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**Are Multinational Enterprises More Productive?
A Test of the Selection Hypothesis**

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Are Multinational Enterprises More Productive?

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Abstract

This paper investigates whether differences in productivity explain why some Japanese manufacturing firms sell only in the domestic market, while others serve foreign markets, either through exports, overseas production, outsourcing or licensing. Using firm level data, it is shown empirically that the productivity of multinational firms differs significantly from that of firms that sell only in the domestic market. It shows therefore that the heterogeneous productivity levels explain the channels of multinational enterprises.

JEL classification: F2

Keywords: FDI, exports, outsourcing, licensing, TFP.

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Are Multinational Enterprises More Productive?

1 Introduction

Companies doing business in a foreign market face various disadvantages vis-à-vis local competitors, such as a lack of consumer recognition or established supplier networks, having to operate in an unfamiliar culture and legal system, etc. Economic theory therefore suggests that firms which set up production facilities overseas need to be sufficiently productive to compensate for these disadvantages. And underpinning this productivity are the intangible assets that multinational enterprises possess, including their stock of technological knowledge accumulated by R&D or the accumulation of marketing know-how from past advertising activity. Furthermore, it is expected that the recipient country will benefit from such inflows.

Based on this line of reasoning, this chapter aims to investigate whether firms' productivity is a determinant of their mode of serving foreign markets, i.e., whether they rely on FDI, exporting, outsourcing or licensing. The literature suggests that firms which serve foreign markets through exporting, outsourcing or licensing are potential MNEs. Examining the nexus between productivity and the mode of serving foreign markets, Head and Ries (2002), for example, show that firms which transfer production overseas typically are most productive than their competitors, compensating for the investment costs required to shift production abroad. Similarly, exporting firms, which need to bear the transport costs associated with exporting, usually are more productive than firms which only sell to the domestic market. Along similar lines, Caves (1996) argued that firms which possess more advanced and complicated

technology tend to choose FDI rather than licensing. Meanwhile, Helpman and Grossman (2002) suggest that constraints on the nature of the contracts which firms can write with suppliers or employees also play a role, providing another explanation why firms' productivity levels may determine their mode of serving overseas markets.

International business activity has increased rapidly through in recent years, both through exports and the establishment of foreign affiliates (see Table 1a). There are prominent firms building a variety of production systems in order to maximize profits. For example, as Table 1b shows, *Intel* produces its products in various subsidiaries, in which the parent company holds equity stakes and decides on important business matters. On the other hand, other firms, such as *Ericsson*, or *Flectronics*, do not rely on subsidiaries but utilize unaffiliated, independent firms. The economic literature suggests that firms with complex and advanced technology tend to internalize production processes in order to avoid leakages of their technology. However, as shown in Table 1b, 1c, and 1d, it is noteworthy that in order to expand their business activity, some firms in the telecommunication equipment industry, some of the largest manufacturers, such as *Ericsson* and *Flectronics* (see Tables 1c and 1d), externalize production, that is, they rely on outsourcing.

Table 1a Selected Indicators of FDI and International Production 1982-1999

(Unit: Billions of dollars)

	1982	1990	1999
FDI inflows	58	209	865
FDI outflows	37	245	800
FDI inward stock	594	1761	4772
FDI outward stock	567	1716	4759
Cross border M&A	N.A.	151	720
Sales of foreign affiliates	2462	5503	13564
Exports of goods non factor servi	2041	4173	6892

Source: UNCTAD (2000)

Note: Sales of foreign affiliates are estimated from those of France, Germany, Italy, Japan and U.S.

Exports are estimated from those of Japan and U.S. The others are for World from UNCTAD estimates.

Table 1b Examples of Different International Production Systems

	Internalized (Equity control)	Mixed (Equity and non equity)	Externalized (non equity)
Technology driven	Semiconductor (Intel)		Telecom equipment (Ericsson & Electronics)
Production driven		Automotive (Toyota)	
Marketing driven			Garments (Limited Brands & Li Fung)

Source: UNCTAD (2002)

Table 1c The Top Telecom Equipment Manufactures (2000)

(Unit: Billions of dollars)

rank	company	Home country	sales
1	Ericsson	Sweden	31.3
2	Nortel Networks	Canada	30.3
3	Nokia	Finland	27.2
4	Lucent technology	U.S.	25.8
5	Cisco Systems	U.S.	23.9
6	Siemens	Germany	22.8
7	Motorola	U.S.	22.8

Source: UNCTAD (2002)

Table 1d The Five Largest Contract Electronics Manufactures (2002)

(Unit: Billions of dollars)

rank	company	Headquarters	Revenue
1	Solelectron	U.S.	16.5
2	Electronics international	Singapore	13.2
3	SCI Systems, Sanmina	U.S.	12.1
4	Celestica	Canada	11.3
5	Jabil Circuit	U.S.	4.9

Source: UNCTAD (2002)

