Entry into Foreign Markets Through Foreign Direct Investment

Toshiyuki Matsuura and Hitoshi Sato

Abstract This chapter investigates patterns of Japanese foreign direct investments (FDIs) using firm-level data on Japanese multinational enterprise (MNE) foreign subsidiaries. First, we present an overview of Japanese FDI and find stylized facts. For example, subsidiary sales and the number of investing countries are related to the scale of operation in Japan. Many foreign subsidiaries are engaged in export to neighboring countries and are categorized as export-platform-type FDI. Second, we present a model that extends the framework of Helpman et al. (Am Econ Rev 94(1):300–316, 2004) and accounts for overseas subsidiaries supplying goods to neighboring countries. Third, based on this model, we estimate the gravity model of MNE foreign subsidiary sales and find that the impact of the subsidiary's distance from the host country on the number of subsidiaries (extensive margin) is very large compared to previous studies that used data from U.S. MNEs. In addition, the estimation models that use market potential instead of host country GDP have a higher explanatory power, suggesting that market potential plays an important role in explaining FDI patterns. In contrast, although the effect of market potential on average subsidiary sales (intensive margin) is significantly positive, its effect on the number of subsidiaries is negative and insignificant.

Keywords FDI • Gravity models • Japanese MNEs • Market potential • Platform-FDI

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1 Introduction

Since the 1990s, foreign direct investment (FDI) flows have been rapidly increasing worldwide, making growth in FDI flows significantly higher than that of exports.[1] As shown in Fig. 1, FDI outflows in Japan also follow a similar trend, suggesting that FDI is the most important mode of globalizing Japanese corporate activities. FDI involves corporate decision making to locate all or part of the production process abroad. It affects not only the trade structure but also the home and host countries' economies. Using data on Japanese foreign subsidiaries, this chapter analyzes Japanese companies' FDI patterns.

Previous studies on FDI categorized FDI according to its motivation, i.e., horizontal FDI, which aims to access the host country market, and vertical FDI, which intends to exploit the international division of labor by utilizing differences in factor endowments. However, in recent years, the analysis was expanded to include two additional points. First, industry-firm heterogeneity recently attracted the attention of many researchers. Because firm-level micro data became available for academic

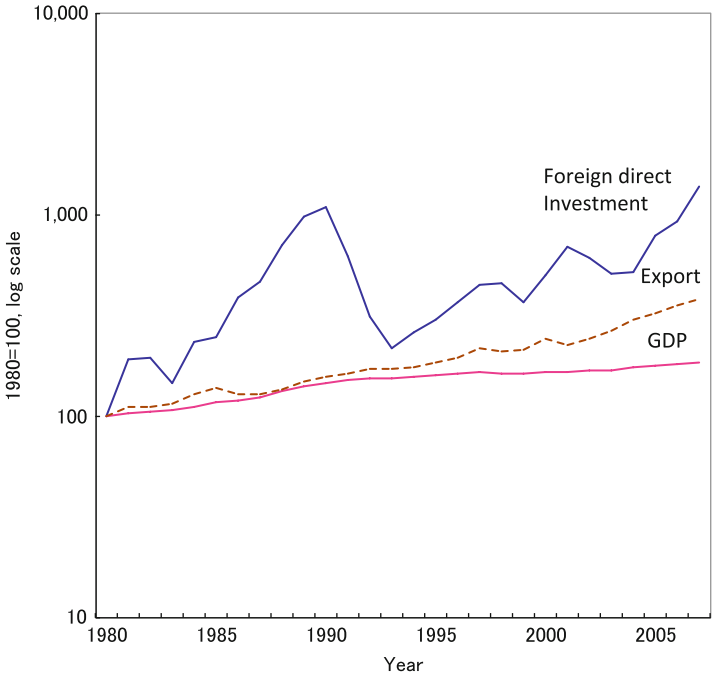

Fig. 1 Trends in Japanese GDP, exports, and FDI outflows. The 1980 values are normalized to 100 and transformed into a logarithmic scale. Source: authors' calculations using UNCTAD data

[1]For example, see Chap. 1 in Navaretti and Venables (2004).

studies, many researchers confirmed a large difference in terms of productivity between multinational enterprises (MNEs) and domestic firms. Inspired by these observations, Helpman et al. (2004) presented a new FDI theory that considers firm heterogeneity in terms of productivity. Empirical analyses supporting the validity of the theory has been increasing, particularly in France and the United States. These studies also considered the effect of globalization on the distribution of firms, which is a new issue in the literature.

The second point is exports to third countries by MNE subsidiaries. In the conventional framework, namely horizontal and vertical FDI, only the host and home countries are assumed to be involved. However, these frameworks ignore the fact that many MNE subsidiaries engage in exporting. For example, MNE subsidiaries in European countries with small markets, such as Ireland, tend to export their products to continental Europe rather than supplying only to host country markets. Similarly, MNE subsidiaries in East Asia are also export-oriented. Ekholm et al. (2007) referred to such FDI as export-platform FDI and presented a theoretical model and examined its empirical validity, using data from the United States.

Thus far, these two points were independently analyzed and not integrated into a single study. Further, most empirical analyses were based on data from the United States or European countries. Previous studies have not used the data from Japanese companies. This chapter uses Japanese firm-level data to present Japanese companies' FDI trends. We then build a framework that integrates these points and checks its empirical validity for Japanese MNE subsidiaries.

The chapter is structured as follows. Section 2 presents an overview of Japanese companies' FDI trends. Section 3 presents a theoretical framework that integrates the aforementioned points. Section 4 introduces the estimation results of the gravity model. Finally, Sect. 5 presents the conclusion and future agenda of this chapter.

2 Overview of Japanese FDI

First, we present an overview of the FDI of Japanese firms. This chapter uses the "Survey of Overseas Business Activity," a firm-level survey conducted by the Research and Statistics Department of the Japanese Ministry of Economy, Trade and Industry.[2] This survey obtains basic information on the activities of Japanese firms' overseas affiliates and includes various items regarding the characteristics of affiliates, such as their year of establishment, breakdowns by sales and purchases, employment, costs, and research and development (R&D).

[2]This survey includes parent companies, which are Japanese corporations that, as of end of March, own or have previously owned overseas subsidiaries, excluding those in the financial and insurance industries or the real estate industry. Overseas subsidiaries are defined as foreign affiliates in which Japanese firms have invested capital of 10 % or more or as foreign firms in which Japanese foreign subsidiaries have invested capital of 50 % or more.

Fact 1: In the 1980s, when Japanese firms began overseas production, their FDI destinations were diversified. However, since 1993, their FDI destinations have become concentrated, probably the result of relocations from Southeast Asia to China.

We use firm-level data from 1995 to 2006 to investigate Japanese firms' overseas production and focus only on foreign subsidiaries that engage in manufacturing. Some Japanese MNEs own more than two affiliates in each host country. In such a case, we consolidate the data from multiple subsidiaries of the same parent company into a single entity.

