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The Internationalization of Japanese Firms: New Findings Based on Firm-Level Data*

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Abstract

Using firm-level data for the Japanese manufacturing sector, we examine characteristics of internationalized firms, i.e., firms engaging in export and/or foreign direct investment (FDI), and compare these characteristics with those for selected European countries. We find that internationalized firms are a few and that their productivity is higher than that of non-internationalized firms, confirming the findings of existing studies on Japan and other countries. In addition, we find that productivity differences between non-internationalized firms, exporters, and FDI firms are substantially smaller in Japan than in the European countries. This evidence suggests that productivity differences alone cannot determine export or FDI behavior of Japanese firms.

Keywords: Exports; Foreign direct investment; Productivity; Japan

JEL classification: F10; F21; L10

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1. Introduction

A number of empirical studies since the mid-1990s, using firm-level data, have shown that firms engaged in international markets display distinct characteristics. Beginning with Bernard and Jensen (1995) for the United State, such studies have found a correlation between export status and firm characteristics. Bernard et al. (2007: 105) summarize the results of empirical studies along this line by observing that “exporters have been shown to be larger, more productive, more skill- and capital-intensive, and to pay higher wages than nonexporting firms." Other studies confirming that firms with relatively high productivity tend to be exporters include Bernard and Jensen (1999) again for the U.S., as well as Aw, Chung, and Roberts (2000) for Taiwan, Clerides, Lack, and Tybout (1998) for Colombia, Mexico, and Morocco. Also in Europe, exporters’ productivity has been shown to higher than nonexporting firms’ productivity. Mayer and Ottaviano (2007) summarize results from a research project on the relation between firms' productivity and their degree of internationalization, titled "European Firms and International Markets" (EFIM).[1] They find that in European countries internationalized firms, or firms serving international markets through exports or foreign direct investment (FDI), are a few and that internationalized firms’ productivity is higher than that of firms serving only the domestic market. Mayer and Ottaviano (2007) call these internationalized firms "the happy few" in reference to Shakespeare’s play “Henry V."

These new empirical studies using firm-level data have brought about the development of a new theory of international trade that assumes heterogeneous firms within industries, rather than the representative firm assumed in the traditional or "new" trade theory. This new approach is first developed by Melitz (2003), who incorporates heterogeneity in firms' productivity level into the "new trade theory" model of Krugman (1980). Melitz's (2003) model predicts that more productive firms engage in export while less productive firms serve only the domestic market, since export requires additional costs. Melitz's model has been extended in various directions. In particular, Helpman, Melitz, and Yeaple (2004) treat not only exports but also horizontal FDI. Assuming that costs of FDI are greater than costs of export, they conclude that most productive firms engage in FDI and that less productive firms engage in export, while least productive firms serve only the domestic firm. This theoretical prediction is consistent with the empirical

[1] EFIM, a research network, was established in 2006. The EFIM research network consists of the Brussels European and Global Economic Laboratory (Bruegel), the Centre for Economic Policy Research (CEPR), and eight research institutes in EU countries. For details, see Mayer and Ottaviano (2007).

results of existing studies such as Mayer and Ottaviano (2007). Moreover, following Antràs (2003), Antràs and Helpman (2004) incorporate incomplete contract theory into the model of Melitz (2003) to model various modes of internationalization, such as FDI and offshoring.[2]

Reflecting these developments in theory and empirics, there have also been a number of empirical studies examining the relationship between firm characteristics and internationalization in Japan. The stylized facts that these studies have produced can be summarized as follows. First, in Japan, too, it is highly productive firms that become exporters or multinational enterprises (MNEs) through FDI. Studies providing clear evidence for the link between firms' productivity and whether they engage in exports and/or FDI include Head and Ries (2001; 2003), Kimura and Kiyota (2006), and Tomiura (2007). Second, studies show that exports and FDI are complementary. Head and Ries (2001), for instance, show that FDI experience has a positive influence on the start of export, while Kiyota and Urata (2005) find evidence that export experience has a positive effect on FDI. According to Kiyota and Urata (2005), in 2000, firms that conducted business overseas through FDI accounted only for 13.8 percent of all Japanese firms, but for 95.1 percent of the total value of exports. This implies that in the large majority of cases, firms that conduct FDI are also exporters and exporters also conduct FDI. Third, it has been shown that the performance of firms improves as a result of exporting or conducting FDI. Head and Ries (2002) find that FDI to low income countries contributes to the upgrading of skill-intensity in Japanese firms. Furthermore, Higuchi and Matsuura (2003) show that after performing FDI, Japanese firms lower the employment level but raise value added and labor productivity. Moreover, Kimura and Kiyota (2006) find that export and FDI improve total factor productivity (TFP), while Hijzen, Inui, and Todo (2008) show that offshoring, including FDI, stimulates productivity growth. Similarly, Hijzen, Inui, and Todo (2007) show that FDI brings about increases in production, employment, and productivity in parent firms.

Against this background, the purpose of this paper is twofold. First, this paper employs firm-level data for Japan and shows a large set of evidence on internationalized firms in Japan, following Mayer and Ottaviano (2007), to confirm the findings of the previous studies. In addition, we use more recent data for a longer period than the previous studies and obtain several new findings. The second purpose is to explore differences between Japanese and

[2] See Helpman (2006) for an excellent survey on the trade theory with firm heterogeneity.

European internationalized firms by comparing our results with the results of Mayer and Ottaviano (2007) on European firms. Such comparison has not been systematically done in the previous studies.

For these purposes, we make use of firm-level data for Japan compiled from *Kigyo Katsudo Kihon Chosa* (the Basic Survey of Japanese Business Structure and Activities) for the period 1997-2005. The survey is conducted annually by the Ministry of Economy, Trade and Industry (METI) and covers all firms with employees of 50 or more and capital of thirty million yen or more. The period 1997-2005 is the longest period for which data on exports are available in a consistent manner. Although the survey includes firms in the service sector, we focus on firms in the manufacturing sector since the latter plays the most significant role in international trade and FDI. In addition, when necessary, we use data for overseas subsidiaries of Japanese firms compiled from *Kaigai Kigyo Katsudo Kihon Chosa* (the Basic Survey of Overseas Business Activities) also collected annually by the METI. The details of the data we use in this paper are presented in the Appendix.

Our findings confirm the previous findings on Japan that the number of internationalized firms in Japan is very small and that firms engaging in export are larger and more productive than firms serving only the domestic market whereas firms engaging in both export and FDI are even larger and more productive than the two types of firm. The characteristics of internationalized firms in Japan are mostly similar to those of their European counterparts. However, we find several differences between Japan and Europe. Most notably, differences in the productivity level between firms serving only the domestic market, exporting firms, and FDI firms are substantially smaller in Japan than in Europe. This evidence may suggest that variations in productivity alone cannot explain export and FDI behavior of Japanese firms.

The remainder of this paper is organized as follows. In Section 2, we explain characteristics of exporters in Japan. Section 3 describes how internationalized firms, exporters and FDI firms, differ from non-internationalized firms. In Section 4, we estimate a standard gravity model for FDI[3] to examine the importance of "intensive margins" (average sales per subsidiary) and "extensive margins" (number of FDI firms). Next, in Section 5, we derive the Pareto distribution of TFP and again consider the relationship between productivity and exports

[3] Due to data constraints, we cannot estimate a gravity model for export.

or FDI status. Finally, Section 6 summarizes our findings.

2. Exporters in Japan

2.1 Exporting by the Japanese firms in the manufacturing sector

We start our examination of Japan's export structure by looking at the distribution of firms' share in total exports and manufacturing employment. Beginning with an international comparison, Table 1 shows the percentage of total manufacturing exports accounted for by the top exporters ranked in terms of their individual exports in each country. It turns out that in all countries, the top 10 percent of exporters are responsible for the overwhelming majority of the total value of exports, although the degree of concentration among the top 1 percent and top 5 percent varies to a larger extent than in the case of top 10 percent. In Japan, the top 1, 5 and 10 percent of exporters account for 62, 85 and 92 percent of the total value of exports, respectively. These figures are generally larger than those for European countries except for Hungary reported in Mayer and Ottaviano (2007).

Further, Figure 1 shows graphically the significant role of top exporters presented in Table 1. On the horizontal axis, the exporters are ranked in terms of their exports from left to right. The vertical axis shows how much the top exporters occupy exports and employment in the total of all exporters. The distribution shown by a diagonal line in this graph indicates that exports or employment of each firm are completely the same. Therefore, the more a curve keeps away from the diagonal line to the northwest, the more distribution is unequally partial. Figure 1 clearly shows that exports and employment are concentrating in top exporters, although the degree of concentration of employment on top exporters is smaller than the degree of concentration of exports.

Turning to the trend in export concentration over time, it appears that the dominance of top exporters has declined somewhat in recent years. Figure 2 shows that between 1997 and 2005, the share in the total exports accounted for by top 1, 5, and 10 percent of exporters fell by between 1 and 5 percentage points. In addition, Figure 3 presents the change from 1998 to 2004 in the distribution of exporters in terms of their exports. Both figures indicate a slight decline in the degree of concentration on top exporters. This trend in Japan contrasts with that in France where, according to Mayer and Ottaviano (2007), the concentration of exports has hardly changed from 1998 to 2003.

2.2 Export intensity

Let us now take a look at the percentage of firms that are engaged in exports and their export intensity defined as the percentage of turnover that firms derive from exports. Table 2 shows relevant figures for Japan and a number of European countries. These figures indicate that the percentage of firms in Japan that export, at 30.5 percent, is lower than in all of the European countries in the table with the exception of the United Kingdom. That the percentage of exporters in Japan is relatively low when compared to their European counterparts comes as little surprise, given that Japan shares none of the advantages in terms of geographic, cultural, and linguistic proximity to major trading partners and regional integration that the European countries enjoy.

Next, looking at the percentage of turnover that firms derive from exports shown in the middle columns of Table 2, clear differences across countries can be observed. While the pattern for the percentage of firms that rely on exports for at least 5 percent of their turnover more or less resembles the pattern for the percentage of firms that export, we find stark differences when we look at the percentage of firms that derive a majority of their turnover from exports. Whereas in Japan, this figure is only 1.7 percent, it is at least 5 percent in six of the European countries and more than 20 percent for Italy and Hungary. But the second column from the right of Table 2 also shows that the 1.7 percent of firms in Japan that derive more than 50 percent of their turnover from exports account for a disproportionate 47.2 percent of total exports. Nevertheless, this figure is again (considerably) lower than in the European countries, indicating a lower degree of export intensity among exporting firms in Japan.

Let us now look at a number of trends in Japan. Table 3 shows that the total value of Japanese firms' exports has increased from 33.99 billion yen in 1997 to 47.99 billion yen in 2005. In addition, over the same period, the percentage of firms that export rose from 24.9 percent to 31.7 percent. In parallel, the shares of firms who rely for more than 5, 10, and 50 percent of their turnover on exports have also increased. Moreover, with the rise in the percentage of firms that derive more than half of their turnover from exports – from 1.0 percent in 1997 to 1.9 percent in 2005 – the share of total exports accounted for by such firms has climbed from 29.3 to 50.4 percent.