Statistics also provide ample evidence of the globalization of Japanese firms. The sales of the foreign affiliates of Japanese firms amounted to 60 trillion yen in 1993, while export sales amounted to 50 trillion yen. Japanese firms also increasingly rely on outsourcing, which in the *Basic Survey of Business Activity (Kigyo Katsudo Kihon Chosa)*, for example, is defined as the reliance on the other firms for the production or assembly of final goods, parts, or materials. Table 2a indicates that outsourcing payments to the foreign firms were 2.8 trillion yen, and receipts from licensing (patents only) to foreign firms amounted to about 0.16 trillion yen, where it should be noted that half of this amount went to “foreign firms” that were the affiliates of Japanese firms.² Table 2a shows, the values of outsourcing and licensing are lower than those of FDI and exports, but they tend to increase in technology-intensive industries. As shown in Table 2b, in 1998, the number of exporting firms was high in the general machinery and the electrical machinery sectors, while the number of firms serving overseas markets through foreign

² Ministry of Education, Culture, Sports, Science and Technology (2002) shows that Japanese firms’ income from licensing in foreign markets, which includes patents, brand names, design and business know-how, amounted to 1 trillion yen in 2000.

affiliates was high in the general machinery and transport machinery sectors. Moreover, the number of firms which outsourced to independent foreign firms was high in the electrical and general machinery sectors. Finally, the number of firms that license to foreign firms was high in the chemical industry. Irrespective of the mode of international activity, firms serving foreign markets tend to hail from technology-intensive industries.

Table 2a Firms Serving Foreign Markets through Licensing and Outsourcing, by Industry (1998)

	Licensing Revenue (million yen)	The Ratio of Licensing to Foreign Affiliates	Licensing Revenue from Foreign Independent Firms (million yen)	Total Payments for Outsourcing to Foreign Firms (million yen)
Food	2568	0.434	1454	31316
Beverages	34	0.434	19	320
Spinning	57	0.182	47	4231
Textiles	0	0.182	0	24743
Lumber and wood products	0	0.753	0	4052
Furniture	9	0.753	2	4591
Pulp, paper and paper prods.	271	0.406	161	15777
Publishing and printing	63	0.846	10	4648
Chemicals	88735	0.455	48381	11987
Petroleum products	86	0.454	47	36
Plastics	448	0.610	175	13941
Rubber products	2832	0.737	745	36350
Leather and leather products	0	0.753	0	739
Stone, clay and glass products	167	0.853	25	20915
Steel	2721	0.135	2355	4148
Nonferrous metals	4185	0.447	2312	11291
Metal products	619	0.369	391	8084
General machinery	11201	0.482	5806	311204
Electrical machinery	28957	0.534	13493	1900033
Transportation machinery	17259	0.640	6211	364144
Precision machinery	430	0.393	261	43679
Total	160642	0.581	81893	2816229

Table 2b Number of Firms Serving Foreign Markets through Exports, Overseas Production, Outsourcing or Licensing by Industry (1998)

	No. of firms serving foreign markets through				
	Exports	Overseas	Outsourcing	Licensing	Total
		production	to foreign	to foreign	
			firms	firms	
Food	87	72	23	10	1,455
Beverages	39	17	4	2	215
Spinning	50	36	10	3	401
Textiles	31	33	28	0	455
Lumber and wood products	11	10	3	0	176
Furniture	18	14	14	1	192
Pulp, paper and paper prods.	40	26	3	5	450
Publishing and printing	57	32	13	2	841
Chemicals	438	154	30	64	941
Petroleum products	26	3	2	3	59
Plastics	130	75	28	8	685
Rubber products	56	30	18	3	150
Leather and leather products	8	3	3	0	45
Stone, clay and glass product	106	40	15	4	603
Steel	76	31	15	9	407
Nonferrous metals	105	58	23	6	339
Metal products	208	84	43	10	1,036
General machinery	712	199	172	28	1,645
Electrical machinery	702	314	239	34	2,061
Transportation machinery	321	202	81	30	1,196
Precision machinery	201	58	63	7	367
Total	3422	1491	830	229	13,719

The rapid internationalization of the global economy in recent decades has spawned a burgeoning literature on the causes and determinants of firms' international activities. In the field of international economics, studies have attempted to explain the circumstances under which firms choose to engage in such activities and the form – foreign direct investment, exporting, outsourcing, or licensing – they take. For instance, as discussed in the previous chapter, industry characteristics are one potential determinant of

international activities. In industries where transport costs are high, firms are more likely to choose foreign production than exports as a way of serving overseas markets. In contrast, economies of scale level tend to tip the balance in favor of exporting rather than local production.³

However, even within the same industry, variations among firms have been observed. Some firms sell only to the domestic market, while others serve foreign markets through exporting, foreign affiliates, outsourcing, and/or licensing. This chapter examines if productivity plays a key role in determining whether a firm internationalizes, and if so, which form this takes (i.e., FDI, exporting, outsourcing or licensing) in the case of Japanese manufacturing firms.

The following methodology is employed for this purpose. First, TFP levels using firm level data are calculated. Then, the productivity of different types of firms is compared, using firms with foreign affiliates as the base-line against firms engaged in exporting, outsourcing or licensing.

The remainder of the chapter is organized as follows. The following section provides a survey of the related literature on the determinants of multinational enterprises' mode of serving foreign markets. Section 3 explains the data set and how TFP levels are measured. Section 4 shows some empirical tests, while Section 5 presents a regression analysis of the issue. Section 6 concludes.

2 *Literature Survey*

Exporting versus FDI

This chapter investigates whether firms' productivity is a determinant of their mode of serving

³ See, for example, Brainard (1993, 1997).

foreign markets. The previous chapter considered whether industry characteristics such as scale economies and freight costs determined whether firms' chose FDI or exporting. As discussed in Helpman, Melitz, and Yeaple (2002) and Head and Ries (2002), firms which expand their business through FDI may be more productive because they need to bear the fixed costs of establishing production facilities in foreign countries.