Table 1 presents the number of investing firms by year and region. The data suggest that major FDI destinations were not constant.[3] In the 1980s, the United States was one of the most popular destinations, with 456 firms investing in the country. As for other popular destinations, 251 and 330 MNEs invested in Asian NIEs and ASEAN 4, respectively.[4] In particular, after the Plaza Accord in 1985, the number of Japanese firms actively investing in the United States increased, with 103 firms investing in the country in 1988. The primary motivation for firms to invest in the United States during this period was to avoid trade conflicts. This type of FDI is a typical example of horizontal FDI.[5]

In the 1990s, China became the most popular destination for Japanese FDI, with 807 firms investing in the country during the period. Following China, 539 and 294 firms invested in ASEAN 4 and the United States, respectively. An examination of annual changes shows that, while FDI in China and ASEAN 4 increased from 1993 to 1995, the number of investing firms subsequently decreased because of the Asian financial crisis. Furthermore, FDI in China markedly increased after 2000, with 530 firms initiating investments in China from 2000 to 2006. This increase was apparent particularly during the period immediately after China became a member of the WTO. From 2002 to 2004, more than 100 firms invested in China each year. In contrast, 124 firms invested in ASEAN 4 from 2000 to 2006.

Figure 2 presents trends in the Herfindahl index (HHI) for the concentration of Japanese FDI destinations in 12 countries and regions. An examination indicates that the HHI reflects a gradual decrease in long-term trends, and the peaks reflect FDI booms in different periods. A peak in 1981 reflects the investment boom after the implementation of voluntary export restrictions on Japanese automobiles shipped to U.S. A peak is observed during 1987–1988, after the rapid appreciation

[3]This table aggregates the number of investing firms by referring to the entry year of foreign affiliates that were active from 1995 to 2006.

[4]Asian NIEs represent South Korea, Taiwan, Hong Kong, and Singapore. ASEAN 4 includes Thailand, Malaysia, Indonesia, and the Philippines.

[5]Blonigen (1997) investigated Japanese FDI in the United States from 1975 to 1992 and demonstrated that an appreciation of the yen accelerated Japanese FDI. He found that industries with a higher R&D intensity have been investing extensively since the appreciation of the yen enabled Japanese firms to acquire managerial resources through mergers and acquisitions or capital participation with U.S. firms.

Table 1 The number of Japanese firms setting up foreign subsidiaries by region and year

Year	North America	U.S.	Canada	Central & South America	ASEAN4	NIEs	China	Other Asia	Middle East	Europe	OECD Europe	Rest of Europe	Oceania	Africa
1980	25	23	2	3	10	21	0	0	2	12	12	0	3	1
1981	29	28	1	4	5	17	1	1	1	7	7	0	0	0
1982	19	18	1	5	6	17	0	4	0	10	10	0	3	0
1983	20	17	3	4	11	15	1	3	0	15	15	0	0	1
1984	34	34	0	5	11	24	4	2	1	12	12	0	3	0
1985	34	31	3	1	8	16	15	8	0	17	17	0	2	0
1986	71	62	9	6	22	52	11	4	2	16	16	0	0	0
1987	85	80	5	5	54	84	13	1	1	25	24	1	3	0
1988	107	103	4	8	96	59	28	3	0	29	28	1	3	2
1989	71	60	11	2	107	46	20	4	0	47	47	0	5	1
1990	61	53	8	5	83	40	40	8	0	49	48	1	7	0
1991	37	33	4	7	43	32	50	3	1	30	28	2	5	0
1992	18	12	6	4	29	20	73	4	1	22	20	2	6	0
1993	20	17	3	4	29	30	116	4	0	20	19	1	4	2
1994	28	27	1	6	81	39	176	8	0	19	18	1	4	0
1995	47	42	5	7	92	37	211	25	2	25	25	0	3	3
1996	54	47	7	8	91	36	57	36	2	17	16	1	2	6
1997	34	31	3	10	62	16	42	26	0	21	19	2	1	1
1998	19	18	1	5	17	17	22	10	1	13	12	1	3	2
1999	17	14	3	3	12	18	20	15	1	17	17	0	0	1
2000	15	14	1	4	22	19	41	5	0	15	13	2	1	2
2001	15	15	0	6	31	29	84	6	0	19	17	2	0	1
2002	20	18	2	4	20	27	125	11	0	13	12	1	1	0

(continued)

Table 1 (continued)

Year	North America	U.S.	Canada	Central & South America	ASEAN4	NIEs	China	Other Asia	Middle East	Europe	OECD Europe	Rest of Europe	Oceania	Africa
2003	10	9	1	2	19	13	107	10	0	9	8	1	1	1
2004	10	9	1	0	11	17	109	12	0	15	15	0	2	0
2005	12	10	2	0	14	4	51	16	1	9	8	1	2	2
2006	6	4	2	5	7	7	13	14	0	10	6	4	1	1
1980s	495	456	39	43	330	351	93	30	7	190	188	2	22	5
1990s	335	294	41	59	539	285	807	139	8	233	222	11	35	15
After 2000	88	79	9	21	124	116	530	74	1	90	79	11	8	7

Notes: Authors' calculation of the "Survey of Overseas Business Activities" (Ministry of Economy, Trade and Industry of Japan). All industries except for the financial, insurance, and real estate industries are covered. The table figures are counted as one when a firm invests in a certain region in a certain year, allowing the same firm to be counted multiple times. United States and Canada are subcategories of North America. ASEAN4 represents Thailand, Malaysia, Indonesia, and the Philippines. NIEs include Korea, Taiwan, Hong Kong, and Singapore. Europe includes not only EU countries but also non-EU countries such as Central and Eastern European and CIS countries. OECD Europe and the rest of Europe are the subcategories of Europe

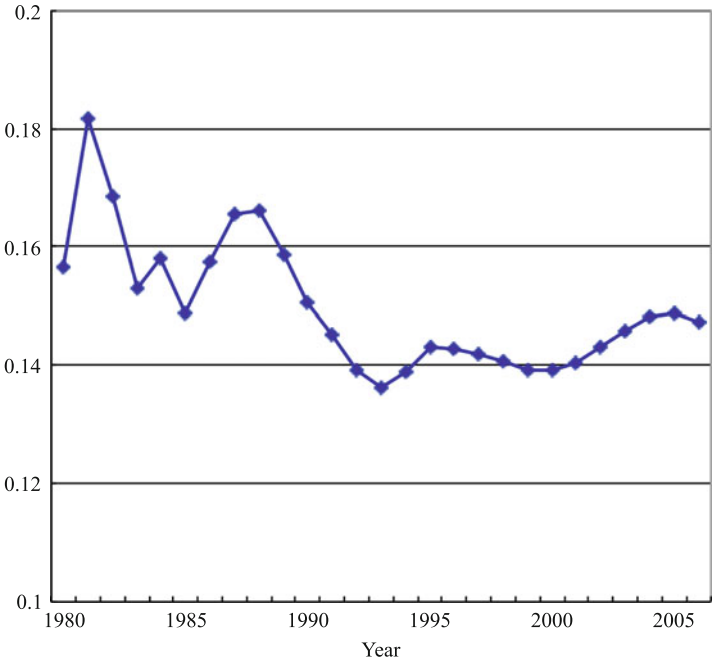

Fig. 2 HHI for FDI destinations. Source: Authors' calculations from the "Survey of Overseas Business Activities" (Ministry of Economy, Trade and Industry of Japan)

of the yen following the Plaza Accord, reflecting a surge in investments in NIES countries and the United States. However, U.S. share as an investment destination gradually declined, whereas that of ASEAN 4 increased. As a result, the concentration in FDI destinations declined. The increase in the HHI during 1993–1995 and 2001–2005 reflects the surge in investments in China. However, after the 1990s, the degree of concentration stabilized and FDI destinations were dispersed worldwide. Next, the distribution of Japanese MNEs is further examined.

