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OF JAPAN

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## Abstract

This paper examines the role of multinational firms in international trade, using firm-level panel data for Japanese firms between 1994 and 2000. Our results indicate that multinational firms dominate Japanese trade. In 2000, only 12.4 percent of Japanese firms were multinationals but they accounted for 93.6 and 81.2 percent of Japanese exports and imports, respectively. Multinational firms are found to have emerged from being exporters/importers. These results imply that firms do not make the choice of either exporting or undertaking FDI, unlike the findings of previous studies. Rather, exporters make a decision on whether or not to undertake FDI.

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## The Role of Multinational Firms in International Trade: The Case of Japan<sup>§</sup>

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### Abstract

This paper examines the role of multinational firms in international trade, using firm-level panel data for Japanese firms between 1994 and 2000. Our results indicate that multinational firms dominate Japanese trade. In 2000, only 12.4 percent of Japanese firms were multinationals but they accounted for 93.6 and 81.2 percent of Japanese exports and imports, respectively. Multinational firms are found to have emerged from being exporters/importers. These results imply that firms do not make the choice of either exporting or undertaking FDI, unlike the findings of previous studies. Rather, exporters make a decision on whether or not to undertake FDI. (98 words)

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## 1. Introduction

Do multinational firms dominate international trade? Recent estimates by UNCTAD (1999, p. 232), extrapolating U.S. data to the world as a whole, indicated that multinational firms “would account for two-thirds to three-quarters of world exports, and more than a third of world exports would be between affiliated firms.” Although such estimates give us useful information on the importance of multinational firms in world trade, they cannot be treated as definitive, because US exports account for only 17.3 percent of world exports in 1998.<sup>1</sup> Besides, existing empirical literature such as the UN study only analyzed the static relationship between international trade and multinational firms, mainly taking the ratio of foreign trade conducted by multinational firms in overall trade. An analysis of their dynamic relationship, which appears to characterize their true relationship, has not been explored.

This paper examines the importance of multinational firms in Japanese trade, and then extends the analysis to explore the cause and effect of the emergence of multinationals. In particular, we ask the following questions. Do multinational firms dominate Japanese trade? If so, is this because firms dominate international trade *before* becoming

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<sup>1</sup> World Bank (2005).

multinationals, or because firms expand international trade and dominate international trade *after* becoming multinationals?

Our analysis uses Japanese firm-level data between 1994 and 2000. We find that multinational firms are in minority in terms of the number of firms, but they dominate Japanese trade. For instance, in 2000, only 12.4 percent of Japanese firms were multinationals but they accounted for 93.6 and 81.2 percent of Japanese exports and imports, respectively. Besides, 80.9 percent of multinational firms are either exporters or importers while 81.6 percent of domestic firms are neither exporters nor importers. Over time, multinational firms have emerged among exporters/importers. Multinational firms dominate international trade because, first of all, they are large exporters/importers *before* they become multinationals. Further, multinational firms expand exports *after* they become multinationals.

Our paper provides two major contributions. First, we show that exporters decide whether or not to become a multinational firm by undertaking foreign direct investment (FDI), not that firms choose either to export or to become a multinational. Our results suggest that the coexistence of exports and FDI is significant. This finding may indicate

that the accumulation of international experience through exporting, or learning-by-exporting, helps exporters to expand their business opportunities to become multinationals by undertaking FDI. Our results cast doubt about the validity of many studies which assume that exports and FDI are substitutes.<sup>2</sup> The firm's decision on FDI should rather be modeled such that a firm can engage in both exports and FDI, simultaneously.<sup>3</sup>

Second, we show that Japanese multinational firms contribute significantly to the growth of Japanese exports. In recent years, the alleged negative impacts of FDI on exports have been debated in the context of so-called "hollowing out" of domestic industry.<sup>4</sup> Our results question the general validity of this claim. That is, "hollowing out" of domestic industry can happen in some firms and/or in some industries, but this argument cannot be generalized. For the economy as a whole, the positive impacts of FDI on exports can be large enough to offset the negative impacts.

Our research on the links between exports and FDI goes beyond the existing

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<sup>2</sup> See, for instance, Helpman, Melitze, and Yeaple (2004).

<sup>3</sup> The example of such study is Rob and Vettas (2003).

<sup>4</sup> For instance, Cowling and Tomlinson (2000) argued that production capacity in some industries was "hollowed out" through FDI in Japan. On the other hand, Lipsey, Ramstetter, and Blomström (2000) stressed that there was no such evidence for Japan and Sweden in terms of employment.

literature in several important aspects. First, our study is closely related to the study by Bernard, Jensen, and Schott (2005) that presented various new facts about the activities of the firms in the U.S. that engaged in international trade.<sup>5</sup> We address this issue in Japan, thus contributing to the literature by adding another national perspective to available evidence.