Helpman, Melitz, and Yeaple (2002) examined the international activities of heterogeneous firms within the same industry, showing that even firms within the same industry do not serve foreign market through the same channels (such as exporting or foreign affiliates) or use these to the same extent. They found that the mode of international activity was a function their productivity.

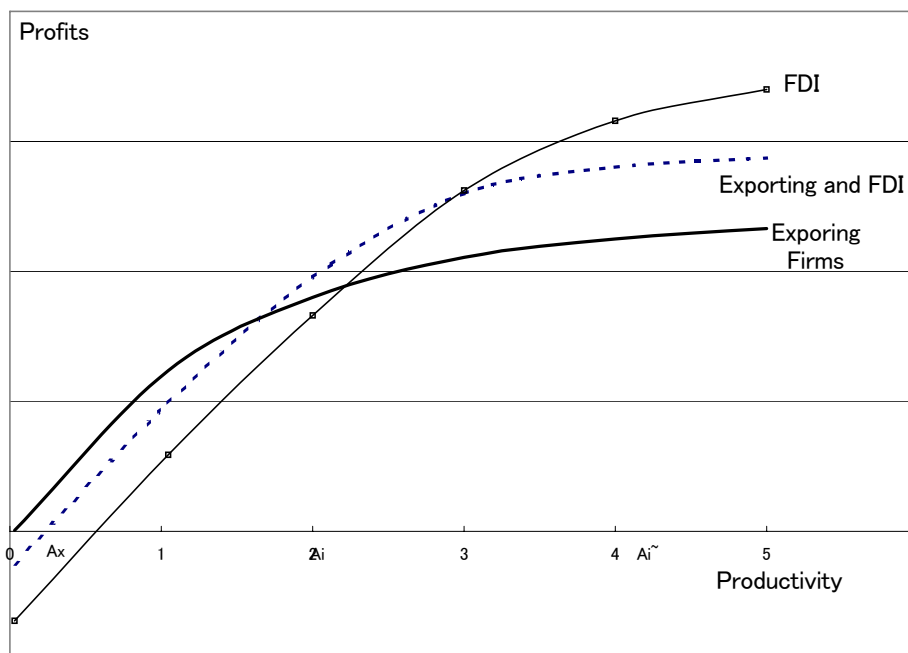
Head and Ries (2002) showed in their model that one would expect productivity to be lowest for those firms that do not serve overseas markets either through exports or foreign affiliates but only sell to the domestic market. Productivity levels should be higher for exporting firms and higher still for those that sell both through exporting and affiliates. The most productive firms, however, would be those serving foreign markets only through foreign affiliates. Figure 1 shows the critical levels for exporting and FDI. First, rising trade costs increase the critical productivity to make exporting profitable. Second, higher trade costs lower the critical productivity to make FDI preferable to exporting. Finally, a higher fixed cost of operating foreign affiliates increases the productivity necessary for FDI to be more profitable than exporting. Their empirical results, using Japanese firm level data, generally confirm their theoretical predictions, though based on their empirical tests, the most productive Japanese manufacturing firms are those that sell abroad through both exporting and foreign affiliates.

Outsourcing versus FDI

As globalization progresses, firms increasingly fragment their producing processes. Rather than carrying out all processes in the home country, some firms transfer intermediate processes to affiliates in low-wage country and then either ship their products back home or sell them in a third country. Other firms, in contrast, contract out production processes or the production of some parts to independent firms.

Helpman and Grossman (2002) demonstrated that the mode a firm chooses – FDI or outsourcing – depends on the firm's productivity. Focusing on the contracts a parent firm (the principal) enters with its employees and independent firms, their model shows a number of things.

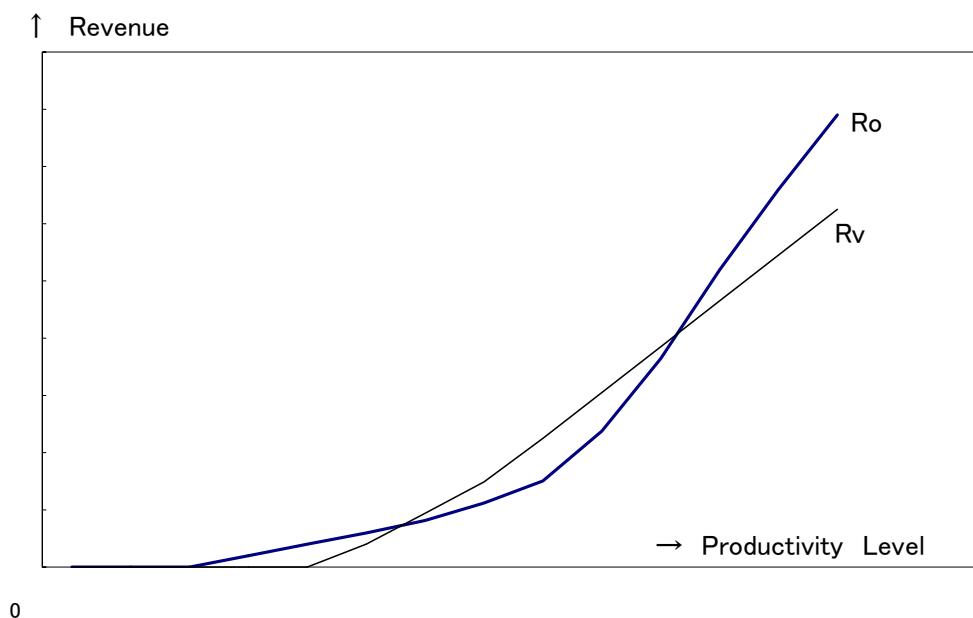
Figure 1 Exporting versus Vertical Integration