Fact 2: A large difference exists in the number of destination countries among Japanese MNEs. Only a few MNEs invest in multiple countries.

First, we investigate the distribution of the number of FDI destination countries. Table 2 provides basic statistics on the number of destination countries per MNE. The maximum number of FDI destination countries per Japanese MNE varied greatly each year, ranging from 25 to 30 countries. In contrast, the average number is two to three, suggesting that the distribution of FDI destination countries is a right-heavy tailed distribution.

An examination of a time-series variation reveals that the average number of FDI destination countries gradually increased from 1.2 in 1985 to 2.9 in 2005. Furthermore, the maximum number of destination countries has increased from 24

Table 2 Basic statistics for the number of invested countries per firm

Year	Mean	S.D.	Min	Max
1985	1.159	2.134	1	24
1990	2.088	2.804	1	25
1995	2.891	3.350	1	28
2000	3.386	3.863	1	31
2005	2.895	3.329	1	38

Notes: Authors' calculation based on the "Survey of Overseas Business Activities" (Ministry of Economy, Trade and Industry of Japan). Foreign subsidiaries are restricted for manufacturing plants

in 1985 to 38 in 2005, reflecting the fact that Japanese MNEs have aggressively invested in multiple countries during these two decades. However, a comparison of basic statistics from 2000 to 2005 indicates that although the maximum number of destination countries increased, the average number of destination countries decreased from 3.4 to 2.9, implying an increase in the dispersion of destination countries.

Fact 3: Countries with small market size have a small number of MNE affiliates.

Figure 3 plots the number of Japanese MNEs and the sizes of the destination markets in terms of GDP in 2000.[6] The most popular destination was the United States, in which 543 Japanese MNEs invested. China was second, with 474 companies doing business in the country. The chart also suggests that only a few firms are able to penetrate markets using FDI in countries with a small market size.

Fact 4: Among MNEs, firms investing in popular destination countries are relatively small, in terms of both sales and employment in the home country.

As confirmed in Fig. 3, some countries attract several Japanese MNE subsidiaries whereas others have very little FDI. What types of firms invest in popular destinations? In other words, are there differences between the characteristics of firms investing in countries with relatively little FDI and other MNEs? The y-axis in Fig. 4 depicts the average parent firm size of Japanese firms investing in the *n*th most popular market, with *n* indicated on the x-axis. Market popularity is measured as the rank in terms of the number of Japanese MNEs investing in the destination country. Panels a and b use sales and employment in Japan, respectively, as indicators of parent firm size, revealing a negative correlation between the destination country's popularity and parent firm size.

[6]We obtained GDP from the World Development Indicator (the World Bank).

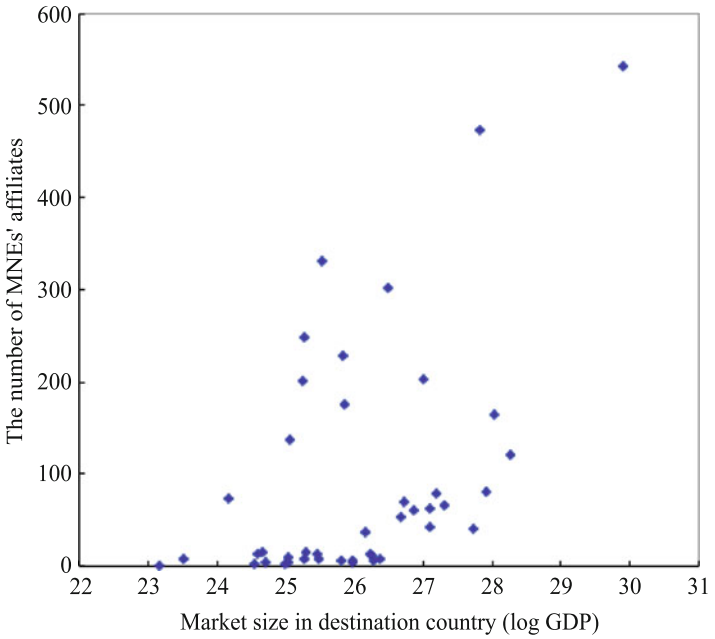

Fig. 3 Number of Japanese MNE affiliates vs. destination market size. Sources: "Survey of Overseas Business Activities" (Ministry of Economy, Trade and Industry of Japan) and the World Development Indicators

Fact 5: Firms investing in multiple countries have larger sales in the home country.

Next, we investigate parent firm size according to the number of investing countries. As Table 2 confirms, the average number of destination countries was 3.39 and the maximum number was 31 in 2000. The y-axis in Fig. 5 depicts the average parent firm size in Japan of firms that invest in at least k markets, with k presented on the x-axis. As Fig. 4, we use sales (Panel a) and employment (Panel b) in Japan as indicators of parent firm size. Both charts indicate that the number of investing countries has a positive correlation with parent firm size, suggesting that larger domestic firms tend to invest in multiple countries.

Fact 6: Most MNE subsidiaries in Asia are categorized as export-platform type subsidiaries.

Finally, we examine the export intensity of foreign subsidiaries.[7] We refer to foreign subsidiaries with higher than average export intensity as export-platform

[7]In this table, for foreign subsidiaries in Europe, sales within European markets are regarded as domestic sales.

