-0.176	-0.212	-0.301	0.030	0.551**	-0.209	0.019	1.260	0.943***
	(0.246)	(0.249)	(0.283)	(0.246)	(0.266)	(0.237)	(0.596)	(1.627)	(0.181)
Number of survival years		-0.012***							
		(0.001)							
Constant	-4.169***	-4.198***	-4.047***	-3.942***	-4.161***	-4.215***	-3.570***	-7.129***	-2.726***
	(0.269)	(0.231)	(0.320)	(0.233)	(0.301)	(0.267)	(0.259)	(0.400)	(0.263)
Number of observations	6,877	7,578	5,666	7,578	4,773	7,456	5,812	5,924	6,966
R-squared	0.044	0.058	0.046	0.071	0.049	0.045	0.043	0.102	0.034

For notes and sources, see Table 4.

Table A5. Year-to-Year Transition Probability Matrix

Manufacturing (%)					
	year *t*				
year *t-1*	*Both*	*Exports only*	*Imports only*	*Non-trader*	Total
Both	89.2	5.6	2.7	2.6	100.0
Exports only	12.5	77.1	0.5	9.8	100.0
Imports only	9.5	0.9	76.2	13.4	100.0
Non-trader	1.1	2.2	1.9	94.8	100.0

	year *t*		
year *t-1*	*Non-MNEs*	*MNEs*	Total
Non-MNEs	97.8	2.2	100.0
MNEs	4.2	95.8	100.0

Wholesale trade (%)					
	year *t*				
year *t-1*	*Both*	*Exports only*	*Imports only*	*Non-trader*	Total
Both	89.7	3.2	4.0	3.1	100.0
Exports only	14.5	72.9	1.0	11.7	100.0
Imports only	8.0	0.3	81.6	10.1	100.0
Non-trader	1.0	1.2	1.9	95.9	100.0

	year *t*		
year *t-1*	*Non-MNEs*	*MNEs*	Total
Non-MNEs	98.3	1.7	100.0
MNEs	5.0	95.0	100.0

Source: Authors' calculation based on the BSJBSA.

Table A6. Number of Firms, by Three-digit Industry

Sector	Three-digit code	Industry	Number of firms
Manufacturing			**15,978**
Food products and beverages	121	Livestock Foodstuff	313
	122	Fisheries food	248
	123	Flour and grain mill products	47
	129	Other food and related products	1,075
	131	Soft drinks, liquors, tea and tobacco	192
	132	Feed and organic fertilizer	53
Textiles	141	Spinning mills	60
	142	Textiles and knit fabric	108
	143	Dyeing organization	103
	149	Other textile industry	120
Pulp, paper and paper products	181	Pulp and paper	120
	182	Paper Processed	374
Chemicals	201	Chemical fertilizer / inorganic chemical industrial product	124
	202	Organic chemical industry product	214
	204	Oil and fat products, soaps, synthetic detergents	152
	205	Pharmaceutical	254
	209	Other chemical industry product	314
Petroleum and coal products	211	Petroleum refining industry	28
	219	Other petroleum products / coal products	28
Non-metallic mineral products	251	Glass and the same product	130
	252	Cement and the same product	277
	259	Other ceramic industry / stone products	269
Basic metal	261	Pig iron / crude steel / steel material	217
	262	Forged castings and other steel products	278
	271	Nonferrous metal refining and refining industry	63
	272	Non-ferrous metal processed goods	327
Fabricated metal products	281	Construction and building metal products	377
	289	Other metal products	808
Machinery	291	Metal processing machinery	300
	292	Special industry machinery	590
	293	Machine tool for office and service	177
	299	Other machinery and parts	889
Electrical machinery	301	Industrial electrical machinery and equipment	497
	302	Consumer electrical machinery and equipment	134
	303	Communication machinery and equipment	322
	304	Electronic equipment	227
	305	Electronic parts / device	884
	309	Other electrical machinery and equipment	253
Transport equipment	311	Automobile and accessories	1,120
	319	Other transportation equipment	285
Precision instruments	321	Medical equipment / medical supplies	113
	322	Optical machinery and equipment / lens	87
Other manufacturing	151	Textiles / knitwear garment	280
	152	Personal items and other textile	104
	161	Sawing and plywood	170
	169	Other wood product	22
	170	Furniture and accessories	200
	191	Newspaper industry	96
	192	Publishing industry	130
	193	Printing industries	738
	220	Plastic product	879
	231	Tire and tube	7
	239	Other rubber products	164
	240	Leather, same product / fur	51
	340	Other miscellaneous manufacturing	586
Wholesale trade			**7,578**
	491	Textile	121
	492	Apparel and accessories	514
	501	Agricultural and livestock products / marine products	634
	502	Food and beverage	679
	511	Building materials	648
	512	Chemical product	441
	513	Mineral and metal material	640
	514	Recycled resource	71
	520	General machinery and equipment	2,418
	531	Furniture and Fittings	209
	532	Medicine and cosmetics	316
	539	Other miscellaneous wholesale trade	887

Source: Authors' calculation based on the BSJBSA.