Second, we provide more rigorous analysis about the causality between exports and FDI. Previous studies have confirmed the positive relationship between exports and FDI both at the industry/macro level (e.g., Lipsey and Weiss, 1981) and at the firm level (e.g., Lipsey and Weiss, 1984; Yamawaki, 1991; Clausing, 2000; Head and Ries, 2001).<sup>6</sup> However, a common problem of these studies is that they focused on the effects of FDI on exports, whereas exports can cause FDI. That is, the international experience through exports may reduce the costs of undertaking FDI, enabling exporting firms to set up affiliates more easily in foreign countries. Based on this observation, we examine the effects of international trade on FDI.

Third, we focus on a new aspect of the gains from exports. Recent firm- or

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<sup>5</sup> Some of their findings are discussed in section 2.2.

<sup>6</sup> At the highly disaggregated product level, however, a negative relationship was confirmed in some studies. See, for instance, Blonigen (2001).

plant-level studies on international trade mainly focus on the relationship between exports and productivity growth. The results of previous studies on the gains from exports are ambiguous. While some studies confirm the positive impacts of exporting activities on productivity (e.g., Baldwin and Gu, 2003, for Canada; Kimura and Kiyota, 2004, for Japan), others do not (e.g., Clerides, Lauch, and Tybout, 1998, for Colombia, Mexico, Morocco; Bernard and Jensen, 1999, for the United States). But the gains from exporting activities are not limited to the productivity growth. Exporting activities contribute to the accumulation of international experience, which may help the firm to expand its international activities.

Finally, we wish to emphasize high reliability and richness of the firm-level data that are collected by the Japanese Ministry of Economy, Trade and Industry (METI). This dataset covers more than 22,000 firms annually, and incorporate both manufacturing and some non-manufacturing sectors.<sup>7</sup>

The organization of the paper is as follows. Section 2 discusses the data used for the analysis and provides an overview of the patterns of the foreign trade for Japanese firms, consisting of multinational firms and domestic firms. Sections 3 and 4 examine dynamic relationship between exports and FDI (or becoming multinational). These sections analyze

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<sup>7</sup> Section 2 discusses the data used in this paper in more detail.



the causes and effects of the emergence of multinational firms, respectively. Section 5 summarizes the major findings and discusses policy implications.

## **2. International Trade and Multinational Firms: An Overview**

### **2.1. The data**

We use the micro database of *Kigyō Katsudō Kihon Chōsa Houkokusho (The Results of the Basic Survey of Japanese Business Structure and Activities)* prepared annually by the Research and Statistics Department, METI (1994-2000). This survey was first conducted in 1991, then in 1994, and annually afterwards. The main purpose of the survey is to capture statistically the comprehensive picture of Japanese corporate firms in light of their active diversification, globalization, R&D and information technology related activities. The strength of the survey is its sample coverage and reliability of information. The survey is comprised of all firms with more than 50 employees and with capital of more than 30 million yen. It covers both manufacturing and non-manufacturing firms, although some non-manufacturing sectors such as finance, insurance and software services are not included. The limitation of the survey is that some information on financial matters and

institutional features such as *keiretsu* are not available and small firms with less than 50 workers (or with capital of less than 30 million yen) are excluded.

From these surveys, we constructed a longitudinal (panel) data set for the years from 1994 to 2000. In our study we classify Japanese firms into two groups, multinational firms and domestic firms. Multinational firms are firms that own a foreign affiliate with an equity worth more than one million yen. The firms other than multinational firms are domestic firms. We drop the firms from our sample for which the firm-age (survey year minus establishment year), total wages, tangible assets, value-added (sales minus purchases), or the number of workers were not positive, or responses incomplete. The number of sample firms exceeds 22,000 annually.

## **2.2. Do multinational firms dominate international trade?**

Positions of multinational firms and domestic firms in Japan from 1994 to 2000 are shown in Table 1. In 2000, multinational firms are in the minority in terms of the number of firms, accounting for 12.4 percent of the total number of firms in Japan. But in terms of the number of workers and sales multinational firms employ 39.2 percent of workers and

conduct 52.7 percent of sales. In terms of international trade, multinational firms accounted for 93.6 and 81.2 percent of total Japanese exports and imports, respectively. These results clearly indicate that multinational firms dominate Japanese international trade.

==== Table 1 ====

Note also that these numbers are quite similar to those of U.S. firms. Recent study by Bernard, Jensen, and Schott (2005) found that employment at multinational firms accounted for 29.1 percent of the non-governmental workforce in 2000 and exports and imports accounted for about 90 percent. The results suggest the multinational firms play an important role in employment and dominant role in international trade in both Japan and the United States.

Table 2 presents the relationship between multinational firms and international trade. The table is in the form of a matrix in which the columns correspond to export/import status and the rows correspond to the multinational status. The top portion of the table reports the number of firms for different categories, while the middle and bottom portions report the compositional shares.