Source: Head and Ries (2002)

First, the least productive firms in a particular industry would use outsourcing to less developed countries. Such outsourcing arrangements do offer the benefit of lower labor costs; however, a major shortcoming of outsourcing is that firms do not have any direct control over the quality of the final product. Second, the model shows that firms with intermediate productivity set up foreign affiliates; this allows them direct control over the production process and hence product quality, but incurs monitoring costs of local managers. Finally, the most productive firms outsource some parts of production process to independent firms in order to avoid the costs of monitoring managers.

Figure 2 Outsourcing versus Vertical Integration



Source: Helpman and Grossman (2002)

Figure 2 depicts this comparison for different levels of revenue productivity levels. R_o shows the revenue from outsourcing and R_v shows the revenue from vertical integration, including in-house production and FDI. A firm prefers to buy components from an independent supplier when its own productivity is sufficiently high or rather low. However, a firm with an intermediate productivity level will choose vertical integration. The advantage of vertical integration for an intermediate range of productivity levels stems from the opportunity it affords the firm to monitor some of the managers' effort. If all tasks of managers can be monitored and rents of principal is not reduced in the most productive firms, the firm can

achieve revenues that are as high with integration as with outsourcing.

Licensing versus FDI

According to the transaction-cost model of multinational enterprises, one reason behind the existence of MNEs is the possession of intangible assets. A firm that possesses intangible assets and would like to capitalize on these beyond its home market can do so by using various alternative channels. One such channel is to establish a foreign affiliate, another to license production to an established firm in the foreign country. A firm may prefer to use licensing agreements rather than FDI for a number of possible reasons. These include, for example, a lack of sufficient skill or capital to set up an affiliate, or investment barriers in the target country. When the intangible asset is a particular technology, the nature of this technology is likely to play an important part in this decision. Thus, if the technology is not difficult to teach to a foreign firm, then licensing may be the preferred option, which has the advantage of a very short ramp-up time. However, if the technology involved is a core or leading-edge technology, then licensing carries the danger of a leakage of the technology to a competitor and the firm is likely to prefer establishing its own affiliate.

3 Data Sources and TFP Measurement

Description of Data Sources and Variables

The purpose of this chapter is to investigate the relationship between firms' productivity level and the type of international activity – exporting, FDI, outsourcing or licensing – they engage in. To this end, a

firm-level panel data set is constructed based on the *Kigyo Katsudo Kihon Chosa* (Basic Survey of Business Activity) – a survey covering firms with more than fifty employees.

TFP Measurement

The discussion now turns to the measurement of TFP that will be used to analyze the international activities of heterogeneous firms. In this context, the work by Caves, Christensen, and Diewert (1982) and by Good, Nadiri, and Sickles (1997) serves as a useful point of departure to devise a way of measuring the relative productivity of firms. Caves et al. introduce the concept of a multilateral productivity index, which is calculated as follows: subtract average output of the industry, the factor of production of each firm, and the average factor of the industry from the output of each firm. The industry average factor which is multiplied by the average cost share of the industry is subtracted from each firm's factor of production multiplied by each firm's cost share. This index is very useful when the object is to compare the productivity of more than two firms at a particular point in time. However, it is inappropriate in a dynamic context, i.e., when allowing for the passage of time and the entry and exit of firms, which lead to changes in the number of observations, in average productivity within the industry, and in the productivity of individual firms. Good, Nadiri, and Sickles (1997) overcome this problem by using a Divisia Index, which reflects changes in the distribution of productivity and changes in the productivity of the representative firm as time passes. Because this paper deals with a longitudinal panel data set, TFP measurement based on Good et al.'s approach is appropriate.

Following this example, the TFP level of a firm here is calculated as the difference with the

representative firm within the same industry. Thus, the TFP level (in logarithmic form) of firm f at time t is defined as follows:

$$\begin{aligned} \ln TFP_{ft} = & (\ln Y_{ft} - \overline{\ln Y_t}) + \sum_{s=2}^t (\overline{\ln Y_s} - \overline{\ln Y_{s-1}}) \\ & - \left[\sum_{i=1}^n 1/2 (S_{ift} + \overline{S_{it}}) (\ln X_{ift} - \overline{\ln X_{it}}) \right. \\ & \left. + \sum_{s=2}^t \sum_{i=1}^n 1/2 (S_{is} + \overline{S_{is-1}}) (\overline{\ln X_{is}} - \overline{\ln X_{is-1}}) \right] \end{aligned} \quad (1)$$

where Y_{ft} is the output of firm f at time t , we use sales from data set, X_{ift} is factor input i , S_{ift} is the cost share of factor i in total costs. The overbar indicates industry averages. The TFP level of each firm is calculated using equation (1) which considers not only the relative TFP level compared with a representative firm at time t in the same industry but also changes in the productivity distribution as time passes. We use the 3-digit industry classifications of the *Kigyō Katsudō Kihon Chōsa*.