Table A7. Regression Results, by Contractibility: Manufacturing, All Coefficients

	(1) Baseline	(2) Above median	(3) Below median	(4) Above mean	(5) Below mean
Both	-0.014	0.012	-0.020	0.008	-0.017
	(0.014)	(0.022)	(0.018)	(0.024)	(0.017)
Exports only	-0.047***	-0.029	-0.051**	-0.001	-0.065***
	(0.015)	(0.022)	(0.020)	(0.025)	(0.019)
Imports only	0.027*	0.062***	-0.006	0.063***	-0.001
	(0.015)	(0.022)	(0.022)	(0.023)	(0.020)
Export intensity	-0.045	-0.012	-0.067	0.057	-0.074
	(0.059)	(0.153)	(0.063)	(0.154)	(0.063)
Import intensity	0.136**	0.084	0.242***	0.139	0.205***
	(0.057)	(0.085)	(0.077)	(0.088)	(0.075)
MNEs	0.038***	0.065***	0.025	0.068***	0.024
	(0.013)	(0.020)	(0.016)	(0.022)	(0.016)
Intrafirm both	0.001	-0.069**	0.040*	-0.046	0.026
	(0.018)	(0.029)	(0.022)	(0.031)	(0.021)
Intrafirm exports only	0.010	0.003	0.022	0.006	0.023
	(0.018)	(0.030)	(0.023)	(0.032)	(0.022)
Intrafirm imports only	0.004	0.006	-0.002	0.012	-0.005
	(0.021)	(0.032)	(0.028)	(0.034)	(0.027)
Intrafirm export intensity	0.486***	0.480	0.421***	0.340	0.450***
	(0.134)	(0.365)	(0.144)	(0.371)	(0.144)
Intrafirm import intensity	0.026	0.156	-0.089	0.113	-0.051
	(0.094)	(0.155)	(0.120)	(0.158)	(0.118)
Firm characteristics					
Employment	0.213***	0.251***	0.148**	0.260***	0.156***
	(0.046)	(0.073)	(0.059)	(0.079)	(0.056)
Employment^2	-0.021***	-0.024***	-0.015***	-0.025***	-0.016***
	(0.004)	(0.007)	(0.005)	(0.007)	(0.005)
Number of establishments	0.004	0.020**	-0.006	0.018*	-0.001
	(0.006)	(0.010)	(0.008)	(0.010)	(0.008)
Age	-0.003***	-0.002***	-0.004***	-0.003***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Share of nonproduction	-0.117***	-0.131***	-0.116***	-0.152***	-0.104***
workers	(0.023)	(0.034)	(0.030)	(0.036)	(0.029)
R&D-sales ratio	-0.640	-2.772***	0.185	-2.487***	0.142
	(0.424)	(0.446)	(0.264)	(0.450)	(0.272)
Industry characteristics					
Import penetration	0.308***	0.235***	0.282***	0.291***	0.265***
	(0.042)	(0.061)	(0.060)	(0.065)	(0.054)
Industry skill share	-0.142***	-0.115***	-0.149***	-0.171***	-0.113***
	(0.029)	(0.043)	(0.039)	(0.046)	(0.037)
Industry size	0.038***	0.043***	0.021***	0.049***	0.021***
	(0.005)	(0.010)	(0.008)	(0.010)	(0.007)
Industry capital-labor ratio	-0.034***	-0.045***	0.005	-0.059***	0.006
	(0.006)	(0.009)	(0.010)	(0.010)	(0.008)
Constant	-3.310***	-3.493***	-2.970***	-3.525***	-3.029***
	(0.139)	(0.232)	(0.183)	(0.245)	(0.173)
Number of observations	15,978	7,028	8,950	6,237	9,741
R-squared	0.043	0.058	0.043	0.068	0.038

For notes and sources, see Table 4.