Finally, let us examine patterns by industry. As mentioned earlier and also shown in Table 4, the percentage of firms that export for the manufacturing sector as a whole in 2005 was

31.4 percent. However, this overall figures masks wide variations, with the percentage of firms that export ranging from less than 10 percent in the publishing and printing, the wood products, the wearing apparel, and the food and beverages industry to around 50 percent or more in the machinery and equipment, the chemicals, and the precision instruments industry. Meanwhile, the industries with the largest average ratio of exports to sales are Japan's major export industries, the motor vehicles (14.8 percent), the machinery and equipment (17.3 percent), the electrical machinery and apparatus (18.7 percent) and the precision instruments industry (19.1 percent). These findings confirm that there are large discrepancies in the characteristics of exporting firms across manufacturing sectors in Japan, as Bernard et al. (2007) find in the United States.

3. The Characteristics of Internationalized Firms

3.1 Export and FDI premia

In this section, we compare the performance of internationalized firms and firms serving the domestic market only. We begin by examining the export or FDI premia – measured in terms of the ratio of the average value of exporters (or firms having invested overseas) to the average value of non-exporters (or firms that have not invested overseas) – for a number of indicators, namely employment, value added, wages, capital intensity, and skill intensity.[4] Table 5 shows a comparison of these ratios for Japan and a number of European countries. Focusing first on Japan, it can be seen that the ratio is greater than one in all cases. There is clear evidence of export and FDI premia. This means that internationalized firms employ more workers, produce more value added, pay higher wages, and are more capital- and skill-intensive than firms serving the domestic market only.

Looking at some of the indicators in detail, we find that in Japan as well as the other countries, the ratios are greater for FDI than for exports. That is, firms engaging in FDI are larger on average than firms that export only. The same pattern also holds for value added. In Japan, for example, FDI firms roughly add nine times more value than non-FDI firms, while exporters add only around five times more value than non-exporters.

[4] We define skill intensity in Japan as the number of skilled workers per unskilled worker. Moreover, following previous studies such as Head and Ries (2002), we use nonproduction workers and production workers as proxies for skilled workers and unskilled workers, respectively.

A further observation is that the gap between FDI firms' and exporters' premia in terms of employment and value added is smaller in Japan than in the European countries. For example, in France, the employment ratio for FDI/non-FDI firms is 18.45, and the same ratio for exporters/non-exporters is only 2.24, while the equivalent ratios for value added are 22.68 and 2.68. Thus, in France there are substantial differences in the average firm size between firms conducting FDI and firms exporting. Other European countries, with the exception of Norway, show a similar tendency. However, this is not the case for Japan in which the employment ratio for FDI/non-FDI firms is 4.79, and the same ratio for exporters/non-exporters is 3.02. Using value added, MNEs' premia is 8.79, whereas exporters' premia is 5.22.

Turning to the other indicators, we find that both in Japan and in European countries, wages paid by exporting and FDI firms are higher than their non-exporting or non-FDI counterparts, with the wage premium ranging from 2 percent (i.e., a ratio of 1.02, for Germany) to 53 percent (for Belgium). With a wage premium of about 25 percent paid by both exporters and FDI firms, Japan falls into the middle of the range. Possible explanations for these wage differentials are differences in capital and skill intensity, and as the table shows, in most countries, exporting and FDI firms are indeed more capital-intensive than non-exporting/ non-FDI firms. Moreover, in Japan (data for most of the other countries are not available), exporting and FDI firms are more skill intensive than their non-exporting/non-FDI counterparts.

Next, let us take a look at changes in the ratios of these indicators in Japan over time. As Table 6 shows, the ratio of the number of employees of exporting or FDI firms to non-exporting or non-FDI firms has been on a downward trend during the period 1997-2005. On the other hand, the skill intensity of exporting/FDI firms relative to other firms has been on an upward trend. These developments most likely reflect the overseas transfer or offshoring of production activities and the concentration on skill-intensive head office functions at home.

We now turn our attention to differences in productivity between internationalized and non-internationalized firms. Table 7 shows these differences for exporters, while Table 8 presents those for FDI firms, again as the ratio vis-à-vis non-exporting or non-FDI firms. Three measures of productivity are shown: apparent labor productivity (APL), which is defined as the revenue per worker; ordinary labor productivity, which is defined as the value added per worker; and TFP, which is estimated using the method of Olley and Pakes (1996). Table 7 shows that in almost all cases, the productivity of exporters is higher than that of non-exporters.

For the manufacturing sector as a whole, exporters are between 34 percent and 48 percent more productive, depending on which measure is chosen. These results are qualitatively similar to those obtained by Mayer and Ottaviano (2007) for France, who find that the productivity of exporters in that country is between 15 percent and 31 percent higher than that of non-exporters. The results in Table 8 for FDI firms paint a very similar picture to those in Table 7. Again, FDI firms on average are more productive than non-FDI firms in almost all cases, and the productivity advantage for the manufacturing sector as a whole ranges from 31 percent to 44 percent, which is very similar to the figures for exporters.

We now examine the relative productivity of internationalized firms vis-à-vis their domestic counterparts from another angle. Figures 4 and 5 show the distributions of ALP and TFP, respectively, for the following four types of firms in Japan: "domestic firms" that only operate in the domestic market; "pure exporters," i.e., firms that only rely on exports to serve overseas markets; "pure FDI firms," i.e., firms that only rely on FDI to serve overseas markets; and "export and FDI firms," i.e., firms that both export and invest abroad. Figures 4 and 5 show that the productivity of pure exporters and pure FDI firms is higher than that of domestic firms, and that the productivity of export and FDI firms is the highest among these four groups.

To check whether the differences between the four types of firm are statistically significant, we perform standard *t* tests for the equality of the mean of the productivity measure between firm types as well as two-sample Kolmogorov-Smirnov tests for the equality of the distribution, following Delgado, Farinas, and Ruano (2002) and Wagner (2006). The results from the *t* tests and the Kolmogorov-Smirnov tests as well as the descriptive statistics for each of the four types of firm presented in Table 9 indicate that the difference in productivity, measured by either ALP or TFP, between domestic and internationalized firms, between pure exporters and export and FDI firms, and between pure FDI firms and export and FDI firms is statistically significant. These findings are consistent with the theoretical predictions of Melitz (2003) and Helpman, Melitz, and Yeaple (2004) and with the existing empirical findings.

However, there is no statistically significant difference in the distribution of the TFP level between pure exporters and pure FDI firms. We should interpret this evidence with care, since the firm-size threshold in our data set may have lead to this result. We should nonetheless pay attention to this evidence, since this has not been found in existing studies[5] and moreover,

[5] This is partly because most existing studies do not distinguish between pure FDI firms and export and FDI firms. One exception is Tomiura (2007) who uses a firm-level data set for Japan taken from a

the similarity of the productivity level between pure exporters and pure FDI firms is inconsistent with the theoretical prediction of Helpman, Melitz, and Yeaple (2004). Further investigation on this issue would improve our understanding on firms' export and FDI behavior.

3.2 Exports and foreign-owned firms

Another aspect of interest with regard to exporters' characteristics is the role of foreign-owned firms. As shown in Table 10, the share of foreign-owned firms is larger among exporters than among non-exporters both in Japan as well as in the European countries. In the case of Japan, foreign-owned firms are defined as firms with a foreign-ownership ratio of 50 percent or more, following Criscuolo (2005).[6] It is likely that foreign-owned firms by their very nature are more internationally oriented than domestically-owned firms. Another possible reason for the larger degree of internationalization of foreign-owned firms is that the productivity of foreign-owned firms is higher on average than that of domestically-owned firms (Kimura and Kiyota, 2007).

However, we also observe in Table 10 that the share of foreign-owned firms in the total number of exporters is substantially lower in Japan than in European countries. Figure 6 indicates that the share of foreign-owned firms in the total number of exporters, when the 50-percent cut-off ratio is used for the definition of foreign-owned firms, remained at a low level without any increasing trend during the period 1997-2005. The smaller share of foreign-owned firms may be a direct consequence of the fact that the level of FDI inflows toward Japan is substantially low compared with FDI flows to other developed countries (Fukao and Murakami, 2005; Ito and Fukao, 2005; and Kimura and Kiyota, 2007).

3.3 Internationalized firms' productivity advantage – self-selection or learning by doing?

This section examines why the productivity of internationalized firms is higher than that of domestic firms. Two possible explanations offer themselves. The first of these is the "self-selection" hypothesis. According to this hypothesis, only firms with high productivity can start to export or conduct FDI because their revenue is sufficiently large to cover the fixed costs

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different data source from ours and finds that the productivity of pure exporters is smaller on average than that of pure FDI firms. We are unaware what generates the difference between the findings of Tomiura (2007) and ours, but one possible reason is that Tomiura (2007) uses data for which there is no firm-size threshold.

[6] Note that the foreign-ownership cut-off ratio most commonly used in Japan (such as in Japanese government statistics) is 33.3 percent. In this paper we use the 50-percent cut-off ratio for the purpose of international comparison.

for export or FDI. The second explanation is the "learning by doing" hypothesis. This hypothesis claims that international firms' productivity increases through the acquisition of knowledge about foreign markets or the absorption of foreign technology. Bernard and Jensen (1999) and others have tried to test these hypothesis.[7] While the self-selection hypothesis finds wide support in these studies, the verdict on the learning-by-doing hypothesis is mixed. Mayer and Ottaviano (2007), for instance, could not find any clear evidences for the learning-by-doing hypothesis in European countries.[8]

On the other hand, studies on Japan have produced evidence confirming both the self-selection and the learning-by-doing hypothesis. Kimura and Kiyota (2007), for example, found that it is high-productivity firms that are engaged in export or FDI, and that such firms experience a rise in productivity as a result of exporting or conducting FDI. Hijzen, Inui, and Todo (2008), meanwhile, showed that conducting offshoring, including FDI, contributes to productivity growth at the firm level. Furthermore, Hijzen, Inui, and Todo (2007) find weak evidence that FDI has a positive impact on productivity. All of these studies confirm both the self-selection and the learning-by-doing hypothesis.