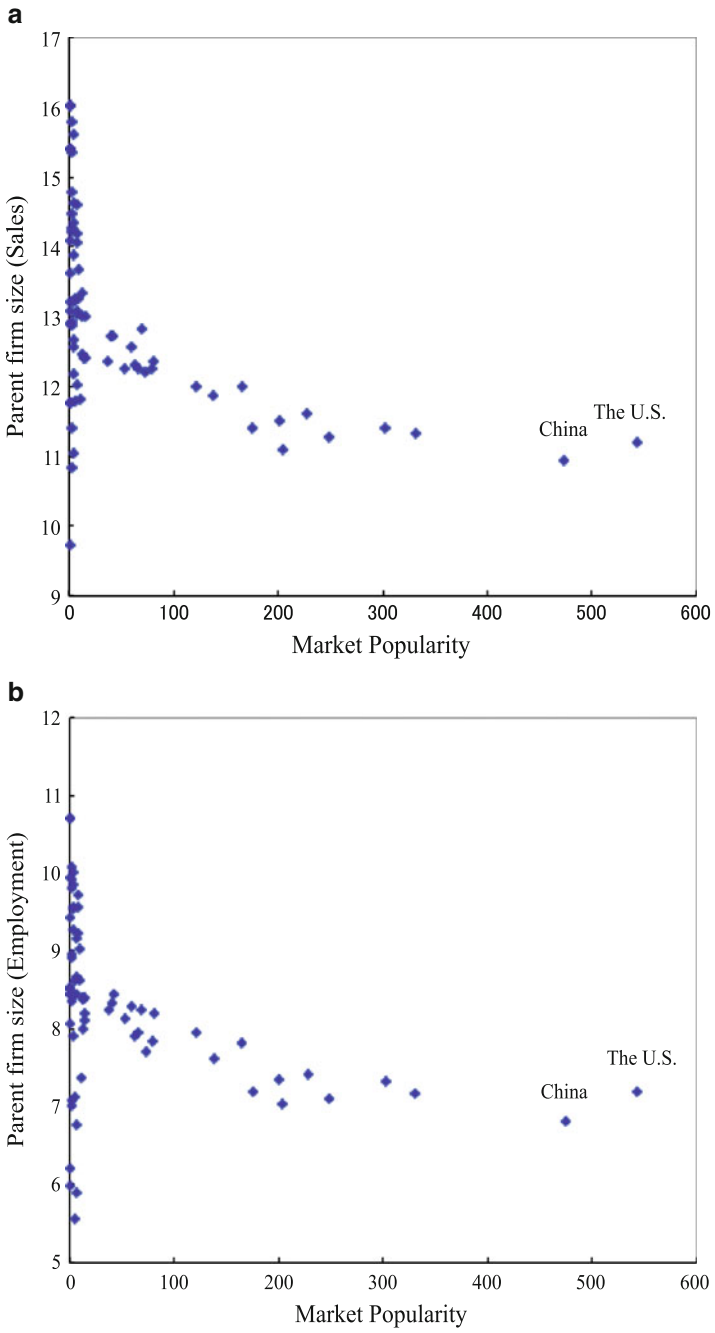

Fig. 4 Destination popularity vs. parent firm size. Panels a and b use sales and employment in Japan, respectively, as indicators of parent firm size. Source: "Survey of Overseas Business Activities" (Ministry of Economy, Trade and Industry of Japan)

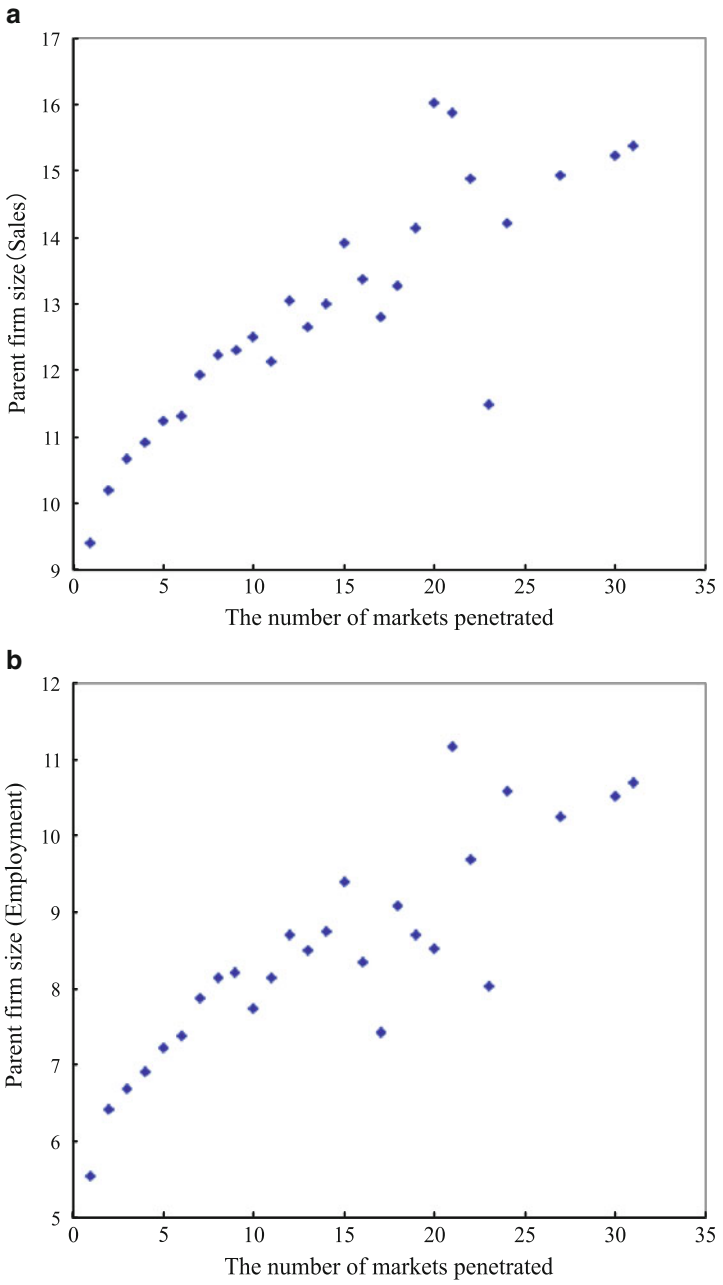

Fig. 5 Number of markets penetrated vs. parent firm size. Panels a and b use sales and employment in Japan, respectively, as indicators of parent firm size. Source: "Survey of Overseas Business Activities" (Ministry of Economy, Trade and Industry of Japan)

Table 3 Share of export-platform type subsidiaries

Industries	North America	Europe	Asia	Total
Textiles	0.15	0.10	0.59	0.43
Chemicals	0.29	0.34	0.46	0.48
Machinery	0.23	0.29	0.54	0.29
Electrical machinery	0.18	0.17	0.51	0.27
Telecommunication equipment	0.27	0.23	0.58	0.20
Transport equipment	0.23	0.22	0.39	0.46
Precision instruments	0.30	0.33	0.65	0.17
Manufacturing n.e.c.	0.27	0.25	0.48	0.50

Notes: Authors' calculation based on the "Survey of Overseas Business Activities" (Ministry of Economy, Trade and Industry of Japan). Export-platform type subsidiaries are defined as those that export ratio is above industry average

type foreign subsidiaries. Table 3 indicates the ratio of this type of subsidiary by region and industry, which reveals large regional differences in this ratio. Notably, 40 % of foreign subsidiaries in Asia are categorized as export-platform type subsidiaries across all industries. In addition, even in North America (the United States and Canada), approximately 30 % of the subsidiaries in chemical, information communication equipment, and precision machinery manufacturing industries are categorized as export-platform type subsidiaries. This statistic may imply that the location choice for MNEs depends on the attractiveness of a host country as an export platform.