The following variables are used to calculate TFP. Output obtained from the *Kigyō Katsudō Kihon Chōsa*, while deflators by industry is obtained by dividing nominal output with real output using the IO Tables of the Management and Coordination Agency. Capital stock is estimated as follows. First, plant and equipment investment (excluding expenses for land and buildings) at the 3-digit-level, obtained from *Census of Manufactures* published by the Ministry of Economy, Trade and Industry, is divided by the SNA deflator and accumulated by the perpetual inventory method. Next, we calculate the real market price/nominal book value ratio, which is the real capital stock divided by nominal tangible fixed assets (book value, end of year) obtained from the *Census of Manufactures*.

We use tangible fixed assets from the *Kigyo Katsudo Kihon Chosa* as the real capital stock of each firm, which is multiplied by this preceding real market price/nominal book value ratio. To adjust for the utilization rate, we use the utilization ratio from Fukao and Murakami (2000). Cost shares are calculated using capital service price data by industry from the JIP database.

Costs for materials are calculated as total operating costs minus other expenses such as rent, wages, depreciation and taxes, while material costs at constant prices are obtained in the same way as in the calculation for output above. In order to calculate productivity precisely, we exclude raw material, energy and other costs from output. The amount of raw materials and energy used reflects firms' utilization ratio which is determined by the demand conditions firms face.

Constant labor input is calculated by multiplying the number of employees by the labor hour index of the SNA divided by 100. Both 0.1% tails of the distribution of output, capital stock, employee, payment, and material are deleted as outliers.

4 *Empirical Tests*

In order to examine the hypothesis that firms engaged in overseas production are more productive, the observations in the data set are classified into the following groups: (1) firms which do not sell abroad either through exports or FDI (but might possibly use either outsourcing or licensing) (2) firms which serve foreign markets through both exports and FDI; (3) firms which serve foreign markets only through FDI; and (4) firms which serve foreign markets only through exports.

Firms are grouped into these four categories according to whether the data base indicates the

presence of export sales (i.e. where these are not zero) and/or employees at foreign affiliates (i.e. where these are given and hence not zero).

In this paper, the terms FDI and foreign affiliates refer to establishments for the purpose of overseas production only. Foreign affiliates that only serve as overseas sales offices are excluded.

Similarly, to examine whether firms that outsource production are more productive than firms that have established their own production facilities overseas, firms are divided into the following four groups: (1) firms which are neither engaged in outsourcing nor FDI; (2) firms which serve foreign markets through both outsourcing and FDI; (3) firms which serve overseas markets only through FDI; and (4) firms which serve overseas markets only through outsourcing. Firms that are not engaged in outsourcing are those whose outsourcing value is zero, while firms not engaged in overseas production are those whose number of employees at foreign affiliates is zero.

To examine whether firms that rely on licensing are more productive, the same method is used. In order to examine the various hypotheses discussed above, a sub-sample of each group is created for each hypothesis and the average productivity is compared with the sub-samples.

Exporting versus FDI

At first, the productivity of exporting firms is compared with that of firms which serve foreign countries through foreign affiliates.

Table 3 Summary Statistics

Variables	Observation:	Mean	Standard deviation	Minimum	Maximum
TFP level	68369	-0.0062	0.1982	-3.7173	2.2991
log(FDI/Export) ¹	68369	-2.9237	2.2622	-15.8342	7.2894
log(FDI/Outsourcing) ¹	68369	-3.4908	1.9695	-16.6319	6.3533
log(FDI/Licensing) ¹	68369	-3.3225	1.8140	-11.7817	6.2146
log(FDI/Export) ²	62930	-2.9736	2.2869	-15.9103	7.1687
log(FDI/Outsourcing) ²	67241	-3.4972	1.9685	-16.6640	6.3063
log(FDI/Licensing) ²	67571	-3.3268	1.7990	-11.8096	6.2114

Notes:

1) The variable *includes* firms serving overseas markets through both foreign affiliates and other channels such as export, outsourcing or licensing.

(2) The variable *excludes* firms serving overseas markets through both foreign affiliates and other channels such as export, outsourcing or licensing.

1) and 2) are measured as deviations from the industry averages.

Table 4a Exports versus FDI: Tests Based on Pooled Panel Data from 1994 to 1998

[Comparison of TFP Level]	observation	mean	standard deviation
Firms which do not serve foreign markets	49774	-0.021	0.202
Firms which serve foreign markets through exports	11874	0.032 ***	0.187
Firms which do not serve foreign markets	49774	-0.021	0.202
Firms which serve foreign markets through foreign affiliates	1506	0.004 ***	0.189
Firms which serve foreign markets through exports	11874	0.032 ***	0.187
Firms which serve foreign markets through foreign affiliates	1506	0.004	0.189
Firms which serve foreign markets through foreign affiliates	1506	0.004	0.189
Firms which serve foreign markets through both exports and foreign affiliates	5445	0.043 ***	0.164
Firms which serve foreign markets through exports	11874	0.032	0.187
Firms which serve foreign markets through both exports and foreign affiliates	5445	0.043 ***	0.164

Note: Exporting firms here are defined as firms whose exporting sales are greater than zero and the number of employees of foreign affiliates is zero. Firms serving foreign markets through foreign affiliates are defined here as firms whose number of employees of foreign affiliates is greater than zero and export sales are zero. Firms, serving foreign markets through both export and FDI, are defined as those whose export sale and number of employees are greater than zero.