Against the background of these studies, we try to reexamine both the self-selection hypothesis and the learning-by-doing hypothesis in Japan graphically, although a rigorous examination would of course require an econometric analysis. In order to do so, we divide firms into "switchers" and "non-switchers," where switchers are firms that started to export (or conduct FDI) in 2001 and continued to do so thereafter, and non-switchers are firms that have neither exported nor conducted FDI in the observation period from 2000 to 2005. The trend over time of the average of the logarithm of the labor productivity of firms that began exporting in 2001 and those that did not is depicted in Figure 7.[9] The figure shows that in 2000, i.e., before they started exporting, the labor productivity of switchers was already higher on average than that of non-switchers. Moreover, the gap in labor productivity between switchers and non-switchers has continued to expand since 2001, the year that switchers started exporting. The trend for the switchers and non-switcher, but this time with FDI as the criterion, is shown in Figure 8[10] and leads to similar conclusions. Figure 9 shows the trend of the ratio of the average

[7] A summary of such studies is provided by Greenaway and Kneller (2007).
[8] Mayer and Ottaviano (2007) did not examine the self-selection hypothesis for the data restriction.
[9] Switchers are 44 firms, while non-switchers are 3,976 firms.
[10] Switchers are 62 firms, while non-switchers are 4,871 firms.

value of the labor productivity[11] of switchers to that of non-switchers. This graph reveals that the gap in labor productivity between switchers and non-switchers has increased almost continuously from the year that switchers started to export or conduct FDI. The results of the analysis confirm those of existing studies on Japan.

4. Extensive and Intensive Margins of FDI Sales

This section estimates the extensive margin (the number of firms) and the intensive margin (sales per firm) of FDI sales by Japanese firms, using a novel database based on an official annual survey, METI's *Kaigai Jigyo Katsudo Kihon Chosa* (Basic Survey of Overseas Business Activities), on the activities of foreign affiliates of Japanese firms.[12] The estimates based on a simple gravity equation highlight the importance of extensive margins in variations of FDI sales by Japanese firms.

4.1 Decomposition and estimation

Following Mayer and Ottaviano (2007), we employ a simple gravity model in order to fit the Japanese FDI sales in each host country:

$$\ln X_{it} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln Dist_i + \mu_{it} \quad (1)$$

where i and t index countries and time, respectively, and X_{it} represents the total sales of foreign affiliates, GDP_{it} the real GDP of host countries, $Dist_i$ the distance from country i, and μ_{it} a random disturbance.

We are also interested in the impact of the explanatory variables on the intensive margin and the extensive margin of FDI sales. Measuring the intensive margin by the average sales per parent firm and the extensive margin by the number of parent firms operating foreign affiliates, we also estimate

$$\ln x_{it} = \beta_{x0} + \beta_{x1} \ln GDP_{it} + \beta_{x2} \ln Dist_i + \varepsilon_{it} \quad (2)$$

[11] We use labor productivity defined as value added per worker.
[12] For details of the definition of variables, data sources, and data construction, see the Appendix, Section g.

and

$$(3) \qquad \ln n_{it} = \beta_{n0} + \beta_{n1} \ln GDP_{it} + \beta_{n2} \ln Dist_i + \mu_{it},$$

where x_{it} is the FDI sales per firm in country *i* and n_{it} the number of firms having foreign affiliates in country *i*. Note that since $X_{it} = x_{it} n_{it}$ by construction, $\beta_1 = \beta_{x1} + \beta_{n1}$ and $\beta_2 = \beta_{x2} + \beta_{n2}$.

4.2. Empirical Results

The results from estimating (1), (2), and (3) are reported in Table 11. The first three columns exhibit results for, respectively, total FDI sales, the average FDI sales per parent firm, and the number of parent firms. The last three columns reports results when the WTO-membership variable, which we include to examine effects of free trade agreements, is added.

The results are qualitatively similar to those reported in Mayer and Ottaviano (2007): (i) the coefficient on host country GDP is positive while that on distance is negative; (ii) the impact of distance mostly arises through changes in the number of firms operating foreign affiliates. In particular, the latter result is striking. The impact of the host country's distance is about 5 times greater for the number of firms that operating foreign affiliates than the average sales per firm. Hence, we confirm that the entry and exit of firms, i.e., the extensive margin, plays an important and, in fact, dominant role in variations in FDI sales. These tendencies hold when we add the dummy variables for host countries' WTO membership.

Two things are noteworthy. First, the coefficients on host country GDP and on distance are considerably greater than those reported in Mayer and Ottaviano (2007) in their study on European countries. This is particularly the case for the distance coefficient. In order to understand more clearly what these regression results suggest, we repeat the same estimation at the industry level. The results are reported in Table 12. It can be immediately seen that the most distance-sensitive industry is the electrical machinery, for which the distant coefficient is -2.40. In contrast, the coefficient for the transportation equipment industry is much lower at -0.56. These two industries are the most internationalized in Japan's manufacturing sector in terms of the number of countries where they have foreign affiliates. This substantial difference in the coefficients suggests that the FDI sales in the electrical machinery industry tend to be more concentrated in Asian countries when compared with the transportation equipment, which in

turn implies that FDI motivated by low wages in Asian countries (i.e., "vertical FDI") plays a greater role in the electrical machinery than in the transportation equipment industry.

Second, the dominant role of the extensive margin in variations in FDI sales arises only in regard to the distance variable. For the other two variables, host country GDP and WTO membership, the coefficients are of similar size for both the extensive and the intensive margin. This pattern also differs from that reported in Mayer and Ottaviano (2007) for the European countries. In order to examine this issue in more detail, we would need to apply a more sophisticated econometric model, which ideally would take account of "vertical FDI" and "horizontal FDI" simultaneously along with firm heterogeneity.

5. Distribution of Firm Productivity and Export Potentials

In this section, we reexamine how firms' productivity level differs depending on whether firms engage in export and/or FDI, assuming a Pareto distribution for the productivity distribution. Helpman, Melitz and Yeaple (2004) find that Pareto distribution fits the actual productivity distribution well. Following Mayer and Ottaviano (2007), we estimate the degree of skewness of the Pareto distribution and the productivity cut-offs for exporters and FDI firms.[13] In addition, we examine the variations in the skewness of the productivity distribution across industries.

Since the cumulative density function for a Pareto distribution is given by

$$(4) \qquad F(X) = 1 - \left(\frac{X_m}{X}\right)^k \quad ,$$

where X is the TFP level and X_m is the lower bound for the TFP level in the whole sample. k, or the "Pareto k," indicates the skewness of the distribution. The larger k, the more is the probability density curve skewed to the left, and the larger is the share of unproductive firms. In other words, a larger k indicates that a fall in costs of export and FDI is associated with a larger number of unproductive firms entering export and FDI.

From equation (4), we obtain

$$(5) \qquad \ln\left(1 - F(X)\right) = k\ln\left(X_m\right) - k\ln\left(X\right).$$

[13] For simple presentation, we do not distinguish between pure FDI firms (firms engaging in FDI but not in export) and export and FDI firms (firms engaging in both export and FDI) in this section.

We regress ln(1 - $F(X)$) on ln$X$, using ordinary least squares (OLS) estimation, to obtain estimates of k and the intercept. From these estimates, we can calculate an estimate of X_m. Since the distribution of exporters' TFP also follow a Pareto distribution for which k is equal to the k for the whole sample, we know the following relation between the mean of TFP among exporters, X^{EX}, and the lower bound of TFP for exporters, X_m^{EX}, or the export cut-off: $X^{EX} = kX_m^{EX}/(k\text{-}1)$. A similar relation can be obtained for FDI firms. From the data mean of TFP among exporters and FDI firms and the estimated k, we can compute the export and the FDI cut-off.

We apply the procedures above to our firm-level data for the Japanese manufacturing sector in 2003. The first row of Table 13 indicates the estimated Pareto k, R^2 from the OLS estimation of equation (5), and the estimated lower bound for the whole sample, X_m. The R^2, 0.85, suggests that our data fit the Pareto distribution well. We normalize X_m to one and depict the Pareto distribution of Japanese firms' TFP in Figure 10, in which the two vertical lines show the cut-off for exporters and FDI firms. This figure confirms that the productivity of FDI firms is distributed in a higher productivity range – they are to the right of second vertical line (FDI cut-off) – than that of exporters, and that in turn that of exporters is distributed in a higher productivity range – the right of first vertical line (export cut-off) – than that of firms operating only in the domestic market.

However, we also find several differences between our results for Japan and those for the European countries reported in Mayer and Ottaviano (2007). First, the estimated k is 1.69 for Japan, while it is 3.03 and 2.55 for Italy and France, respectively.[14] As we discussed earlier, a smaller k for Japan implies a larger degree of productivity heterogeneity at the firm level. Our results indicate that the share of productive firms in Japan is relatively large. Second, after normalizing the lower limit of TFP to one, the export and the FDI cut-off are 1.07 and 1.10, respectively, for Japan. These findings suggest that firms with a TFP level 7 and 10 percent higher than the lowest TFP level among all firms can export and conduct FDI, respectively. Since the export and the FDI cut-off for Norway reported in Mayer and Ottaviano (2007) are 1.66 and 1.88, respectively, our results suggest that productivity differences between firms serving only the domestic market, exporters, and export and FDI firms are relatively small in

[14]By eliminating the firms with extremely low-level of productivity, we can find an OLS fit P(ln TFP > x)=-k ln TFP +b with k=2.2. With k=2.2, the export and FDI cut-off TFPs are 1.16 and 1.18, respectively. Hence, this alternative estimation widens the productivity difference between firms serving only the domestic market and exporters. However, the property that the productivity difference between exporters and FDI firms are relatively small remains intact.

Japan.[15] In fact, this conclusion is consistent with our previous findings in Figure 5 that the distribution of TFP among each of the four types of firm is substantially overlapped with each other. These findings suggest that productivity differences alone do not determine export and FDI decision of Japanese firms and that there may be other major determinants of export and FDI.

Next, we turn to the analysis of the distribution of productivity across industries. Table 13 shows the Pareto k, the lower bound (not normalized), and R^2 by industry. Moreover, Figure 11 provides a scatter diagram of the Pareto k and the lower bound for each industry. According to Table 13 and Figure 11, Pareto k and the lower bound vary considerably across industries, although there seems no systematic relation between the Pareto k and the lower bound of TFP.

6. Conclusion

The purpose of this paper was to examine the characteristics of internationalized firms in Japan and the differences of such firms from their European counterparts using firm-level data. Specifically, using various indicators of firm characteristics such as productivity, value added, employment, and capital- and skill-intensity, we examined what distinguishes internationalized firms from other firms. The main findings of our study can be summarized as follows.

First, our results indicate that firms in Japan are similar to those in Europe in the following respects:

1. Exports are dominated by a few top exporters. The top ten percent of exporters are responsible for more than 90 percent of total exports.
2. There are only very few firms whose export-to-sales ratio exceeds 50 percent. However, these few firms with an export-to-sales ratio of more than 50 percent account for roughly half or more of total exports.
3. Internationalized firms perform better in terms of a number of indicators than domestic firms.
4. The share of foreign-owned firms is higher among exporting than among non-exporting firms.

[15] We also find that there is little difference in cut-off productivity between pure exporters and pure FDI firms.

5. The number of FDI firms (extensive margin) has a bigger influence on total sales by overseas subsidiaries than sales per firm (intensive margin).