==== Table 2 ====

The figures in the middle portion of Table 2 show that most of multinationals engage in exports and imports. Of multinational firms, 71.6 and 63.9 percent engage in exports and imports, respectively. Moreover, 54.1 percent of multinational firms engage in exports and imports at the same time. Table 2 also implies that 63.9 percent of exporters and 65.4 percent of importers do exports and imports at the same time.<sup>8</sup> The corresponding shares are significantly smaller for the US firms. Bernard, Jensen, and Schott (2005, Table 10) reported that firms that engaged in both exports and imports were 6 percent of exporters and 9 percent of importers. The bottom part of Table 2 indicates the shares of multinational firms in exporters and importers. Table 2 suggests that exporters and importers are not necessarily multinational firms. More than half of exporters and importers do not own an affiliate in foreign countries.

Table 2 also reveals that both exporters and importers are minorities in terms of the number of firms. Out of total number of firms, 19.5 percent are exporters, while 19.1 percent are importers.<sup>9</sup> More than 80 percent of domestic firms neither export nor import.

These results imply that multinational firms dominate Japanese international trade. Besides,

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<sup>8</sup> Among 4,150 exporters, 2,653 firms or 63.9 percent ( $=2,653/4,150$ ) of firms engage in imports. Similarly, 65.3 percent ( $=2,653/4,059$ ) of importers engage in exports.

<sup>9</sup> Similarly, Bernard, Eaton, Jensen, and Kortum (2003) found that exporters were in the minority. They found that exporters accounted for only 21 percent of firms in the United States.

in the static sense, the coexistence of trade and FDI is important. Most firms engaged in FDI are exporters or importers. But exporters and importers are not always multinational firms.

### **3. International Trade and Multinational Firms: The Causal Relationship**

#### **3.1. Are exporters and importers potential candidates for multinationals?**

Are exporters and importers potential candidates for multinationals? Table 3 presents a transition matrix. It indicates whether or not multinational firms in year  $t$  were exporters or importers in year  $t-1$ . If firms are not multinationals and if firms are neither exporters nor importers in year  $t-1$ , more than 99 percent of them are not multinationals in year  $t$ . However, if firms are not multinationals but if firms are either exporters or importers in year  $t-1$ , 5-9 percent of firms become multinationals in year  $t$ . This implies that exporters and importers are potential candidates of future multinationals.

=== Table 3 ===

It is also interesting to note that around 10-15 percent of multinational firms stop being multinational firms. Table 4 traces the multinational status for firms that stop being

multinationals. For instance, the first column indicates that 347 of multinational firms in 1994 stop being multinationals in 1995. Of 347 firms, 9 firms, or the 2.6 percent of firms, exit in 1996; 111 firms, or the 32.0 percent of firms, start being multinationals again; and 227 firms, or the 65.4 percent of firms, stay as domestic firms. The results indicate that more than 60 percent of firms could not become multinational firms after they stop being multinational firms. The result implies the existence of sunk costs to be a multinational firm. We investigate this relationship in more detail by applying econometric methods.

=== Table 4 ===

Suppose that firm  $i$  becomes multinational in year  $t$  if current and expected profits of becoming multinational are greater than costs.<sup>10</sup> Costs are defined as the sum of sunk cost for becoming multinational  $F_{it}$  and variable cost. Denote current profit and current profit excluding fixed cost as  $\tilde{\pi}_{it}$  and  $\pi_{it}$ , respectively. Assume that fixed cost is required if the firm was not multinational in the previous year and that  $Y_{it}$ , a variable indicating a multinational status, takes value one if firm  $i$  was multinational in year  $t$  and zero for otherwise. For simplicity, assume that the fixed cost is the same across firms

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<sup>10</sup> Our model is extended from the dynamic model of the decision to export developed by Roberts and Tybout (1997).

and across years ( $F_{it} = F$ ). Thus the profit  $\pi_{it}$  is described as  $\pi_{it} = \tilde{\pi}_{it} - F(1 - Y_{it-1})$ .<sup>11</sup>

Denote the discount rate of future revenue as  $\delta$ . Assume that in year  $t$  the firm chooses infinite sequence of values  $(Y_{it}, Y_{it+1}, \dots)$  that maximizes expected value of revenues. Denote the maximized revenues as

$$V_{it}(\Omega_{it}) = \max_{Y_{it}} E_t \left( \sum_{\tau=t}^{\infty} \delta^{\tau-t} \tilde{\pi}_{it\tau} \mid \Omega_{it} \right), \quad (1)$$

where  $\Omega_{it}$  is the firm specific information set. Using Bellman's equation, firm  $i$ 's current decision to become multinational is represented as  $Y_{it}$  that satisfies

$$V_{it}(\Omega_{it}) = \max_{Y_{it}} E_t \left( \tilde{\pi}_{it}(Y_{it}, Y_{it-1}, \dots) + \delta E[V_{it+1}(\Omega_{it+1} \mid Y_{it}, Y_{it-1}, \dots)] \right). \quad (2)$$