Table 3 shows summary statistics of the variables that are used in the empirical tests in this chapter. In the underlying statistics, exports are defined as merchandise that pass customs under the name of the exporting firm, including sales to overseas affiliates and related companies. Since the export sales data in the underlying statistics include export sales to foreign affiliates, we adjusted the value of export sales by using the ratio of export sales to foreign affiliates over total exporting sales. The ratio was obtained from the *Basic Survey of Overseas Activities (Kaigai Jigyo Katsudo Kihon Chosa)*. Table 4a summarises the findings of the test. The table shows that firms that do not serve foreign markets through exports or FDI display a lower productivity than firms that do serve foreign markets either through exports or FDI. Comparing firms that only export with those that only engage in overseas production, the productivity of the former is higher. Moreover, comparing firms that only engage in FDI with those that both export and engage in FDI, the productivity of the latter is higher. Similarly, firms that both export and engage in FDI enjoy a higher productivity than firms that only export.

These findings contradict the predictions of the theory developed by Head and Ries (2002). Head and Ries (2002) predicted that firms selling only to the domestic markets would be the least productive, followed by those engaged in exports and then those relying on both exports and FDI, while firms which serve foreign markets only through FDI would be the most productive. But the ranking implied by the results here – from least to most productive – is as follows: (1) firms which only sell to the domestic market; (2) firms which rely only on FDI; (3) firms which only export; and (4) firm which rely on both exports and FDI.

The finding that the productivity of firms which serve foreign markets through FDI is lower than that

of exporting firms differs from in the findings of Head and Ries's (2002) for Japanese firms and Helpman, Melitz and Yeaple's (2003) results for American firms. A possible explanations for this difference is that the data used here cover all Japanese firms with more than 50 workers, while Head and Ries (2002) used data covering only large, listed companies. When we divided the firms in our database into two groups – smaller firms with less than 300 workers and larger firms – and then conduct our average test, we obtain the same conclusion that exporting firms are more productive. This result is shown in Table 4b. However, this table suggests that the firms with a greater number of workers are more productive. Given that Head and Ries (2002) use data of about a thousand firms of the listed companies, their results indicating that firms serving overseas markets through foreign affiliates are more productive, might simply be a reflection of firm size.

Table 3-4b Exports versus FDI: TFP of Smaller Firms and Larger Firms	observations	mean		standard deviation
Smaller firms which serve foreign markets through exports	11874	0.023	***	0.192
Smaller firms which serve foreign markets through foreign affiliates	1506	-0.018		0.191
Larger firms which serve foreign markets through exports	4002	0.050	***	0.176
Larger firms which serve foreign markets through foreign affiliates	732	0.027		0.184

Outsourcing versus FDI

Next, we compare the productivity of the firms which transfer production facilities abroad and that of firms which outsource to foreign countries. The results are summarized in Table 4c.

Table 4c Outsourcing versus Foreign Affiliates: Tests Based of Pooled Panel Data from 1994 to 1998

[Comparison of TFP Level]	observator	mean		standard deviation
Firms which do not serve foreign markets	59943	-0.012		0.201
Firms which serve foreign markets through foreign affiliates	5593	0.028	***	0.174
Firms which do not serve foreign markets	59943	-0.012		0.201
Firms which serve foreign markets through outsourcing	1705	0.045	***	0.173
Firms which serve foreign markets through outsourcing	1705	0.045	***	0.173
Firms which serve foreign markets through foreign affiliates	5593	0.028		0.174
Firms which serve foreign markets through both outsourcing and foreign affiliates	1358	0.060	***	0.155
Firms which serve foreign markets through foreign affiliates	5593	0.028		0.174
Firms which serve foreign markets through both outsourcing and foreign affiliates	1358	0.060	***	0.155
Firms which serve foreign markets through outsourcing	1705	0.045		0.173

Note: Outsourcing firms here are defined as firms whose payments for outsourcing are greater than zero and the number employees of foreign affiliates is zero. Firms serving foreign markets through foreign affiliates are defined as firms whose number of employees of foreign affiliates is greater than zero and payments for outsourcing are zero. Firms serving foreign markets though both outsourcing and FDI are defined as firms whose payments for outsourcing and number of employees of foreign affiliates are greater than zero.

Looking at firms that neither outsource nor engage in FDI, we find that their productivity is lower than that of firms that engage in one of the two international activities. Comparing firms that engage in one of the two activities shows that those that outsource are more productive than those that rely on foreign affiliates. Finally, firms that serve foreign markets through both outsourcing and FDI display a higher productivity than firms that rely on only one of these two international activities.

Again, we compare these results with the theoretical predictions. Helpman and Grossman (2002) predict the following ranking in terms of firms' productivity (in ascending order of productivity): (1) outsourcing firms; (2) firms using foreign affiliates; (3) domestic firms; (4) outsourcing firms. However, the productivity ranking result obtained in this paper is: (1) domestic firms; (2) firms engaged in FDI; (3)

outsourcing firms; (4) firms serving foreign markets through both channels. One reason, why in the case of Japanese manufacturing industries, outsourcing firms are more productive might be that the number of outsourcing firms is high in technology-intensive industries, such as the general and electrical machinery industries.