Second, the following features with regard to Japanese internationalized firms are notable:

1. The concentration of exports on the top exporter has tended to become weaker.
2. The share of exporting firms among all manufacturing firms is very low in Japan and – of the countries considered – above only that in the United Kingdom. However, the share of exporting firms has been rising.
3. There are fewer firms with a high export-to-sales ratio in Japan than in the European countries.
4. The difference in performance between exporters and FDI firms in Japan is small when compared with the European countries.
5. The skill intensity of internationalized firms relative to non-internationalized firms has been increasing.
6. The share of foreign-owned firms among exporters in Japan is much lower than in the European countries.
7. Firms that started to export or conduct FDI already had higher productivity prior to doing so than firms that did not start to export or conduct FDI. Moreover, the difference in productivity between the two groups increased over time.
8. The influence of the distance on overseas subsidiary sales is larger for Japanese firms than for European firms.
9. The differences in productivity between firms serving the domestic market only, exporters, and FDI firms are small. This suggests that factors other than productivity prevent firms from becoming exporters and/or FDI firms. In particular, the difference between the TFP levels of pure exporters and pure FDI firms is statistically insignificant.

Although our study provides a comprehensive picture of Japanese internationalized firms, this paper has two limitations and further studies are required. First, our results are based on descriptive statistics and simple estimations. We did not employ any sophisticated econometric methods. Second, this paper did not deal with offshoring, although Tomiura (2005; 2007), Hijzen, Inui and Todo (2008), and Wakasugi, Ito, and Tomiura (2008) have begun to analyze offshoring by Japanese firms. These aspects deserve further study.

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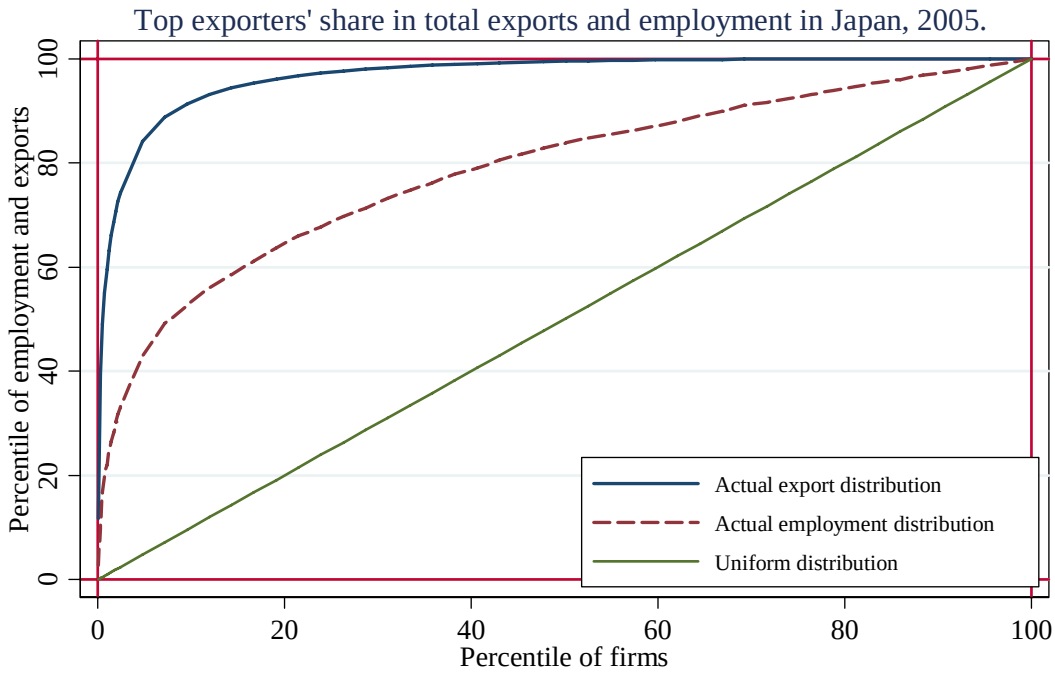
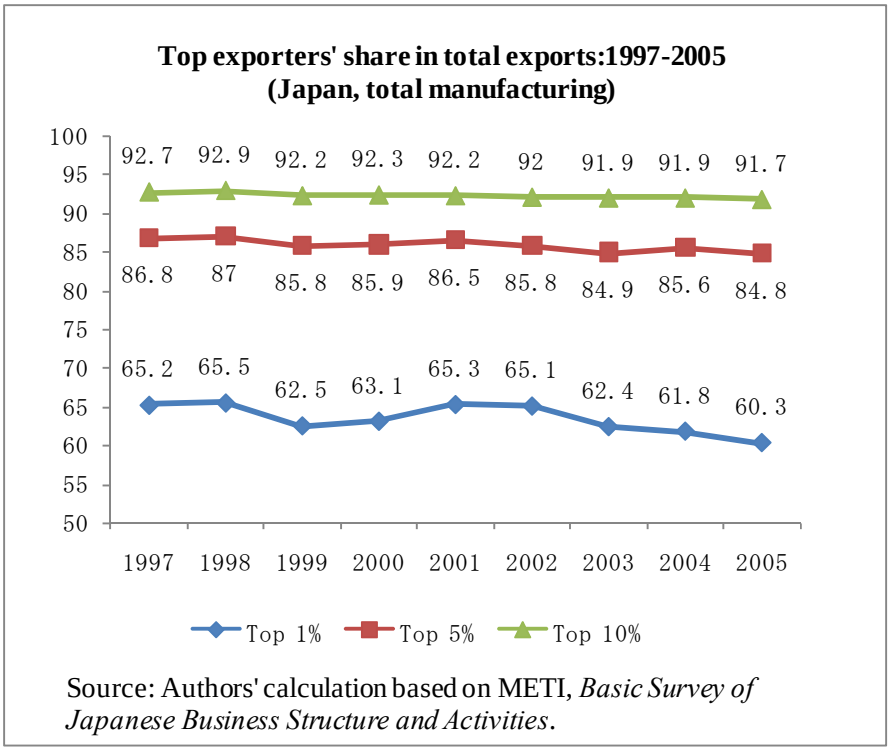
Figure 1



Note: The horizontal axis shows firms arranged in order of their value of exports (high to low).

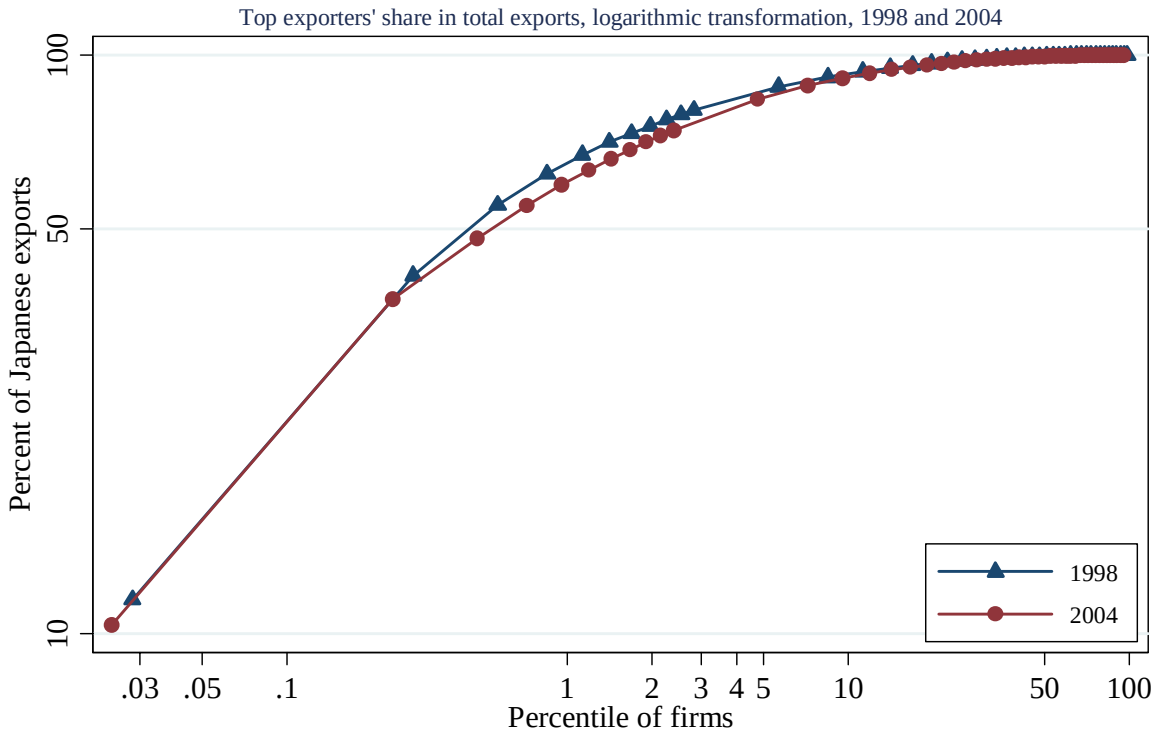
Source: METI, Basic Survey of Japanese Business Structure and Activities

Figure 2



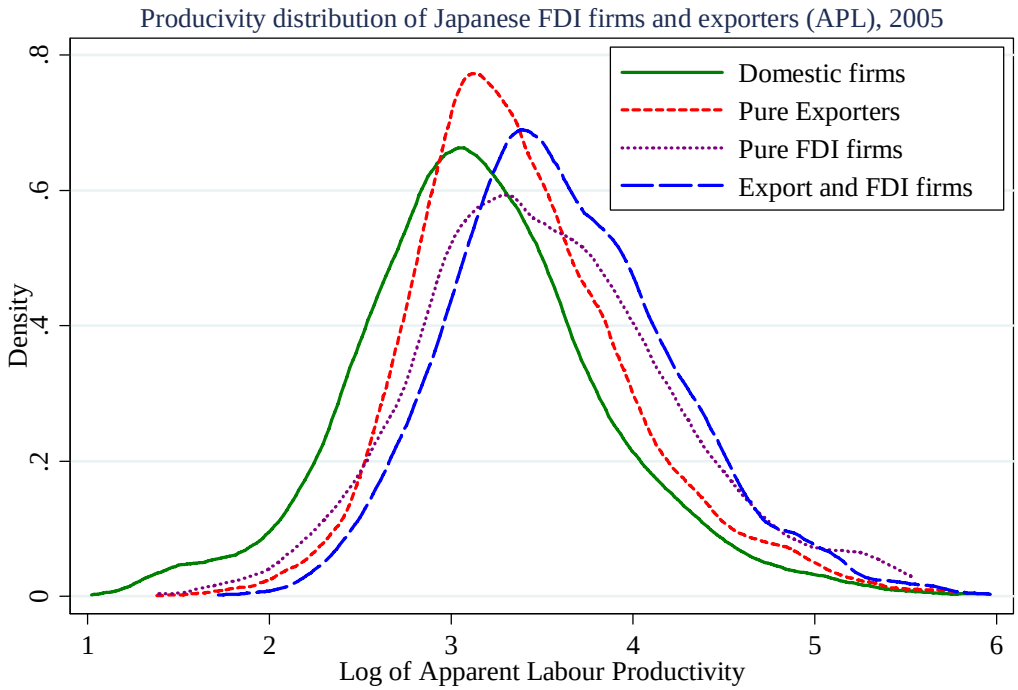
Source: Authors' calculation based on METI, *Basic Survey of Japanese Business Structure and Activities*.