Assume that fixed cost is required if the firm was not multinational in the previous year. In the dynamic framework, the firm becomes multinational if the present value of current and future revenues of becoming multinational is larger than the total costs (fixed cost plus variable cost). Denote the current profit and discounted increase in the value of the firm in the future if the firm becomes multinational in year  $t$  as

$$\pi_{it}^* = \tilde{\pi}_{it} + \delta (E_t[V_{it+1}(\bullet) \mid Y_{it} = 1] - E_t[V_{it+1}(\bullet) \mid Y_{it} = 0]), \quad (3)$$

where  $E[V_{it+1}(\bullet)]$  is the expected value of maximized pay-off conditioned by  $Y_{it}$ . The

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<sup>11</sup> New investors are required to pay sunk fixed cost while current multinationals are not. Since multinationals cannot recoup this cost when they exit from a foreign country, the multinationals have a strong incentive to persist in being multinationals. This persistency effect is sometimes referred to as "hysteresis" effect. For more details, see Roberts and Tybout (1997).

decision to be multinational of firm  $i$  is represented as

$$Y_{it} = \begin{cases} 1 & \text{if } \pi_{it}^* > F(1 - Y_{it-1}); \\ 0 & \text{otherwise.} \end{cases} \quad (4)$$

In the empirical analysis, we specify the regression equation as follows:

$$Y_{it} = \begin{cases} 1 & \text{if } \beta_0 + \sum_{k=1}^K \beta_k Z_{ikt-1} - F(1 - Y_{it-1}) + \mu_{it} > 0; \\ 0 & \text{otherwise,} \end{cases} \quad (5)$$

where  $Z_{ikt-1}$  indicates firm-specific variables that might affect the probability of becoming multinational firm at period  $t$ .  $\mu_{it}$  represents the disturbance term.

There are several estimation strategies for this dynamic binary-choice model with unobserved heterogeneity. For instance, Roberts and Tybout (1997) and Bernard and Wagner (2001) employ a probit model with random effects while Bernard and Jensen (1999) and Bernard and Wagner (2001) use a linear probability model with fixed effects. A linear probability model requires instruments such as two-period lags of the levels of right-hand side variables (Bernard and Wagner, 2001). Since our sample period is not long enough to use such instruments, we employ the probit model with random effects of the form:



$$Y_{it} = \beta_0 + \sum_{k=1}^K \beta_k Z_{ikt-1} + FY_{it-1} + \mu_{it}. \quad (6)$$

Additional firm characteristics  $Z_{it-1}$  include trade, capital-labor ratio, the number of workers, R&D expenditure-sales ratio, and total factor productivity (TFP) as well as year and industry dummies.<sup>12</sup> In addition, we introduce two-digit industry dummies for some of the regressions to control industry-wise characteristics such as comparative advantage and market conditions.<sup>13</sup> The regression therefore captures how firms undertake FDI, controlling for various factors such as initial trade status, firm characteristics, and hysteresis effect. In order to avoid possible simultaneity problems, we lag all firm characteristics and other exogenous variables one year.<sup>14</sup> Summary statistics and a correlation matrix of the variables are summarized in the Appendix Table.

### 3.2. Estimation results

Table 5 presents the regression results of equation (6) with random effects probit estimation. Column 1 indicates that exports and imports are important factors for firms to

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<sup>12</sup> We use the multilateral TFP index developed by Caves, Christensen, and Diewert (1982) and extended by Good, Nadiri, Roller, and Sickles (1983). For the detail description of the data and their manipulation, see Nishimura, Nakajima, and Kiyota (2005).

<sup>13</sup> Foreign market conditions could also be important factors to affect the decision to export and/or conduct FDI. We however do not introduce any variable for them except industry dummies due to the difficulty in obtaining detailed relevant data.

<sup>14</sup> For more detail, see Bernard and Jensen (1999, p.12 and footnote 19).

be multinational in the future. Further, column 2 suggests that potential multinational firms are large exporters and large importers. In addition, they are large in terms of employment and capital intensity. Moreover, the potential multinationals achieve high productivity, and have previous multinational experience.

==== Table 5 ====

Column 3 reports the marginal effects for the probability to become a multinational firm, assuming that the random effect is zero. The marginal effects are calculated at the mean values of the independent variables. The results suggest that one percentage (10 million yen) change of exports and imports raise the probability to be a multinational firm by 0.2 percent and 0.1 percent, respectively. Our results thus indicate that engagement in international trade is an important factor for a firm to become multinational. Scale and capital intensity are also important factors. Firms with high productivity are potential multinational firms. This finding is consistent with the finding for U.S. multinationals (Helpman, Melitz, and Yeaple, 2004).