Licensing versus FDI

Next, we compare the productivity of licensing firms and that of firms serving foreign markets through FDI. The results are summarized in Table 4d. As licensing payments in the statistics include those from foreign affiliates, we adjusted such payments by using the ratio of licensing payments from foreign affiliates over the licensing payments by industry. This ratio is obtained from the Statistics Bureau, Director-General for Policy Planning (Statistical Standards), Statistical Research and Training Institute (1999).

Table 4d Licensing versus Foreign Affiliates: Tests Based of Pooled Panel Data from 1994 to 1998.

[Comparison of TFP level]	observator	mean		standard deviation
Firms which do not serve foreign markets	61147	-0.011		0.201
Firms which serve foreign markets through licensing	501	0.052	***	0.166
Firms which do not serve foreign markets	61147	-0.011		0.201
Firms which serve foreign markets through foreign affiliates	6153	0.031	***	0.174
Firms which serve foreign markets through licensing	501	0.052	***	0.166
Firms which serve foreign markets through foreign affiliates	6153	0.031		0.174
Firms which serve foreign markets through both licensing and foreign affiliates	798	0.062	***	0.136
Firms which serve foreign markets through foreign affiliates	6153	0.031		0.174
Firms which serve foreign markets through both licensing and foreign affiliates	798	0.062		0.136
Firms which serve foreign markets through licensing	501	0.052		0.166

Note: Licensing firms here are defined as firms whose revenue from licensing is greater than zero and number employees of foreign affiliates is zero. Firms serving foreign markets through foreign affiliates are defined as firms whose number of employees of foreign affiliates is greater than zero and revenue from licensing is zero. Firms serving foreign markets though both licensing and FDI are defined as firms whose revenue from licensing and number of employees of foreign affiliates are greater than zero.

In line with the findings in the previous subsections, it is found that firms that neither license nor engage in FDI display a lower productivity than those firms that engage in one of these international activities. Comparing firms that engage either in licensing or in FDI, the productivity of the former is higher. And again, firms that engage in both activities display greater productivity than firms that engage in only one of the two.

Contrary to what the literature would lead one to expect, the productivity ranking found here is as follows (in ascending order of productivity): (1) firms serving only the domestic market; (2) firms serving overseas markets only through FDI; (3) firms serving overseas markets only through licensing; and (4)

firms serving overseas markets through both channels.

The reason for this finding is the prevalence of cross-licensing. The National Institute of Science Technology Policy (2003) provides details on the technology exports of Japanese manufacturing firms. According to this survey, one-third of firms exporting new technology hail from the electrical machinery industry, which is very technology-intensive, and 25% of their licensing contracts take the form of cross-licensing. Nagaoka and Kwon (2003) suggest that listed companies in Japan predominantly cross-license with firms from developed rather than developing countries, i.e. firms that can offer assets of a similar technologically advanced stage. This situation may explain our result that firms relying on licensing are more productive, which contradicts the theory of internalization advantages.

5 *Regression Analysis*

These average tests do not consider potential inter-industry differences. Therefore, we next conduct a regression analysis including industry dummy variables to examine the hypothesis that the productivity of firms determines their channel of internationalization. The result is shown in Table 5. The first regression analysis shown in Table 5a *includes* firms which serve overseas markets simultaneously through both foreign affiliates and other channels. The second regression, shown in Table 5b includes firms that rely either on foreign affiliates or on other channels.

The dependent variable is the ratio of the number of employees in foreign affiliates to firms' exports or outsourcing sales or licensing revenue calculated as the difference from the average ratio in the respective industry. As the *Basic Survey of Business Activity* does not provide data on the sales of foreign

affiliates in every year, we made use of the number of employees in foreign affiliates. Details of the estimation procedure are provided in the appendix. Strictly speaking, the number of workers in foreign affiliates and the amount of sales through other channels as measures of the degree of firms' internationalization are of course not directly comparable. Therefore, in order to minimize this problem, we measure firms' degree of internationalization based on these statistics as the deviation from the average.

The regression analysis supports the average tests above comparing firms that export or engage in FDI. The results show that more productive firms choose exporting rather than overseas production through FDI. The regression analysis including the firm dummy also showed the exporting firms are more productive.

The regression analysis showed that more productive firms choose FDI rather than outsourcing or licensing. These results suggest that in the case of Japanese manufacturing industry, the theory by Helpman and Grossman (2000) is not supported, however, the theory of internalization advantages is supported.

Table 5a Exporting, Foreign Affiliates, Outsourcing, and Licensing Regressed on Productivity

	FDI/Export		FDI/Outsource		FDI/License	
TFP level	-1.0093 *** (-19.51)	-0.2209 *** (-3.52)	0.4866 *** (10.89)	0.0140 (0.25)	0.9221 *** (22.12)	0.0538 (1.29)
_cons	-3.9679 *** (-109.74)	-3.4005 *** (-43.84)	-4.3837 *** (-140.16)	-4.5651 *** (-66.52)	-3.8837 *** (-133.33)	-4.3468 *** (-83.85)
year-dummy	yes	yes	yes	yes	yes	yes
indy-dummy	yes	yes	yes	yes	yes	yes
firm-dummy	no	yes	no	yes	no	yes
obs	68369	68369	68599	68599	68369	68369
adj-R2	0.107	0.0268	0.1177	0.0002	0.0985	0.0824

Note: FDI/Export is calculated as the difference of $\ln((1+\text{employees at the foreign affiliates})/(1+\text{exporting sales}*(1-\text{the ratio of exports to foreign affiliates})))$ of each firm from the industry average. The other dependent variables are calculated as the same method. Firms serving overseas markets both through FDI and exports (or other channels) are included in this regression analysis.