Figure 3



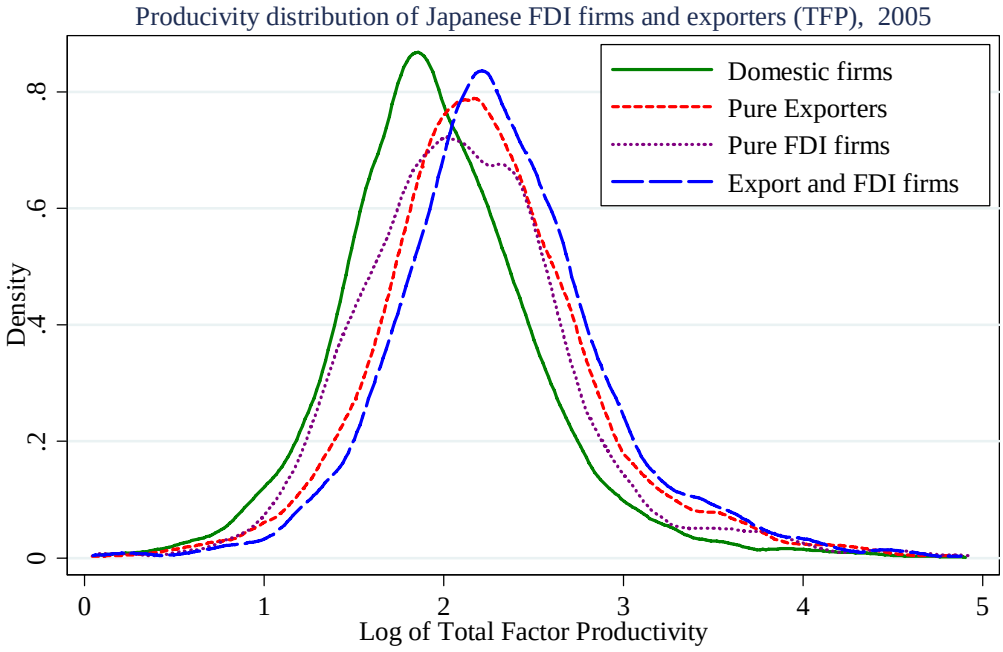
Note: The horizontal axis shows firms arranged in order of their value of exports (high to low).
Source: Authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities

Figure 4



Source: Authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities.

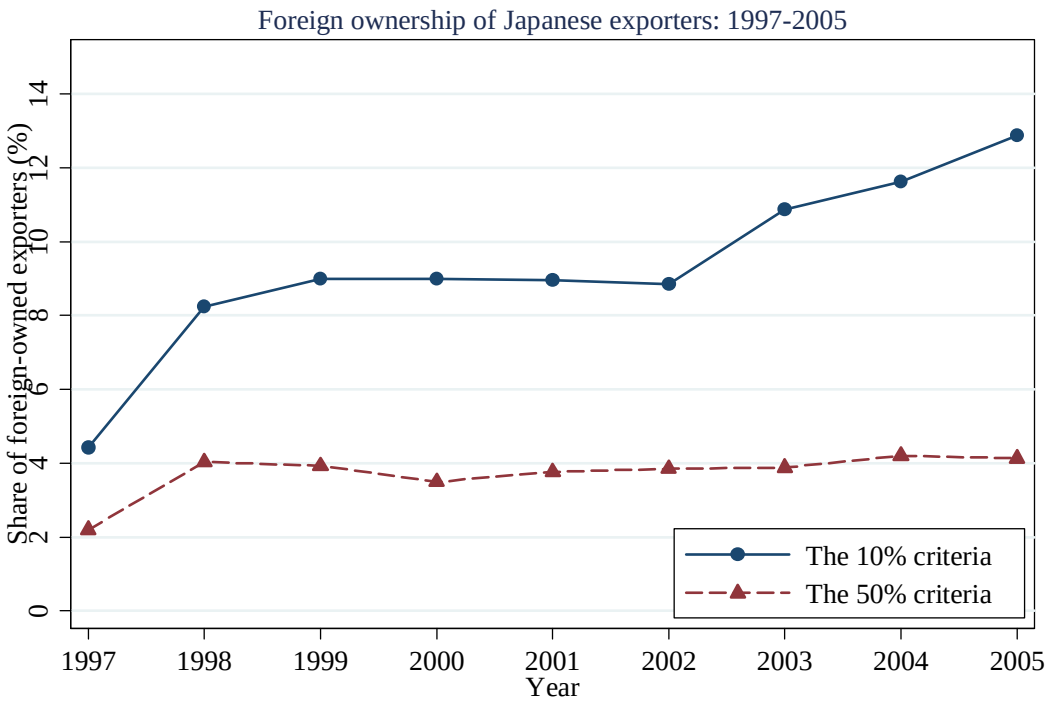
Figure 5



Note: TFP is estimated following the Olley-Pakes method.

Source: Authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities.

Figure 6



Source: Authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities.

Figure 7

Source: Authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities.