## 4. The Effects of Multinational Firms on International Trade

### 4.1. Do multinational firms contribute to the expansion of international trade?

Next, we examine the reverse causation: whether or not FDI contributes to the growth of exports and imports. Following Bernard and Jensen (1999), we ran a simple regression of the changes in growth of exports or imports,  $T_{it}$ , on initial multinational status,  $Y_{it}$ , and other firm characteristics,  $Z_{ikt-1}$ :

$$\begin{aligned} \% \Delta T_{it} &= \ln T_{it} - \ln T_{it-1} \\ &= \alpha + \beta Y_{it-1} + \sum_{k=1}^K \gamma_k Z_{ikt-1} + \varepsilon_{it}. \end{aligned} \tag{7}$$

The coefficient,  $\beta$ , represents the difference in the annual average growth rates of exports or imports between multinational firms and domestic firms. If multinational firms expand international trade more rapidly than domestic firms,  $\beta$  will be significantly positive. Additional firm characteristics for the initial year are the number of workers, capital-labor ratio, R&D-sales ratio, firm age, TFP, and initial value of exports (imports).<sup>15</sup>

There are two strategies to estimate equation (7): fixed effect and random effect models. For estimating (7), however, a fixed effect model has a problem. The fixed effect model identifies the effects of multinational status only when there are changes in the status

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<sup>15</sup> We take the natural log for the number of workers, capital-labor ratio, firm age, and TFP.

during the period. In other words, a firm that is a multinational firm (or a domestic firm) throughout the period does not have any effects on the estimated coefficient  $\beta$ . In order to take into account the effects of a firm that has multinational status throughout the period, we employ the random effect model.

#### **4.2. Estimation results**

Table 6 presents the estimation results of equation (7) based on the random effect model.

Without controlling for firm characteristics, coefficient  $\beta$  does not show statistically significant signs in export growth although it shows a significant sign in import growth.

Once we control for firm characteristics, however, the coefficients  $\beta$  indicate statistically significant signs in both export and import growth estimations. This result implies that the growths of exports and imports are much faster in multinational firms than in domestic firms. The differences of annual average growth rates are 12.9 percent in exports and 10.8 percent in imports.

==== Table 6 ====

In addition to multinational status, various factors contribute to the growth of

exports and imports. The growth of exports and imports are faster for large, capital-intensive, and efficient firms than small, labor-intensive, and inefficient firms. Firms with active R&D achieve high export growth. The growth of exports and imports are related to the scale of exports and imports. Small exporters and importers show much faster growth than large exporters and importers.

A concern may be raised about longer-term effects. It may take some years that substitution effect between FDI and exports appears. Since the data set only covers the period of 1994-2000 and degrees of freedom are limited, we test the 5-year growth of exports and imports. Accordingly, the regression is rewritten as follows:

$$\begin{aligned} \% \Delta T_{it+4} &= \ln T_{it+4} - \ln T_{it-1} \\ &= \alpha + \beta Y_{it-1} + \sum_{k=1}^K \gamma_k Z_{ikt-1} + \varepsilon_{it}. \end{aligned} \tag{8}$$

Table 7 presents the regression results of equation (8). Note that we lose 16,028 firms for exports and 15,313 firms for imports. The results indicate that the multinational status has still has positive and significant effects on the growth of exports and imports if we control for firm characteristics. However, the effects on 5-year trade growth are weak compared with 1-year trade growth. The results thus imply that the positive effects still

exist, but some substitution effects emerge in the long-run, which partially offsets the complementarity effects of multinational firm on exports and imports.

==== Table 7 ====

Other firm characteristics have the same effects as the effects confirmed in Table 6. That is, the growth of exports and imports are fast in small exporters and importers, efficient, large, and capital-intensive firms. Our results thus are robust even after we control for the mid-term effects.

#### **4.3. Effects on overall export and import growths**

The overall growths of exports and imports depend not only on the growths of exports and imports by each firm but also on the increases in the number of multinational firms. To examine how multinational firms contribute to the Japanese trade, we perform simple decomposition exercise:  $dX / X = dn / n + d(X / n) / (X / n)$ , where  $X$  and  $n$  represent the value of exports (or imports) and number of multinationals, respectively. The first term indicates the changes in multinational firms and the second term indicates the average growth of exports (or imports).

Table 8 indicates the decomposition results. The annual average growth rates of overall exports and imports are 4.5 percent and 4.2 percent, respectively. For both exports and imports, the overall growths are attributable to the increases in the number of multinational firms. The increases in the number of multinationals account for 3.5 percentage point of export growth while the increases in the average trade volume accounts for 1.0 percentage point. Similarly, the increases in the number of multinationals account for 3.6 percentage point while increases in the average trade volume accounts for 0.6 percentage point. These results suggest that multinational status contribute to the growth of exports and imports but the overall growths of exports and imports are mostly driven by the shifts of exporters and importers to be multinational firms.