3 Theoretical Framework

This section presents a theoretical FDI framework in order to obtain a sense of empirical predictions. The model incorporates two characteristics of FDI—heterogenous firms and export-platform FDI—that are now broadly observed as important to understanding MNEs. The model follows a standard horizontal FDI model presented by Helpman et al. (2004) in which firms varying in productivity may choose either export or FDI to serve foreign markets. We extend the model to a multiple country setting that allows firms to export to third countries from their foreign subsidiaries as per Head and Mayer (2004) and Lai and Zhu (2006).[8]

Consider the world economy composed of N countries. All countries share the same preferences over differentiated varieties of goods. The representative consumer in country i maximizes the following Dixit and Stiglitz (1977) type utility function:

[8]Head and Mayer (2004) and Lai and Zhu (2006) considered MNEs that choose the location of production sites. However, MNEs are homogenous in their settings.

$$U_i = \left[\sum_{j=1}^{N} \int_0^{n_j} q_{ij}(z)^{(\sigma-1)/\sigma} dz \right]^{\sigma/(\sigma-1)} \tag{1}$$

where $q_{ij}(z)$ represents consumption of variety z supplied from country j to country i, n_j represents the number of the varieties supplied by country j, and $\sigma > 1$ represents a single elasticity of substitution between varieties. This utility function leads to the following iso-elastic demand for good z:

$$q_{ij}(z) = \frac{p_{ij}(z)^{-\sigma} E_i}{\sum_{j'=1}^{N} \int_0^{n_{j'}} p_{ij'}(z')^{1-\sigma} dz'}, \tag{2}$$

where $p_{ij}(z)$ denotes the price of variety z supplied from country h to country i and E_i is the total expenditure of country i.

Because the production of differentiated goods involves a fixed cost, each firm specializes in a different variety of goods. Profit-maximizing firms in country j perceive the demand function with constant elasticity σ and set prices at a constant markup over the marginal cost $c_j(z)$:

$$p_{ij}(z) = \frac{\sigma}{\sigma - 1} d_{ij} \tau_{ij} c_j(z), \tag{3}$$

where $d_{ij} \geq 1$ represents the iceberg type transportation cost for delivering from country j to country i and $\tau_{ij} \geq 1$ represents ad valorem tariffs imposed by country i on the goods from country z. Transportation costs and tariffs for domestically supplied goods do not exist, i.e., $d_{ii} = 1$ and $\tau_{ii} = 1$ for all i.

Substituting the price in (3) into (2), we express the demand for each variety such that:

$$q_{ij}(z) = \frac{\sigma - 1}{\sigma} \left(d_{ij} \tau_{ij} c_j(z) \right)^{-\sigma} P_i^{\sigma-1} E_i, \tag{4}$$

where $P_i \equiv \left[\sum_{j'=1}^{N} \int_0^{n_{j'}} \left(d_{ij'} \tau_{ij'} c_{j'}(z') \right)^{1-\sigma} dz' \right]^{1/(1-\sigma)}$ represents the price index.

Consider firms in country j that may choose export or FDI to supply goods to country i. Following Melitz (2003) and Helpman et al. (2004), firms in country j must incur an additional fixed cost f_{ij}^X to export to country i. This fixed cost can be interpreted as an investment for developing sales networks and/or modifying product designs according to country i's product standards. Denoting the marginal cost of firms in country j by $c_j(z) = c_j/\varphi$, where c_j is common across all firms in country j and φ represents each firm's productivity, each firm in country j earns the following export profits by exporting to country i:

$$\pi_{ij}^X(\varphi) = B_i \left[\frac{d_{ij} \tau_{ij} c_j}{\varphi} \right]^{1-\sigma} - f_{ij}^X, \tag{5}$$

where $B_i \equiv P_i^{\sigma-1}E_i/\sigma$ is country i's market size. B_i is exogenously given for each firm in a monopolistic competition. Firms in country j can export to country i as long as π_{ij}^X are nonnegative.

We now turn to FDI. In particular, firms are allowed to engage in export-platform FDI: namely, firms in country j can supply goods to country i through FDI in country i and to third countries by exporting from the subsidiaries in country i. As the previous section showed, export-platform FDI is broadly observed among Japanese firms. Suppose that a firm from country j sets up a subsidiary in country i and serves both country i's market and county k's market. Assuming that the fixed entry cost for country k's market occurs in country j, the profits earned from country k's market are given by

$$\pi_{ki}^X(\varphi) = B_k\left[\frac{d_{ki}\tau_{ki}c_i}{\varphi}\right]^{1-\sigma} - f_{kj}^X. \tag{6}$$

If $\pi_{ki}^X \geq \pi_{kj}^X$ holds, then the firm chooses to export from the subsidiary in country i instead of directly exporting from country j to serve country k's market. Let a set of country k and country i such that $\pi_{ki}^X \geq \pi_{kj}^X$ holds be denoted by Ω_i. In other worlds, Ω_i represents a set of countries that the firm serves using the subsidiary set up in country i (thus, countries belonging to Ω_i depend on the firm's productivity).

Similar to exports, FDI requires additional fixed costs. Let the fixed cost that firms in country j must incur for establishing a subsidiary in country i be f_{ij}^I, which is assumed to be greater than the initial fixed cost for exports, f_{ij}^X. Total profits for the firm in country j that sets up a production site in country i and serves not only country i but also all countries in Ω_i are given by

$$\Pi_{ij}^I = \left[\frac{c_i}{\varphi}\right]^{1-\sigma}\sum_{k\in\Omega_i} B_k(d_{ki}\tau_{ki})^{1-\sigma} - f_{ij}^I - \sum_{k\neq i,k\in\Omega_i} f_{kj}^X. \tag{7}$$

Alternatively, when the firm serves all of these markets through exports, total profits are expressed by

$$\Pi_j^X = \left[\frac{c_j}{\varphi}\right]^{1-\sigma}\sum_{k\in\Omega_i} B_k(d_{kj}\tau_{kj})^{1-\sigma} - f_{ij}^X - \sum_{k\neq i,k\in\Omega_i} f_{kj}^X. \tag{8}$$

As long as $\Pi_{ij}^I \geq \Pi_j^X$ holds, the firm chooses FDI. The productivity level $\hat{\varphi}_{ij}$ at which FDI yields the same profits as exports is given by

$$\hat{\varphi}_{ij} = \left[\frac{f_{ij}^I - f_{ij}^X}{B_i\left[c_i^{1-\sigma} - (d_{ij}\tau_{ij}c_j)^{1-\sigma}\right] + \Phi_{ij}}\right]^{1/(\sigma-1)}, \tag{9}$$

where

$$\Phi_{ij} \equiv c_i^{1-\sigma}\sum_{k\in\Omega_i,k\neq i} B_k(d_{ki}\tau_{ki})^{1-\sigma} - c_j^{1-\sigma}\sum_{k\in\Omega_i,k\neq i} B_k(d_{kj}\tau_{kj})^{1-\sigma}.$$

In Φ_{ij}, the first term, $c_i^{1-\sigma}\sum_{k\in\Omega_i,k\neq i}B_k(d_{ki}\tau_{ki})^{1-\sigma}$, is interpreted as markets in which exports from the FDI subsidiary in country i are more profitable than exports from the home plant in country j. The second term, $c_j^{1-\sigma}\sum_{k\in\Omega_i,k\neq i}B_k(d_{kj}\tau_{kj})^{1-\sigma}$, represents the same markets evaluated on the basis of exporting from country j. Thus, Φ_{ij} represents the net additional markets obtained by replacing direct exports from country j with exports from the FDI plant in country i.