Figure 8

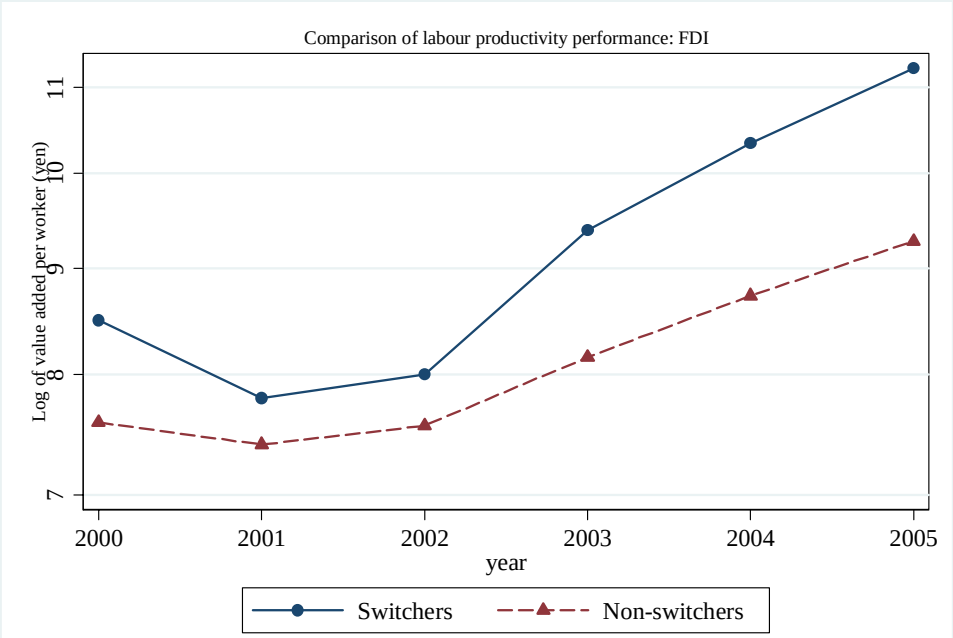


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Figure 9

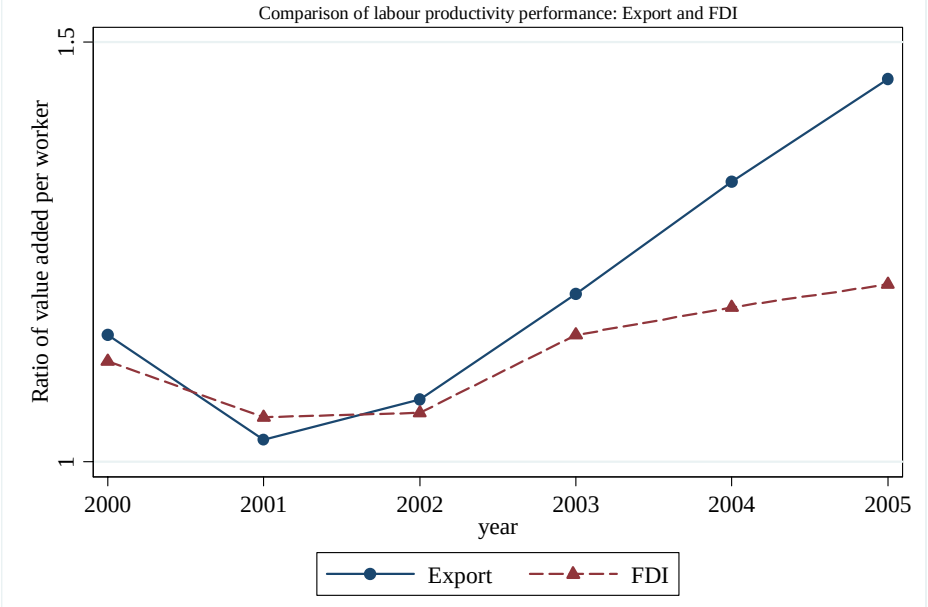

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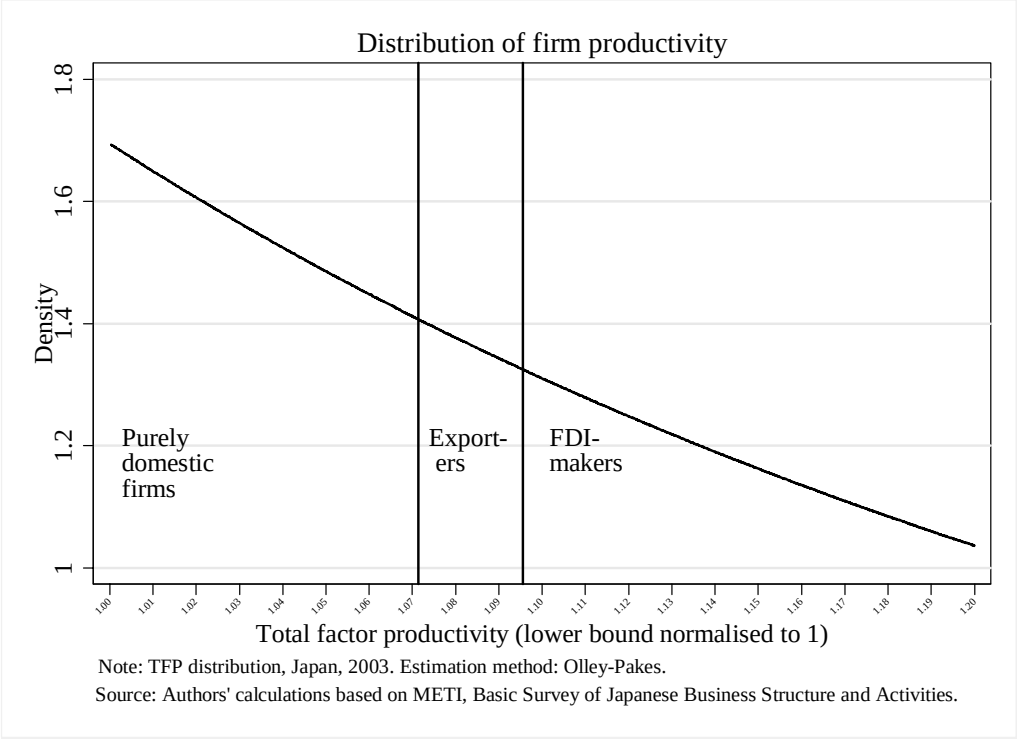
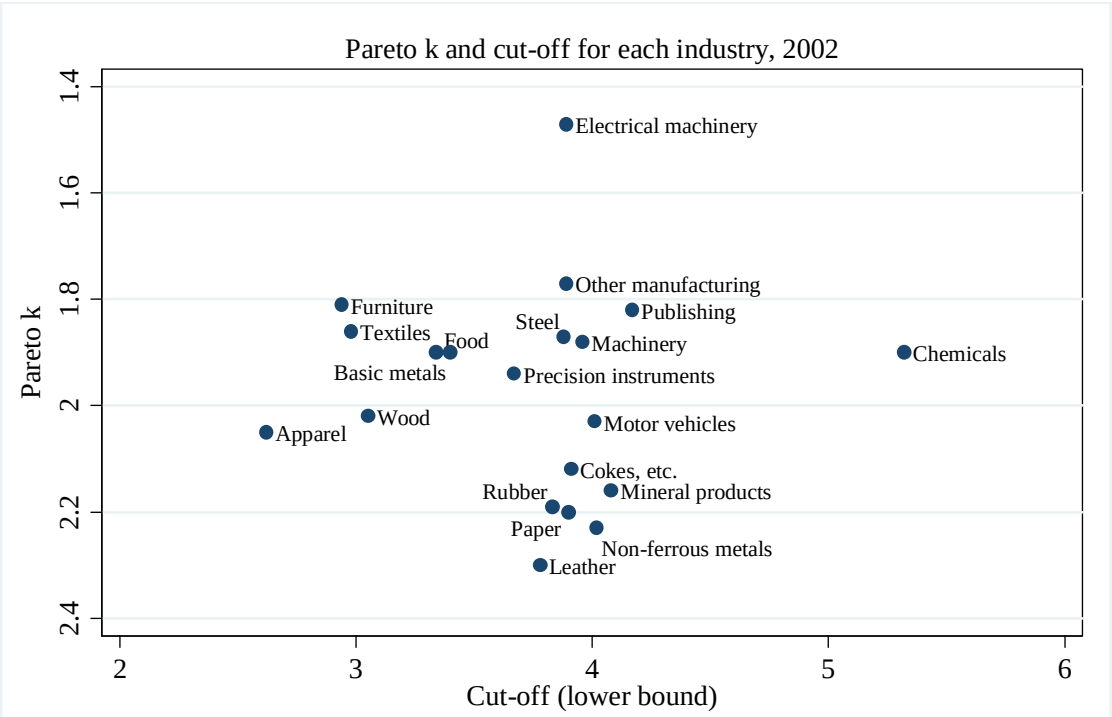
Figure 10



Note: TFP distribution, Japan, 2003. Estimation method: Olley-Pakes.

Source: Authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities.

Figure 11



Note: Industries located in the upper right of the scatter graph have relatively high productivity.

Source: Authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities.

Table 1

Top exporters' share in total exports, manufacturing sector

Country	Top 1%	Top 5%	Top 10%
Japan	62	85	92
Germany	59	81	90
France	44 (68)	73 (88)	84 (94)
United Kingdom	42	69	80
Italy	32	59	72
Hungary	77	91	96
Belgium	48	73	84
Norway	53	81	91
United States			96

Source: The data for Japan are from authors' calculations based on METI, *Basic Survey of Japanese Business Structure and Activities,* those for the United States from Bernard et al. (2007), and those for the European countries from Mayer and Ottaviano (2007).

Note: The figures for Japan, France, Germany, Hungary, Italy and the UK are based on large firms only, while those for Belgium, Norway, and the United States cover all firms. The figures in parentheses for France are those for all firms. The figures for the United States are for 2000, while those for all other countries are for 2003.

Table 2

International comparison of total manufacturing exports and distribution of exports by type of firm, 2003

				% of firms exporting more than				% of total exports by firms exporting more than			
Country	No. of firm	Total mfg. exports (billion €)	% exporters	5% of turnover	10% of turnover	50% of turnover	90% of turnover	5% of turnover	10% of turnover	50% of turnover	90% of turnover
Japan	12,660	318.0	30.5	16.2	11.4	1.7	0.2	98.0	94.8	47.2	2.6
Germany	48,325	488.7	59.3	46.9	40.3	11.9	1.0	99.5	98.5	73.6	6.0
France	23,691	171.7	67.3	41.2	33.0	9.0	1.4	93.6	95.1	49.2	9.7
United Kingdom	14,976	71.5	28.3	22.5	19.3	8.1	1.5	97.6	93.4	65.7	19.0
Italy	4,159	58.6	74.4	64.9	57.4	25.6	2.9	99.7	98.5	69.1	7.5
Hungary	6404	30.0	47.5	38.4	34.7	22.2	11.0	99.9	99.6	92.0	69.1
Norway	8,125	16.1	39.2	18.0	14.5	5.2	1.3	98.5	97.4	70.3	28.6
United States			18								

Source: The data for Japan are authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities, those for the United States are from Bernard et al. (2007), and those for the European countries from Mayer and Ottaviano (2007). The figures for Japan, France, Germany, Hungary, Italy and the UK are based on large firms only, while those for Belgium, Norway, and the United States cover all firms. The total manufacturing exports for Japan were converted to euro using the exchange rate released by Japan Customs.

Table 3

Total manufacturing exports and distribution of exports by type of firm, Japan: 1997-2005

				% of firms exporting more than				% of total exports by firms exporting more than			
Year	No. of firm	Total mfg exports (trillion yen)	% exporters	5% of turnover	10% of turnover	50% of turnover	90% of turnover	5% of turnover	10% of turnover	40% of turnover	50% of turnover
1997	14,104	33.99	24.9	11.5	7.8	1.0	0.2	97.3	93.3	54.5	29.3
1998	14,075	34.72	25.2	12.0	8.3	1.1	0.1	97.6	94.4	59.8	40.3
1999	13,861	33.22	26.3	12.6	8.9	1.1	0.1	97.5	94.7	56.0	24.4
2000	13,486	36.91	27.8	13.7	9.5	1.2	0.1	97.4	94.7	56.6	35.1
2001	13,470	35.30	28.8	14.3	10.1	1.4	0.2	97.3	94.5	61.0	49.1
2002	13,158	37.63	29.8	15.4	11.1	1.6	0.1	97.7	94.8	62.0	48.1
2003	12,660	41.55	30.5	16.2	11.4	1.7	0.2	98.0	94.8	64.5	47.2
2004	13,472	40.54	29.5	15.4	11.0	1.6	0.2	97.8	94.6	60.9	47.8
2005	13,203	47.99	31.7	16.9	12.2	1.9	0.2	98.3	94.8	64.8	50.4

Source: Authors' calculations based on METI, *Basic Survey of Japanese Business Structure and Activities* .

Table 4

Japanese manufacturing exports by industry, 2005

Industry	Number of firms	Value of exports (100 billion Yen)	Percent of exporters	Average ratio of exports to sales
Total manufacturing	13203	479.95	31.7	13.6
Food products and beverages	1599	0.96	9.3	4.3
Textiles	281	0.46	22.4	5.9
Wearing apparel	270	0.13	9.3	4.8
Wood and products of wood	142	0.03	9.2	2.7
Furniture	153	0.05	11.8	3.6
Paper and paper products	390	0.32	13.1	5.7
Publishing and printing	827	1.83	7.0	2.7
Leather	29	0.07	31.0	5.4
Rubber products	158	6.31	44.9	12.2
Chemicals and chemical products	930	30.95	52.7	10.4
Coke, refined petroleum and plastic products	759	12.62	31.1	8.4
Other non-metallic mineral products	494	4.43	22.5	11.1
Basic iron and steel	408	3.19	20.1	7.4
Non-ferrous metals	318	8.81	39.9	10.0
Basic metals	988	2.24	26.8	8.8
Machinery and equipment	1610	71.43	49.6	17.3
Electrical machinery and apparatus	1986	136.01	41.7	18.7
Motor vehicles	1155	178.56	36.3	14.8
Precision instruments	380	12.85	61.1	19.1
Other manufacturing	326	8.70	42.6	13.4

Source: Authors' calculations based on METI, *Basic Survey of Japanese Business Structure and Activities* .

Table 5

Export and FDI premia

Country	Employment premium	Value added premium	Wage premium	Capital intensity premium	Skill intensity premium
Export premia					
Japan	3.02 (3.76)	5.22 (6.06)	1.25 (1.10)	1.29 (1.00)	1.58 (1.30)
Germany	2.99 (4.39)		1.02 (0.06)		
France	2.24 (0.47)	2.68 (0.84)	1.09 (1.12)	1.49 (5.6)	
United Kingdom	1.01 (0.92)	1.29 (1.53)	1.15 (1.39)		
Italy	2.42 (2.06)	2.14 (1.78)	1.07 (1.06)	1.01 (0.45)	1.25 (1.04)
Hungary	5.31 (2.95)	13.53 (23.75)	1.44 (1.63)	0.79 (0.35)	
Belgium	9.16 (13.42)	14.8 (21.12)	1.26 (1.15)	1.04 (3.09)	
Norway	6.11 (5.59)	7.95 (7.48)	1.08 (0.68	1.01 (0.23)	
FDI premia					
Japan	4.79 (8.71)	8.79 (12.52)	1.26 (1.24)	1.53 (1.23)	1.52 (1.52)
Germany	13.19 (2.86)				
France	18.45 (7.14)	22.68 (6.1)	1.13 (0.9)	1.52 (0.72)	
Belgium	16.45 (6.82)	24.65 (11.14)	1.53 (1.2)	1.03 (0.82)	
Norway	8.28 (4.48)	11 (5.41)	1.34 (0.76)	0.87 (0.13)	

Source: For Japan, authors' calculations based on METI, *Basic Survey of Japanese Business Structure and Activities* ; for other countries, Mayer and Ottaviano (2007).

Note: Refer to the text for an explanation of how the premia were calculated. Figures in parentheses are the ratio of standard deviations. The figures for Japan, France, Germany, Hungary, Italy and the UK are based on large firms only, while those for Belgium and Norway cover all firms.