==== Table 8 ====

## **5. Conclusions**

This paper examined the role of multinational firms in international trade, using data for Japanese firms between 1994 and 2000. We have shown that, multinational firms register faster export growth than domestic firms. Multinational firms emerged among exporters/importers, especially large exporters/importers. In other words, potential

multinational firms are large exporters/importers. Our results suggest that firms do not choose either exports or FDI. Rather, exporters choose whether or not to undertake FDI. This observation, coupled with our finding of a positive relationship between FDI and exports, indicates that FDI and exports are complements rather than substitutes. However, in the long-term, some substitution effects emerge, somewhat offsetting the complementarity effects.

The implications for the theoretical model and economic policy are summarized as follows. Our findings support the model that allows the coexistence of exports and FDI. This in turn implies that two types of theoretical models are useful to describe the relationship between exports and FDI. One is a dynamic model with single product as was developed by Rob and Vettas (2003). The other is a static model with multiple products as was constructed by Head and Ries (2004). An important policy implication is the invalidity of the argument that claims that FDI leads to the “hollowing out” of domestic industry by reducing exports at least in the medium-term.

We should note that the more detailed analysis on the loss of employment as well as the loss of exports shipment is needed to clarify the relationship between multinational



activity and the “hollowing out” of industries. One possible approach is to examine the difference of job creation and job destruction patterns between multinational firms and domestic firms. Another possible approach is to follow Hanson, Mataloni, and Slaughter (2003) that directly asks whether foreign and parent employment is substitute. The former approach is pursued by Kiyota and Matsuura (2006) and the latter is included in our future research agenda.

Our results also imply that the gains from exports are not limited to productivity growth. Accumulation of international experience through exporting, or learning-by-exporting, enables exporters to expand international business through FDI. To discern the gains from conducting FDI is certainly another important agenda for future research.

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**Table 1. Multinational Firm Versus Domestic Firm: Number of Firms, Workers, Sales, Exports and Imports, 2000**

	Number of firms		Employment (thousand)		Sales (billions of yen)		Exports (billions of yen)		Imports (billions of yen)	
	Multinational firm	Domestic firm	Multinational firm	Domestic firm	Multinational firm	Domestic firm	Multinational firm	Domestic firm	Multinational firm	Domestic firm
1994	2,163	18,644	3,101	4,607	222,688	197,155	26,015	1,849	14,544	1,835
1995	2,311	19,479	3,145	4,660	229,332	205,198	28,891	1,869	17,382	2,210
1996	2,458	19,249	3,138	4,657	237,180	212,796	28,067	2,116	17,628	2,575
1997	2,593	19,298	3,231	4,799	241,594	205,923	35,422	2,412	20,144	3,358
1998	2,613	19,028	3,232	4,732	223,775	192,669	33,547	2,176	17,355	2,619
1999	2,548	18,447	3,133	4,665	217,311	192,510	30,347	2,133	14,733	3,321
2000	2,628	18,608	3,186	4,948	231,779	207,846	34,103	2,336	17,107	3,969
Share (%)	Multinational firm	Domestic firm	Multinational firm	Domestic firm	Multinational firm	Domestic firm	Multinational firm	Domestic firm	Multinational firm	Domestic firm
1994	10.4	89.6	40.2	59.8	53.0	47.0	93.4	6.6	88.8	11.2
1995	10.6	89.4	40.3	59.7	52.8	47.2	93.9	6.1	88.7	11.3
1996	11.3	88.7	40.3	59.7	52.7	47.3	93.0	7.0	87.3	12.7
1997	11.8	88.2	40.2	59.8	54.0	46.0	93.6	6.4	85.7	14.3
1998	12.1	87.9	40.6	59.4	53.7	46.3	93.9	6.1	86.9	13.1
1999	12.1	87.9	40.2	59.8	53.0	47.0	93.4	6.6	81.6	18.4
2000	12.4	87.6	39.2	60.8	52.7	47.3	93.6	6.4	81.2	18.8

Source: The METI database.

**Table 2. Multinational Firms and International Trade, 2000**

Number of firms	Exporters			Importers			Both exporters and importers		
	Yes	No	Total	Yes	No	Total	Yes	No	Total
Multinational firm	1,881	747	2,628	1,680	948	2,628	1,436	1,192	2,628
Domestic firm	2,269	16,339	18,608	2,379	16,229	18,608	1,217	17,391	18,608
Total	4,150	17,086	21,236	4,059	17,177	21,236	2,653	18,583	21,236

  

Share (%)	Exporters			Importers			Both exporters and importers		
	Yes	No	Total	Yes	No	Total	Yes	No	Total
Multinational firm	71.6%	28.4%	100.0%	63.9%	36.1%	100.0%	54.6%	45.4%	100.0%
Domestic firm	12.2%	87.8%	100.0%	12.8%	87.2%	100.0%	6.5%	93.5%	100.0%
Total	19.5%	80.5%	100.0%	19.1%	80.9%	100.0%	12.5%	87.5%	100.0%

  

Share (%)	Exporters			Importers			Both exporters and importers		
	Yes	No	Total	Yes	No	Total	Yes	No	Total
Multinational firm	45.3%	4.4%	12.4%	41.4%	5.5%	12.4%	54.1%	6.4%	12.4%
Domestic firm	54.7%	95.6%	87.6%	58.6%	94.5%	87.6%	45.9%	93.6%	87.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Notes: 1) Multinational firm is defined as a firm that has at least one foreign affiliate.