Equation (9) suggests that, holding other things constant, when the difference in the initial fixed cots, $f_{ij}^I - f_{ij}^X$, is smaller, the market size for country i is larger, production cost in country i, c_i, is smaller, and additional market potential in country i, Φ_{ij}, is greater, less productive firms tend to choose FDI in country i instead of exporting.

If we ignore the possibility that firms can serve third countries through subsidiary plants, the choice between FDI and exports is based on a comparison of the net profits from serving country i's market (Helpman et al. 2004; Yeaple 2009). Then, the threshold productivity at which FDI and exports yield the same profits is

$$\hat{\varphi}_{ij} = \left[\frac{f_{ij}^I - f_{ij}^X}{B_i\left[c_j^{1-\sigma} - (d_{ij}\tau_{ij}c_j)^{1-\sigma}\right]}\right]^{1/(\sigma-1)}. \tag{10}$$

A comparison of Eqs. (9) and (10) reveals that ignoring subsidiaries' exports to the third countries overstates the threshold productivity levels. The empirical section of this chapter shows that disregarding host countries' market potential may cause serious omitted bias in the estimations of FDI sales.

Letting $G(\varphi)$ denote the cumulative density function of firms' productivity and n_j denote the total number of firms in country j, the number of country j's firms that choose FDI in country i is expressed by

$$n_{ij} = [1 - G(\hat{\varphi}_{ij})]\, n_j, \tag{11}$$

which is decreasing in the threshold productivity $\hat{\varphi}_{ij}$.

In summary, the model discussed so far implies that holding other things constant, the number of country j's firms that choose FDI in country i, n_{ij}, increases as

- the gap between the initial fixed costs of FDI and exports, $f_{ij}^I - f_{ij}^X$, decreases;
- the market size of country i, B_i, decreases;
- the production cost in country i, c_i, falls; and,
- country i's net foreign markets obtained through FDI, Φ_{ij}, increases.

Next, consider total foreign affiliate revenue earned by country j's firms with subsidiaries in country i. Letting $g(\varphi)$ denote the density function of productivity, the average productivity of such firms is given by

$$\tilde{\varphi}_{ij}(\hat{\varphi}_{ij}) = \frac{1}{1 - G(\hat{\varphi}_{ij})}\int_{\hat{\varphi}_{ij}}^{\infty}\varphi^{1-\sigma}g(\varphi)d\varphi. \tag{12}$$

Thus, the marginal cost of the firms is, on average, $\tilde{c}_{ij} \equiv c_i/\tilde{\varphi}_{ij}$, and total revenue earned from country k through exports from the subsidiaries in country i is

$$R_{ki}^{j} = n_{ij}\left(d_{ki}\tau_{ki}\tilde{c}_{ij}\right)^{1-\sigma} P_k^{\sigma-1} E_k \tag{13}$$

Aggregating R_{ki}^{j} over all k yields total foreign affiliate revenue earned by country j's firms from their subsidiaries in country i:

$$R_i^j = \sum_{k\in\Omega_i} n_{ij}\left(d_{ki}\tau_{ki}\tilde{c}_{ij}\right)^{1-\sigma} P_k^{\sigma-1} E_k = \sigma n_{ij} c_i^{1-\sigma} \tilde{\varphi}_{ij}^{\sigma-1} \sum_{k\in\Omega_i} B_k \left(d_{ki}\tau_{ki}\right)^{1-\sigma}. \tag{14}$$

Hence, the average affiliate sale per firm, $r_i^j = R_i^j/n_{ij}$, is given by

$$r_i^j = \sigma c_i^{1-\sigma} \tilde{\varphi}_{ij}^{\sigma-1} \sum_{k\in\Omega_i} B_k \left(d_{ki}\tau_{ki}\right)^{1-\sigma}. \tag{15}$$

Equation (15) shows that, holding other factors constant, average affiliate sales per firm increases as

- the production cost in the host country, c_i, decreases;
- the average productivity level of FDI firms, $\tilde{\varphi}_{ij}$, increases; and,
- the market potential in country i, $\sum_{k\in\Omega_i} B_k \left(d_{ki}\tau_{ki}\right)^{1-\sigma}$, increases.

The next section empirically tests all of these characteristics for the number of FDI firms (the extensive margin of FDI sales) and the average FDI sales per firm (the intensive margin of FDI sales).

The model sheds some light on the characteristics of Japanese firms' FDI. For instance, on the one hand, the positive correlation between the host countries' GDP and the number of FDI firms (Fig. 3) is consistent with the prediction of Eqs. (9) and (11): the number of FDI firms increases as the host country's market size increases. On the other hand, the weak correlation in Fig. 3 suggests that some other factors may play an important role in determining the number of FDI firms. Our theoretical framework suggests that one such factor is market potential.

Figure 4 shows that average FDI sales per firm tends to be low in host countries in which a large number of Japanese firms operate. This observations is also consistent with the theoretical framework. Equation (11) implies that higher productivity levels help firms satisfy threshold productivity levels in a larger number of countries. Thus, as shown in Fig. 5, the positive correlation between FDI firms' average domestic sales and the number of countries in which they operate is consistent with this theoretical framework.