Table 6

Export and FDI premia in Japan (1997-2005)

Export premia

Year	Employment premium	Value added premium	Wage premium	Capital intensity premium (K/Y)	Capital intensity premium (K/VA)	Skill intensity premium	TFP premium
1997	3.47 (4.10)	4.44 (3.25)	1.20 (1.00)	1.24 (0.82)	1.86 (3.22)	1.29 (0.92)	1.20 (0.84)
1998	3.53 (4.23)	4.43 (3.53)	1.20 (1.03)	1.24 (0.79)	1.05 (0.77)	1.40 (0.86)	1.16 (1.24)
1999	3.22 (3.34)	4.09 (3.29)	1.19 (1.00)	1.22 (0.80)	1.02 (1.27)	1.36 (0.86)	1.17 (1.14)
2000	3.14 (3.59)	4.42 (3.94)	1.20 (1.04)	1.22 (0.84)	0.95 (0.42)	1.57 (4.17)	1.21 (1.01)
2001	3.03 (3.50)	4.35 (4.56)	1.21 (1.03)	1.24 (0.88)	1.11 (1.58)	1.52 (1.14)	1.16 (0.94)
2002	3.01 (3.41)	4.80 (5.15)	1.23 (1.16)	1.27 (0.88)	0.99 (0.95)	1.60 (1.67)	1.23 (1.30)
2003	3.02 (3.76)	5.22 (6.06)	1.25 (1.10)	1.29 (1.00)	0.84 (0.17)	1.58 (1.30)	1.32 (1.76)
2004	2.12 (2.27)	2.88 (2.04)	1.20 (1.02)	1.17 (0.79)	0.71 (0.31)	1.47 (1.13)	1.34 (1.50)
2005	2.69 (3.21)	4.69 (5.53)	1.25 (1.07)	1.31 (0.91)	0.89 (0.85)	1.65 (1.32)	1.38 (1.47)

FDI premia

Year	Employment premium	Value added premium	Wage premium	Capital intensity premium (K/Y)	Capital intensity premium (K/VA)	Skill intensity premium	TFP premium
1997	5.93 (6.65)	8.96 (7.92)	1.19 (1.05)	1.43 (0.89)	1.05 (0.29)	1.20 (1.07)	1.23 (0.92)
1998	5.72 (6.69)	8.16 (6.58)	1.18 (1.07)	1.42 (0.93)	1.12 (0.90)	1.31 (0.97)	1.17 (1.18)
1999	5.84 (10.43)	8.69 (10.16)	1.19 (1.04)	1.46 (1.03)	1.17 (1.30)	1.28 (0.94)	1.19 (1.10)
2000	5.56 (10.20)	9.00 (9.65)	1.21 (1.20)	1.54 (1.12)	1.11 (0.50)	1.65 (4.78)	1.22 (1.13)
2001	5.25 (9.10)	8.30 (7.37)	1.22 (1.17)	1.51 (1.07)	1.26 (2.05)	1.47 (1.57)	1.16 (1.00)
2002	5.00 (9.74)	8.90 (15.61)	1.25 (1.33)	1.53 (1.01)	1.08 (0.97)	1.51 (1.59)	1.22 (1.17)
2003	4.79 (8.71)	8.79 (12.52)	1.26 (1.24)	1.53 (1.23)	0.99 (0.20)	1.52 (1.52)	1.26 (1.06)
2004	4.51 (8.52)	8.12 (11.11)	1.25 (1.20)	1.54 (1.04)	0.64 (0.21)	1.59 (1.85)	1.28 (1.31)
2005	4.38 (7.69)	7.57 (8.85)	1.24 (1.17)	1.56 (1.07)	1.33 (0.89)	1.58 (1.48)	1.31 (1.47)

Source: Authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities.

Note: For an explanation of how the premia were calculated, refer to text. Figures in parentheses are the ratio of standard deviation.

Table 7

Export premia by industry, 2005

Industry	Apparent labour productivity	Labour productivity (VA/L)	Estimated TFP (Olley-Pakes)
Total manufacturing	1.34 (1.29)	1.48 (1.38)	1.38 (1.47)
Food products and beverages	1.58 (1.12)	1.66 (1.18)	1.45 (1.28)
Textiles	1.53 (1.68)	1.35 (2.59)	1.24 (1.82)
Wearing apparel	2.00 (1.57)	1.52 (1.25)	1.53 (1.51)
Wood and products of wood	1.11 (1.11)	1.10 (0.38)	1.04 (0.53)
Furniture	1.34 (2.00)	1.32 (1.65)	1.28 (1.75)
Paper and paper products	1.09 (0.85)	1.17 (1.25)	1.10 (1.16)
Publishing and printing	1.38 (1.43)	1.06 (0.93)	1.03 (0.98)
Leather	0.98 (0.77)	1.20 (1.25)	0.98 (0.58)
Rubber products	1.27 (0.90)	1.28 (0.92)	1.22 (1.00)
Chemicals and chemical products	0.88 (0.31)	1.36 (0.53)	1.09 (0.97)
Coke, refined petroleum and plastic products	1.78 (2.37)	1.27 (1.58)	1.19 (1.34)
Other non-metallic mineral products	1.20 (1.14)	1.34 (1.62)	1.24 (1.22)
Basic iron and steel	0.90 (0.61)	1.11 (1.06)	1.00 (0.87)
Non-ferrous metals	1.11 (0.70)	1.31 (1.10)	1.24 (1.00)
Basic metals	1.06 (0.90)	1.28 (0.97)	1.23 (1.00)
Machinery and equipment	1.26 (0.92)	1.21 (0.71)	1.15 (0.75)
Electrical machinery and apparatus	1.52 (1.38)	1.43 (1.24)	1.29 (1.26)
Motor vehicles	1.37 (1.06)	1.28 (1.25)	1.21 (1.21)
Precision instruments	1.16 (1.28)	1.20 (0.94)	1.12 (0.88)
Other manufacturing	1.09 (1.11)	1.11 (1.06)	1.05 (0.99)

Source: Authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities.
Note: The firms considered are manufacturers with more than 50 employees. Figures in parentheses are the ratio of standard deviation.

Table 8

FDI premia by industry, 2005

Industry	Apparent labour productivity	Labour productivity (VA/L)	Estimated TFP (Olley-Pakes)
Total manufacturing	1.44 (1.28)	1.44 (1.29)	1.31 (1.47)
Food products and beverages	1.66 (1.15)	1.64 (1.41)	1.39 (1.21)
Textiles	1.61 (0.94)	1.28 (0.71)	1.16 (0.85)
Wearing apparel	1.53 (1.24)	1.31 (1.22)	1.20 (1.12)
Wood and products of wood	1.05 (0.67)	1.04 (0.60)	1.02 (0.81)
Furniture	1.46 (1.81)	1.45 (1.71)	1.40 (1.62)
Paper and paper products	1.34 (1.10)	1.22 (0.99)	1.06 (0.71)
Publishing and printing	1.73 (2.28)	1.25 (1.37)	1.10 (0.92)
Leather	1.61 (1.75)	1.37 (1.87)	1.04 (0.76)
Rubber products	1.48 (1.19)	1.29 (0.97)	1.32 (1.13)
Chemicals and chemical products	1.00 (0.35)	1.27 (0.64)	1.05 (0.94)
Coke, refined petroleum and plastic products	1.42 (1.47)	1.18 (1.59)	1.10 (1.27)
Other non-metallic mineral products	1.24 (0.99)	1.29 (0.94)	1.22 (0.75)
Basic iron and steel	0.99 (0.65)	1.27 (1.55)	1.13 (1.24)
Non-ferrous metals	1.22 (0.81)	1.19 (1.11)	1.08 (0.81)
Basic metals	1.22 (1.04)	1.29 (1.11)	1.24 (1.27)
Machinery and equipment	1.39 (1.10)	1.25 (0.85)	1.17 (0.81)
Electrical machinery and apparatus	1.60 (1.45)	1.44 (1.18)	1.30 (1.35)
Motor vehicles	1.44 (1.12)	1.32 (1.25)	1.19 (1.14)
Precision instruments	1.39 (1.79)	1.29 (1.36)	1.19 (1.18)
Other manufacturing	1.39 (1.55)	1.28 (1.68)	1.19 (1.39)

Source: Authors' calculations based on METI, Basic Survey of Japanese Business Structure and Activities.
Note: The firms considered are manufacturers with more than 50 employees. Figures in parentheses are the ratio of standard deviation.

Table 9

Productivity distribution in the Japanese manufacturing sector, 2005

		Domestic firms	Exporters	FDI firms	Export and FDI firms	All
	Number of firms	8226	1872	791	2314	13203
	Share of each type	62.30	14.18	5.99	17.53	100.00
Log of ALP	Mean	3.17	3.41	3.52	3.63	3.30
	S. D.	(0.71)	(0.63)	(0.73)	(0.65)	(0.71)
Log of TFP	Mean	1.97	2.23	2.11	2.31	2.08
	S. D.	(0.59)	(0.63)	(0.67)	(0.65)	(0.63)

		Domestic firms vs. Exporters	Exporters vs. FDI firms	FDI firms vs. Export and FDI firms	Exporters vs. Export and FDI firms
Log of ALP	Prob-values of t-test	0.00	0.00	0.00	0.00
	Prob-values of KS-test	0.00	0.00	0.00	0.00
Log of TFP	Prob-values of t-test	0.00	1.00	0.00	0.00
	Prob-values of KS-test	0.00	0.99	0.00	0.00

Source: Authors' calculations based on METI, *Basic Survey of Japanese Business Structure and Activities.*

Note: ALP stands for apparent labor productivity and is defined as sales per worker. KS-test refers to the two-sample Kolmogorov-Smirnov test. In the t-test, the null hypothesis is that the mean of the first group is equal to the mean of the second group, while the alternative hypothesis is that the mean of the first group is smaller than that of the second group, while in the K-S test, the null hypothesis is that the distributions are equal, while the alternative hypothesis is that the distribution of the second group stochastically dominates the distribution of the first group.

Table 10

Percentage of foreign-owned firms among exporters and non-exporters, 2003

Country	Non-exporters	Exporters
Japan	0.7	3.9
Italy	4.0	10.3
Belgium	0.6	12.2
United Kingdom	18.7	27.9
Hungary	11.5	43.6

Source: The data for Japan are from METI, *Basic Survey of Japanese Business Structure and Activities* , while those for the other countries are from Mayer and Ottaviano (2007).

Table 11

Equation (1), (2), and (3) Estimates

	Model I			Model II		
	Sales	Avg. sales	No. firms	Sales	Avg. sales	No. firms
GDP	1.11	0.51	0.6	1.12	0.51	0.6
	[0.06]***	[0.03]***	[0.04]***	[0.06]***	[0.03]***	[0.04]***
Distance	-1.5	-0.24	-1.26	-1.6	-0.27	-1.33
	[0.17]***	[0.09]**	[0.11]***	[0.17]***	[0.10]***	[0.11]***
WTO				0.71	0.21	0.5
				[0.30]**	[0.17]	[0.20]**
N	619	619	619	619	619	619
R^2	0.49	0.31	0.48	0.5	0.32	0.49

Notes: Standard Errors are in parentheses. ***, **, * show statistical significance of the coefficients at the 99%, 95%, and 90% levels, respectively.