2) Domestic firm is a firm not classified as foreign-owned or Japanese multinational firm.

Source: The METI database.



**Table 3. Simple Probability of Multinationals**

(Number of firms and percent)

	Multinational firm in year $t$								
	$t=1995$			$t=1996$			$t=1997$		
	Yes	No	Total	Yes	No	Total	Yes	No	Total
Multinational firm in year $t-1$	1,733	347	2,080	2,015	237	2,252	2,145	232	2,377
Domestic firm in year $t-1$									
Non-exporters/importers	189	13,938	14,127	141	14,509	14,650	132	14,303	14,435
Exporters/importers	269	2,904	3,173	252	3,395	3,647	249	3,351	3,600
Share (%)	Yes	No	Total	Yes	No	Total	Yes	No	Total
Multinational firm in year $t-1$	83.3	16.7	100.0	89.5	10.5	100.0	90.2	9.8	100.0
Domestic firm in year $t-1$									
Non-exporters/importers	1.3	98.7	100.0	1.0	99.0	100.0	0.9	99.1	100.0
Exporters/importers	8.5	91.5	100.0	6.9	93.1	100.0	6.9	93.1	100.0
Number of firms	$t=1998$			$t=1999$			$t=2000$		
	Yes	No	Total	Yes	No	Total	Yes	No	Total
Multinational firm in year $t-1$	2,258	245	2,503	2,244	243	2,487	2,139	231	2,370
Domestic firm in year $t-1$									
Non-exporters/importers	119	14,540	14,659	98	14,276	14,374	117	12,917	13,034
Exporters/importers	183	3,118	3,301	156	2,989	3,145	233	2,858	3,091
Share (%)	Yes	No	Total	Yes	No	Total	Yes	No	Total
Multinational firm in year $t-1$	90.2	9.8	100.0	90.2	9.8	100.0	90.3	9.7	100.0
Domestic firm in year $t-1$									
Non-exporters/importers	0.8	99.2	100.0	0.7	99.3	100.0	0.9	99.1	100.0
Exporters/importers	5.5	94.5	100.0	5.0	95.0	100.0	7.5	92.5	100.0

Source: The METI database.

**Table 4. What happens If Multinational Firms Stop Being Multinational Firms?**

	Firms switch its status from multinational firm in year $t-1$ to domestic firm in year $t$				
	$t = 1995$	$t = 1996$	$t = 1997$	$t = 1998$	$t = 1999$
Total (number of firms)	347	237	232	245	243
Exit in year $t+1$	9	11	12	17	25
Stay as domestic firms in year $t+1$	227	133	137	140	116
Become multinational firms again in year $t+1$	111	93	83	88	102
Total (share)	100.0	100.0	100.0	100.0	100.0
Exit in year $t+1$	2.6	4.6	5.2	6.9	10.3
Stay as domestic firms in year $t+1$	65.4	56.1	59.1	57.1	47.7
Become multinational firms again in year $t+1$	32.0	39.2	35.8	35.9	42.0

Source: The METI database.

**Table 5. Do Large Exporters/Importers Become Multinational Firms?**

Dependent variable: multinational dummy (t)	Model 0	Model 1	
	Coefficient	Coefficient	Marginal effect
Independent variables (t-1)			
Export dummy	0.519** [0.020]		
Import dummy	0.337*** [0.020]		
Exports (billions of yen)		0.018*** [0.002]	0.002*** [0.0003]
Imports (billions of yen)		0.005*** [0.001]	0.0005*** [0.0001]
Multinational firm dummy	2.826*** [0.018]	3.079*** [0.017]	0.829*** [0.0148]
TFP (index)	0.029*** [0.007]	0.037*** [0.006]	0.004*** [0.0008]
Number of workers	0.177*** [0.009]	0.166** [0.010]	0.016*** [0.0023]
Capital-labor ratio (billions of yen)	2.950*** [0.387]	2.535*** [0.394]	0.247*** [0.0502]
R&D expenditure-sales ratio (%)	0.020*** [0.004]	0.041*** [0.004]	0.004*** [0.0006]
Constant	-2.532*** [0.058]	-2.499*** [0.058]	
Year dummy	Yes	Yes	
Industry dummy	Yes	Yes	
<i>N</i>	119,305	119,305	
AIC	27625.4	29173.7	
Log-Likelihood	-13778.7	-14552.8	

Notes: 1) Random-effect probit model is used for estimation.  
2) \*\* and \* indicate level of significance at 1% and 5%, respectively. Figures in brackets indicate standard errors.  
3) All independent variables are at period t-1. We take natural log for TFP, number of workers, capital-labor ratio, exports, and imports.