4 Estimation for the Gravity Model

In this section, we estimate a gravity model as described in Sect. 3 for the number of Japanese MNE subsidiaries and their sales. The dependent variables (LHS) are the sum of subsidiary sales by country and region (Sales), the number of subsidiaries (Number), average subsidiary sales (AverageSales), and the ratio of subsidiary sales to sales in the home country (ln (Sales / Domestic Sales)). As explanatory variables, we use host country GDP, distance from Japan (Distance), and market potential (MP).[9] We depict the following combinations of the explanatory variables and since we have four dependent variables, we estimate twelve equations.

$$LHS = \beta_0 + \beta_1 \ln(GDP) + \beta_2 \ln(Distance) + \mu, \tag{16}$$

$$LHS = \beta_0 + \beta_1 \ln(GDP) + \beta_2 \ln(Distance) + \beta_3 \ln(ForeignMP) + \mu, \tag{17}$$

$$LHS = \beta_0 + \beta_2 \ln(Distance) + \beta_3 \ln(ForeignMP) + \mu. \tag{18}$$

We use GDP as a variable to indicate local market demand. For distance from Japan, we use the geographical distance between Tokyo and the capital of the destination country. Equation (16) presents the traditional gravity model formula. To maintain consistency with the theoretical framework, average productivity of MNEs (or the cut-off level of productivity) should be included in Eq. (16). However, productivity data are not available in our data set. Therefore, (Sales/Domestic Sales) is also used as a dependent variable. In this specification, assuming that domestic sales are proportional to productivity level, the latter is negated. Equations using ln (Number) and ln (AverageSales) as dependent variables correspond to extensive and intensive margins, respectively. An examination of the coefficients of market size and distance in these equations enables a comparison of their effects on extensive and intensive margins.

Estimation Eqs. (17) and (18) are derived from the equation presented in Sect. 3. In Eq. (17), in addition to distance (ln (distance)) and GDP (ln (GDP)), we include third country market potential. In Eq. (18), instead of ln (GDP), we use the market potential indicator, which includes the size of the host country's economy. To estimate market potential, several studies used a Harris-type market potential indicator derived by summing up all countries' GDP discounted by geographical distances. However, recently, Redding and Venables (2004) and Head and Mayer (2004) proposed new methodologies to directly estimate market potential, as presented by Φ_{ij} in Eq. (9). We employ the market potential indicator estimated by Head and Mayer (2004), which was published on the CEPII website. Because Head and Mayer (2004) market potential indicator is only available from 1995 to 2003, our estimation periods are restricted to these years. Our data set covers 39

[9]The data for distance are obtained from CEPII's Gravity Dataset, which is publicly available at the CEPII web site (http://www.cepii.fr/anglaisgraph/bdd/gravity.htm). Basic statistics of the data used for estimation and correlations for explanatory variables are reported in Appendix.

destination countries and 351 samples. Equations are estimated using a random effect model. Moreover, we control the year fixed effect in each equation.[10]

Table 4 summarizes the estimation results. Columns [1]–[3] present the results corresponding to Eq. (16). The results are similar to those reported by Yeaple (2009) and Mayer and Ottaviano (2007). In column [1], the coefficient for GDP is 1.14 and that for distance is −1.08. A comparison of the size of coefficients in columns [2] and [3], which correspond to extensive margin and intensive margin, respectively, shows that extensive margin plays a major role in explaining variations in the sum of subsidiary sales by country. For example, while the elasticity of GDP to total sales for MNEs' subsidiaries is approximately 1 in column [1], that to the number of firms (extensive margin) in column [2] is approximately 0.64. With respect to sales per firm (intensive margin) in column [3], the elasticity of GDP is approximately 0.38. The effect of distance from Japan is more pronounced in the case of extensive margin. The coefficient of distance in the model with the number of subsidiaries (extensive margin) is −1.30, and the coefficient of distance in the equation with sales per MNE is 0.19. The latter effect mitigates the negative effect of distance on total sales of foreign subsidiaries (column 1). This result suggests that firms investing in countries far from Japan have relatively higher productivity and is consistent with the observation in Sect. 2 and the theoretical framework in Sect. 3. Compared with Yeaple (2009), who estimated the same gravity model using data from U.S.-owned foreign subsidiaries, distance has significantly large coefficients. Whereas the coefficients of distance for total sales of subsidiaries and the number of subsidiaries for Japanese MNEs are −1.1 and −1.3, respectively, Yeaple (2009) found coefficients of −0.49 for sales and −0.31 for the number of subsidiaries. In addition, the coefficient of sales per subsidiary for the United States is −0.17; our corresponding estimate is insignificant. These points require further analysis but may reflect the fact that Japanese MNEs are actively engaged in intra-firm intermediate goods trade associated with a vertical division of labor between a parent firm and foreign subsidiaries. Moreover, the productivity dispersion for Japan may be smaller than that for the United States.[11]

In Table 4, columns [4]–[6] and [7]–[9] correspond to Eqs. (17) and (18), respectively. For the distance coefficients, the major findings presented in columns [1]–[3] do not change significantly. That is, in the equation including the number of foreign subsidiaries, distance has a large negative coefficient; however, the equation that includes average sales reflects a slightly positive coefficient. In contrast, when market potential is included, the elasticity of market size differs for an equation with average sales and for an equation including the number of foreign subsidiaries. First,

[10]Since host-country specific factors such as distance are not included in a fixed effect model, we use a random effect model. We conduct a Breush–Pagan test and confirm that a random effect model performs better than pooling regression.

[11]If productivity dispersion is small, most firms respond to market size and distance in a similar manner. As a result, coefficients for extensive margin become sensitive. Note that a smaller productivity dispersion means a larger skew in parameter k for productivity distribution G.

Table 4 Gravity estimation for total FDI sales, extensive margins, and intensive margins

Independent variables	[1] Sales	[2] Number of firms	[3] Sales per firm	[4] Sales	[5] Number of firms	[6] Sales per firm	[7] Sales	[8] Number of firms	[9] Sales per firm	[10] Sales	[11] Number of firms	[12] Sales per firm
ln(distance)	−1.082*	−1.305**	0.191	−1.116*	−1.307**	0.168	−1.094*	−1.463**	0.331	−0.588	−0.630+	−0.313
	[−2.24]	[−4.39]	[0.72]	[−2.39]	[−4.35]	[0.71]	[−2.08]	[−4.16]	[1.33]	[−1.49]	[−1.86]	[−0.90]
ln(GDP)	1.140**	0.641**	0.380**	1.140**	0.638**	0.390**				0.549**	0.547**	
	[4.90]	[5.30]	[2.88]	[5.06]	[5.23]	[3.27]				[2.81]	[3.23]	
Third country market potential				0.523**	0.022	0.393**					0.647**	
				[2.83]	[0.25]	[3.82]					[4.46]	
Market potential							0.315*	0.017	0.259**			0.451**
							[2.31]	[0.30]	[3.36]			[4.25]
Constant	2.443	6.690*	2.086	−4.610	6.442+	−3.374	11.990*	15.980**	1.513	−11.633*	−20.347**	−14.332**
	[0.44]	[2.07]	[0.68]	[−0.77]	[1.89]	[−1.07]	[2.12]	[4.68]	[0.53]	[−2.53]	[−4.56]	[−3.62]
R^2(within)	0.091	0.267	0.071	0.105	0.267	0.088	0.057	0.245	0.056	0.126	0.144	0.114
R^2(between)	0.403	0.552	0.133	0.454	0.554	0.318	0.304	0.320	0.276	0.173	0.405	0.388
R^2(overall)	0.381	0.548	0.119	0.430	0.549	0.266	0.286	0.318	0.226	0.164	0.358	0.339
N	351	351	351	351	351	351	351	351	351	351	351	351
Year dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Numbers in squared brackets are t-statistics. **, *, and + indicate significance at the 1 %, 5 %, and 10 % levels, respectively

when the number of foreign subsidiaries is included, as indicated in column [5], GDP is positive and significant, but third country market potential is insignificant. In contrast, in column [6], for the equation with average sales, both GDP and third country market potential significantly influence average sales. Similarly, in columns [8] and [9], market potential significantly affects only average sales and not the number of foreign subsidiaries. These results do not necessarily adhere to the theoretical model presented in Sect. 3. However, they may imply that because large MNEs already developed a foreign subsidiary network before our sample period (1995–2003), firms that started investing in this period may have been relatively small and tended to supply their product only to the destination market rather than exporting to a third country.