Table 5b Exporting, Foreign Affiliates, Outsourcing, and Licensing Regressed on Productivity

	FDI/Export		FDI/Outsource		FDI/License	
TFP level	-1.0037 *** (-18.76)	-0.1671 *** (-2.96)	0.5400 *** (12.02)	0.0711 (1.43)	0.8456 *** (20.48)	0.0536 (1.34)
_cons	-4.1589 *** (-106.26)	-3.4823 *** (-47.26)	-4.4141 *** (-138.28)	-4.5613 *** (-73.62)	-3.9066 *** (-135.05)	-4.3554 *** (-87.46)
year-dummy	yes	yes	yes	yes	yes	yes
indy-dummy	yes	yes	yes	yes	yes	yes
firm-dummy	no	yes	no	yes	no	yes
obs	62930	62930	67241	67241	67571	67571
adj-R2	0.119	0.0351	0.1197	0.1078	0.1064	0.0921

Note: FDI/Exports is calculated as the difference of $\ln((1+\text{employees at foreign affiliates})/(1+\text{exporting sales}*(1-\text{the ratio of export to foreign affiliates})))$ of each firm from the industry average. The other dependent variables are calculated by the same method. Firms serving overseas markets through both FDI and exports ((or other channels) are excluded in this regression analysis.

6. *Conclusion*

The purpose of this chapter was to investigate whether firm's productivity helps to explain their international activities and to examine empirically the theories developed by Head and Ries (2002), Helpman and Grossman (2002), and others, dealing with firms' decision to serve foreign markets through various modes. According to these theories, more productive firms tend to choose FDI rather than exporting, outsourcing or licensing as their preferred channel because FDI is accompanied with the fixed costs, partly of which are sunk costs, outsourcing is accompanied with risks in the contracts with the supplier, and licensing has possibilities to leak out the technological knowledge.

The results of the investigation can be summarized as follows. The comparison of productivity levels of firms engaged in various international activities shows the following pattern: when exports and FDI are used as the relevant criteria, then we find that firms which engage in both activities display the highest productivity. Among firms that engage in only one of the two, those that export show a higher productivity than those that engage in FDI. Productivity is lowest for those firms that engage in neither of these international activities.

The patterns in the other comparisons were similar to the result on exporting versus FDI. Thus, when examining outsourcing and FDI, those firms that engage in both enjoy the highest productivity, while those that outsource are more productive than those engaged in FDI. Again, those engaged in neither of these activities are the least productive. Similarly, taking licensing and FDI as the criteria, again firms that engage in both are the most productive, while those that engage in neither are the least productive. Among those that engage either in licensing or FDI, the former are more productive.

Finally, the regression analysis to consider inter-industry differences, showed that the firms that choose exporting more productive than those that rely on FDI as same as the result of the average test. However, the regression analysis showed the firms which choose FDI are more productive than the firms which choose outsourcing or licensing was not similar with the average test.

Taken together, exporting firms showed their superiority through all tests against our expectation. The empirical tests using Japanese manufacturers showed the exporting firms are more productive. On the other hands, the empirical tests did not show the consistent results that the firms, which choose FDI, are more productive than the outsourcing or licensing firms.

The empirical analysis using manufacturing firms in this chapter did not show the results which conform with the theory. However, we found that more productive firms in Japan choose various modes to serve foreign markets.

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Appendix

This appendix shows how the number of employees at Japanese foreign affiliates in Asia and other regions was calculated.

The data are based on the micro-data of the *Kigyo Katsudo Kihon Chosa (Basic Survey of Business Activity)*, which provides detailed information on the status of Japanese foreign affiliates, such as the number of employees at foreign affiliates, the name of the host country, and industry classifications. We exclude firms which do not belong to the manufacturing sector and foreign affiliates set up solely for sales.

The number of employees at foreign affiliates is available only up to the survey for 1994. For 1995-1998, only the number of foreign affiliates are available, making it necessary to estimate the number of employees at foreign affiliates for this period. We do so by estimating the number of employees at foreign affiliates each year by referring to the *Kaigai Jigyo Katsudo Kihon Chosa (Basic Survey of Overseas Activities)* of the Ministry of Economy, Trade and Industry, which records the number of employees at foreign affiliates by region and by industry each year. We assume that there are no differences between the *Basic Survey of Business Activity* and the *Basic Survey of Overseas Activities* in the distribution of Japanese firms and their foreign affiliates

By using the *Kaigai Jigyo Katsudo Kihon Chosa (Kai-ji)*, the average number of employees of each foreign affiliate by region each year is calculated. For example, the number of employees at foreign affiliates each year is calculated as follows:

The Number of Employees at Foreign Affiliates of each year

= the Number of Employees at Foreign Affiliates in 1994

* the Number of foreign affiliates each year / the Number of Foreign Affiliates in 1994

* Average Number of Employees at Foreign Affiliates each year (*Kai-ji*)

/ Average Number of Employees at Foreign Affiliates in 1994 (*Kai-ji*)