Source: The METI database.

**Table 6. The Multinational Status and the Growth of Trade**

Independent variables (t)	Dependent variable (from year t to t+1)			
	Growth of exports		Growth of imports	
	[1]	[2]	[3]	[4]
Multinational firm dummy	0.861 [1.309]	2.816* [1.378]	12.860** [1.652]	10.833** [1.751]
Exports (natural log, millions of yen)			-19.437** [0.416]	
Imports (natural log, millions of yen)				-21.433** [0.430]
TFP (natural log)			6.696** [1.435]	14.476** [1.521]
Number of workers (natural log)			18.520** [0.930]	15.078** [0.924]
Capital-labor ratio (natural log, millions of yen)			3.476** [0.832]	2.313** [0.808]
R&D expenditure-sales ratio (%)			0.844** [0.317]	0.327 [0.343]
Constant	-2.484 [8.273]	20.175** [7.241]	-28.471** [10.235]	17.368 [9.607]
Model	Random effects	Random effects	Random effects	Random effects
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
Firm characteristics	No	No	Yes	Yes
N	21,483	19,951	21,483	19,951
R <sup>2</sup>	0.025	0.048	0.283	0.308

Notes: 1) \*\* and \* indicate level of significance at 1% and 5%, respectively. Figures in brackets indicate standard errors.  
2) Estimated coefficients indicate the gaps of growth rate between multinational firms and domestic firms.

Source: The METI database.

**Table 7. The Multinational Status and the Growth of Trade: Longer-term Effect**

Independent variables (t)	Dependent variable (from year t to t+5)			
	Growth of exports		Growth of imports	
	[1]	[2]	[3]	[4]
Multinational firm dummy	0.313 [0.752]	3.462** [0.865]	3.126** [0.732]	4.346** [0.819]
Exports (natural log, millions of yen)			-8.197** [0.223]	
Imports (natural log, millions of yen)				-8.862** [0.229]
TFP (natural log)			2.265** [0.665]	5.480** [0.745]
Number of workers (natural log)			8.675** [0.496]	6.730** [0.517]
Capital-labor ratio (natural log, millions of yen)			0.646 [0.429]	1.085* [0.449]
R&D expenditure-sales ratio (%)			0.423** [0.159]	0.195 [0.204]
Constant	13.567* [5.512]	10.975 [5.658]	7.75 [5.537]	10.415 [5.648]
Model	Random effects	Random effects	Random effects	Random effects
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
Firm characteristics	No	No	Yes	Yes
N	5,455	4,638	5,455	4,638
R <sup>2</sup>	0.002	0.003	0.477	0.490

For notes and source, see Table 6.

**Table 8. Decomposition of Japanese Export and Import Growths**

	Exports	Imports
Overall growth (annual average)	4.5%	4.2%
Increases in the number of multinational firms	3.5%	3.6%
Increases in the average trade volume	1.0%	0.6%

Note: The number of multinationals include multinationals that export (or import).

Source: The METI database.

**Appendix Table. Summary Statistics**

<b>A) Summary Statistics</b>										
Variable	<i>N</i>	Mean	Std. Dev.							
Export dummy	119,305	0.20	0.40							
Import dummy	119,305	0.19	0.39							
Multinational firm dummy	119,305	0.12	0.32							
Exports + 1 (natural log)	119,305	1.10	2.45							
Imports + 1 (natural log)	119,305	0.99	2.27							
TFP (natural log)	119,305	-0.02	0.59							
Number of workers (natural log)	119,305	5.19	0.96							
Capital-labor ratio (natural log)	119,305	1.67	1.25							
R&D expenditure-sales ratio	119,305	0.52	1.62							
<b>B) Correlation Matrix</b>										
(obs=119,305)		ExpD	ImpD	MND	Exp	Imp	TFP	L	KL	R&D
Export dummy	[ExpD]	1.00								
Import dummy	[ImpD]	0.56	1.00							
Multinational firm dummy	[MND]	0.47	0.42	1.00						
Exports + 1 (natural log)	[Exp]	0.90	0.55	0.54	1.00					
Imports + 1 (natural log)	[Imp]	0.53	0.90	0.45	0.59	1.00				
TFP (natural log)	[TFP]	0.18	0.17	0.15	0.20	0.20	1.00			
Number of workers (natural log)	[L]	0.23	0.21	0.36	0.33	0.28	0.05	1.00		
Capital-labor ratio (natural log)	[KL]	0.10	0.09	0.13	0.12	0.10	-0.09	0.10	1.00	
R&D expenditure-sales ratio	[R&D]	0.30	0.21	0.23	0.34	0.20	0.11	0.21	0.09	1.00

Source: The METI database.