Table 12

Industry Estimates

	Food products and beverages			Textiles			Pulp, paper and paper products		
	Sales	Avg. sales	No. firms	Sales	Avg. sales	No. firms	Sales	Avg. sales	No. firms
GDP	0.69***	0.17***	0.52***	0.73***	0.39***	0.35***	0.71***	0.42***	0.28***
	(0.09)	(0.07)	(0.05)	(0.06)	(0.04)	(0.03)	(0.12)	(0.11)	(0.03)
Distance	-1.20***	-0.49***	-0.71***	-1.58***	-0.69***	-0.90***	0.63*	0.59*	0.04
	(0.16)	(0.12)	(0.09)	(0.14)	(0.09)	(0.08)	(0.33)	(0.31)	(0.10)
WTO	0.54	0.57*	-0.03	0.13	0.79***	-0.66***	0.71	0.78	-0.07
	(0.40)	(0.29)	(0.22)	(0.36)	(0.23)	(0.19)	(0.59)	(0.55)	(0.17)
N	250	250	250	348	348	348	133	133	133
R^2	0.35	0.15	0.45	0.54	0.39	0.56	0.29	0.19	0.41

	Chemicals			Petroleum and coal products			Non-metallic mineral products		
	Sales	Avg. sales	No. firms	Sales	Avg. sales	No. firms	Sales	Avg. sales	No. firms
GDP	0.97***	0.32***	0.65***	0.27*	0.06	0.21***	0.49***	0.19*	0.30***
	(0.08)	(0.06)	(0.04)	(0.15)	(0.14)	(0.04)	(0.13)	(0.10)	(0.05)
Distance	-1.34***	-0.15	-1.19***	-0.09	-0.23	0.14*	-0.90***	-0.15	-0.74***
	(0.17)	(0.13)	(0.09)	(0.27)	(0.25)	(0.08)	(0.26)	(0.20)	(0.10)
WTO	-0.07	-0.45*	0.38**	1.41**	1.68***	-0.27	-0.2	0.05	-0.25
	(0.36)	(0.26)	(0.19)	(0.61)	(0.58)	(0.18)	(0.57)	(0.44)	(0.22)
N	358	358	358	107	107	107	193	193	193
R^2	0.41	0.11	0.57	0.09	0.1	0.29	0.15	0.05	0.37

	Basic metal			Fabricated metal products			Machinery		
	Sales	Avg. sales	No. firms	Sales	Avg. sales	No. firms	Sales	Avg. sales	No. firms
GDP	0.65***	0.20***	0.44***	0.43***	0.09*	0.35***	1.36***	0.58***	0.78***
	(0.09)	(0.07)	(0.05)	(0.08)	(0.05)	(0.05)	(0.08)	(0.05)	(0.05)
Distance	-1.12***	-0.06	-1.06***	-1.48***	-0.39***	-1.09***	-1.85***	-0.64***	-1.21***
	(0.17)	(0.12)	(0.09)	(0.15)	(0.09)	(0.09)	(0.16)	(0.10)	(0.09)
WTO	0.35	-0.42*	0.77***	0.60*	0.48**	0.12	1.94***	1.12***	0.82***
	(0.32)	(0.22)	(0.17)	(0.35)	(0.22)	(0.22)	(0.37)	(0.23)	(0.20)
N	255	255	255	202	202	202	320	320	320
R^2	0.29	0.08	0.5	0.41	0.12	0.53	0.57	0.36	0.62

	Electrical machinery			Transport equipment			Precision instruments		
	Sales	Avg. sales	No. firms	Sales	Avg. sales	No. firms	Sales	Avg. sales	No. firms
GDP	1.01***	0.41***	0.59***	1.33***	0.63***	0.69***	1.05***	0.51***	0.55***
	(0.08)	(0.06)	(0.04)	(0.08)	(0.06)	(0.04)	(0.10)	(0.07)	(0.04)
Distance	-2.40***	-0.83***	-1.57***	-0.56***	0.27**	-0.83***	-1.71***	-0.84***	-0.87***
	(0.19)	(0.13)	(0.09)	(0.16)	(0.13)	(0.07)	(0.18)	(0.14)	(0.08)
WTO	1.87***	0.75***	1.12***	0.81**	0.55**	0.26	0.99**	0.85***	0.14
	(0.36)	(0.24)	(0.17)	(0.35)	(0.28)	(0.16)	(0.42)	(0.31)	(0.18)
N	415	415	415	427	427	427	256	256	256
R^2	0.49	0.25	0.62	0.46	0.23	0.6	0.46	0.27	0.56

Note: Standard Errors are in parentheses. ***, **, * show statistical significance of the coefficients at the 99%, 95%, and 90% levels, respectively.

Table 13

Pareto k and cut-off by industry for Japan

Industry	Pareto k	R-square	Cut-off (lower bound)
Total manufacturing	1.69	0.85	3.94
Food products and beverages	1.63	0.76	3.24
Textiles	1.96	0.80	3.32
Wearing apparel	1.65	0.82	2.46
Wood and products of wood	2.12	0.75	3.31
Furniture	1.87	0.79	3.09
Paper and paper products	2.06	0.84	3.83
Publishing and printing	1.78	0.81	4.08
Leather	1.93	0.91	3.78
Rubber products	2.05	0.85	4.02
Chemicals and chemical products	1.85	0.82	5.28
Coke, refined petroleum and plastic products	1.92	0.75	3.92
Other non-metallic mineral products	1.87	0.77	3.98
Basic iron and steel	2.18	0.86	4.07
Non-ferrous metals	1.78	0.69	3.63
Basic metals	1.62	0.62	3.22
Machinery and equipment	1.99	0.79	4.55
Electrical machinery and apparatus	1.37	0.92	4.67
Motor vehicles	2.20	0.81	4.62
Precision instruments	1.86	0.81	3.96
Other manufacturing	1.67	0.83	4.23

Source: Authors' calculations based on METI, *Basic Survey of Japanese Business Structure and Activities.*

Note: The figures are for 2003.

Appendix. Data source and variable construction

a. Firm-level data

The data on firms' exports, FDI and the variables used for the calculation of TFP at the firm-level in Sections 2, 3 and 5 are retrieved from *Kigyo Katsudo Kihon Chosa* (KKKC, the Basic Survey of Japanese Business Activities) for the years 1997-2005. This annual national survey is conducted by the Japan Ministry of Economy, Trade and Industry (METI), is mandatory for all firms with 50 or more employees and whose paid-up capital is over 30 million yen, and covers the mining, manufacturing, wholesale, retail, and food and beverage industries. We transformed nominal values into real values using appropriate deflators from the Japan Industry Productivity (JIP) Database 2008, which provides comprehensive data at the 3-digit industry-level for Japan for the period 1970-2005. We used KKKC with legal permission, while the JIP database 2008 is downloadable from the website of the Research Institute of Economy, Trade and Industry (http://www.rieti.go.jp/en/).

b. Labor input

Labor input is defined as the total number of employees of all kinds, including full-time employees, part-time employees, and temporarily dispatched workers. We do not adjust the number of employees using work hours or the education level of employees, since these data are unavailable.

c. Value-added

We calculated value-added as total sales minus intermediate input defined as the sum of the cost of goods sold and general and administrative expenses minus wages, rental costs, depreciation, and taxes. Total sales and intermediate input are deflated using the output and input deflators of the JIP Database 2008, respectively. Since wage payments to temporary workers received from dispatch companies are recorded under outsourcing expenses which are part of the cost of sales, we defined payments to temporary workers as the average ratio of payments to non-regular employees over regular employees in Japanese manufacturing industries (0.578) multiplied by both the number of temporary workers and average payments to regular employees of each firm.

d. Capital stock

Real capital stock is calculated by the perpetual inventory method. While firms report the book value of fixed tangible assets, this is transformed into real values using the ratio of the real value of fixed tangible assets to their book value at the 3-digit industry level provided by Tokui et al. (2007). The investment goods deflator used for deflating the value of investment flows and the depreciation rate have also been taken from the JIP Database 2008.

e. TFP

We estimate the TFP level for each firm using the firm-level data of sampled firms for the period 1997-2005. The direct calculation of TFP using the estimated coefficients of capital stock and labor in the Cobb-Douglas function form suffers from the endogeneity problem. As the benchmark of TFP, the estimated labor share and capital share are 0.78 and 0.18, respectively, when estimating the production function by the Olley and Pakes (1996) procedure using investment as the proxy for productivity shocks. We also used an alternative method by employing intermediate input or the purchase of inputs as a proxy, as proposed by Levinsohn and Petrin (2003); however, since the results were changed greatly by the choice of proxy, we relied on the result of the Olley - Pakes procedure.

f. Export and FDI

We used the real value of exports deflated by the output deflator of the JIP Database 2008 and defined exporters as firms reporting positive export values. Regarding FDI firms, we used data from KKKC and defined firms with at least one subsidiary or affiliate in foreign countries as FDI firms. In the survey, Japanese firms' subsidiaries in foreign countries are defined as overseas firms in which the Japanese parent holds an equity stake of over 50 percent, while foreign affiliates are overseas firms in which the Japanese parent holds between 20 and 50 percent of the equity. Hence, FDI firms in this study are firms that hold 20 percent or more of the equity of an overseas firm.

g. Sources and data construction for Section 4

Firm-level variables come from the *Kaigai Jigyo Katsudo Kihon Chosa* (*Basic Survey of Overseas Business Activities*), an annual survey conducted by the Ministry of Economics and

International Trade.[16] The data set used is a panel and the number of observations is 65,430 affiliate-years (cumulative total from 1995 through 2004).[17]

Country-level variables such as real GDP and exchange rates come from the Penn World Tables (PWT6.2). The distance data is taken from Jon Haveman's "International Trade Data."[18] The data on WTO membership is constructed based on information provided on the WTO's website.[19]

Sales of FDI firms are constructed as follows. We sum the sales of foreign affiliates recorded in the panel by parent firm and country. Thus, for example, the number of firms operating in country *i* is the number of parent firms that have foreign affiliates in country *i* rather than the number of foreign affiliates in country *i*. The average sales are derived by dividing the total sales in country *i* by the number of parent firms.[20]

16 The survey covers all Japanese firms that had affiliates abroad as of the end of the fiscal year (March 31). A foreign affiliate of a Japanese firm is defined as a firm that is located in a foreign country in which a Japanese firm had an equity share of 10 percent or more.

17 A more detailed description of the procedure for constructing the panel data can be found in Kiyota et al. (2008).

18 See http://www.macalester.edu/research/economics/page/haveman/trade.resources/tradedata.html.

19 See http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm.

20 The sales data in the database is recorded in terms of Japanese yen so that we convert it into international-dollar values using the price level data in PWT6.2. The price level of GDP in PWT, *P*, is given by *P* = 100*(*PPP*/the exchange rate). Thus, after conversion into U.S. dollar values, the sales data are multiplied by 100/P.