R^2 (overall) indicates that columns [4]–[6] have the highest R^2, suggesting that Eq. (17), which considers third country market demand, is more significant than Eq. (16), which is based on a traditional gravity model. R^2 in columns [4]–[6] is greater than that in columns [7]–[9] probably because the models in columns [7]–[9] assume that the effect of market demand does not differ on the basis of country market size and market demand. In fact, columns [4]–[6] have different coefficients and different statistical significance for GDP and third country market potential.

The estimation results in columns [10]–[12] use the ratio of subsidiary sales to parent sales as dependent variables. Based on the discussion in Sect. 3, we derive the following theoretical model, which corresponds to the results in columns [10] to [12]:

$$\frac{R_{ij}}{R_j} = \left[\frac{c_i}{c_j}\right]^{1-\sigma} \frac{\sum_{k\in\Omega} B_k (d_{ki}\tau_{ki})^{1-\sigma}}{\sum_{k\in\Omega} B_k (d_{kj}\tau_{kj})^{1-\sigma}}. \tag{19}$$

From a theoretical perspective, marginal cost in host country c_i, host country market size, GDP, and market potential are major determinants of the ratio of subsidiary sales to parent sales. In our estimation results, both GDP and market potential have positive significant coefficients. These results are consistent with our theoretical predictions. In contrast, the coefficients for distance from Japan are negative but not statistically significant. Because no direct equivalent to Eq. (19) exists, these results cannot be interpreted from the theoretical model.

5 Concluding Remarks

This chapter provides an overview of recent trends in FDI by Japanese firms and empirically examines the determinants of intensive and extensive margins, using firm level data. On the one hand, the data reveal that Japanese firms' FDI show many characteristics that are commonly observed in other countries' firm level FDI data. Such characteristics include the following: (a) host countries with large market size attract a larger number of FDI firms and (b) MNE firms with many destination countries tend to exhibit large scale operations in home countries.

On the other hand, the data exhibit some interesting trends for Japanese FDI. The United States and China are the two primary FD destinations. However, Japanese firms set up subsidiaries in these destinations in completely different periods. Whereas Japanese firms' FDI tended to be concentrated in the United States during the 1980s, the weight of their FDI shifted to ASEAN countries in the 1990s. Since the 2000s, China has been a primary destination for Japanese FDI. The number of destination countries per firm and the number of FDI firms with multiple destination countries have increased since the 1980s. However, since 2000, although the maximum number of destination countries per firm continued to increase, the average number of destination countries declined. In other words, the disparity in the number of FDI destinations increased. Finally, we confirmed that a substantial portion of Japanese FDI is export-platform FDI. In particular, more than half of the subsidiaries in ASEAN countries export to third countries.

Based on these empirical regularities, particularly the importance of export-platform FDI for Japanese MNEs, we propose a theoretical framework in which firms determine FDI by considering that FDI subsidiaries deliver goods not only to host countries' markets but also to neighboring countries' markets. Then, we estimate FDI intensive margins and extensive margins, using micro data on Japanese firms. Our theoretical framework indicates that exports from FDI subsidiaries to third markets may affect both intensive and extensive margins of FDI sales. Accordingly, we include distance-adjusted third country market size (market potential) in the gravity equations. Our estimation confirms that the inclusion of market potential improves the fitness of the estimated equation. Furthermore, as the theoretical framework suggests, the market potential has a positive effect on both intensive margins and extensive margins of FDI sales. However, with respect to extensive margins, the estimation is not statistically significant. This estimation result may suggest that Japanese firms tend to set up foreign subsidiaries by initially targeting markets of destination countries and only later on do they consider exporting from subsidiaries.

Another interesting result is that the effect of distance on extensive margins is substantially large compared with the results of Yeaple (2009), who estimates a gravity model, using U.S. FDI sales data. The difference between ours and Yeaple (2009)'s may be partially attributed to the fact that Japanese FDI is heavily concentrated in Asia.

Issues exist that should be further examined. First, the theoretical framework articulates that firms' productivity influences their decision making regarding FDI and FDI sales. However, our data is not sufficient to directly address the relationship between the productivity of FDI firms' headquarters and the extensive and intensive margins in FDI. Because this prediction is critical to our theoretical framework, collecting further data and checking the robustness of the prediction is important. Second, clarifying why the market potential affects the intensive and extensive margins differently is important because our empirical exercise shows that the effect of market potential on the extensive margins is positive, but not statistically significant. Finally, the degree of fitness of our empirical model is not satisfactory. R^2 is approximately 0.40 for FDI sales, 0.55 for extensive margins, and 0.10 for

intensive margins. These results may be attributed to the fact that our empirical model does not fully account for the production fragmentation broadly observed in FDI in the Asian region. These issues remain open for future research on Japanese MNEs.

Appendix

Basic statistics

Variables	Mean	S.D.	Max	Min
Sales	7.50	2.24	12.24	0.98
FDI sales/Domestic sales	−9.73	1.64	−5.87	−16.40
FDI sales per firm	8.87	1.10	12.25	2.75
Number of FDI firms	3.37	1.56	6.55	0.00
ln(distance)	8.98	0.58	9.82	7.05
ln(GDP)	12.83	1.13	16.14	10.99
Third country market potential	14.39	1.27	17.83	12.50
Market potential	16.33	1.73	21.93	13.87

Notes: All figures are expressed in logarithm. Third country market potential and Market potential are obtained from the CEPII database: http://www.cepii.fr/anglaisgraph/bdd/marketpotentials.htm

Correlations for explanatory variables

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
[1] Sales	1							
[2] FDI sales/Domestic sales	0.7858	1						
[3] FDI sales per firm	0.7729	0.8258	1					
[4] Number of FDI firms	0.8944	0.5489	0.41	1				
[5] ln(distance)	−0.3602	−0.261	0.0463	−0.5516	1			
[6] ln(GDP)	0.5465	0.3233	0.3184	0.5637	−0.1388	1		
[7] Third country market potential	0.1862	0.4251	0.3721	0.0085	0.0292	−0.0598	1	
[8] Market potential	0.5188	0.5661	0.4282	0.4479	−0.3161	0.053	0.5888	1

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