Chapter 6

Interdependence in Multinational Production Networks: Evidence of Exit Overseas Affiliates

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CHAPTER 6

Interdependence in Multinational Production Networks: Evidence from Exit of Overseas Affiliates

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By setting up and shutting down their overseas affiliates, multinational enterprises (MNEs) have established their production and distribution networks in the world. The entry strategy of their affiliates has been investigated in the academic literature of location choice, but it has remained unknown how MNEs decide the shutdown of their overseas affiliates. In this paper, by exploiting data on Japanese foreign direct investment, we empirically examined the exit of MNEs' production affiliates. In particular, we explore not only the effects of affiliate or host country specific characteristics on the exit of affiliates but also how the exit of an affiliate is affected by the existence of the other affiliates belonging to the same parent firm. As a result, we found that affiliates in countries to which the other same-firm affiliates have better market access are more likely to be shut down.

Keywords: Multinational enterprises; Exit; Japan

JEL Classification: F21; F23

1. Introduction

By setting up and shutting down their overseas affiliates, multinational enterprises (MNEs) have established their production and distribution networks in the world. Every year, while some new overseas affiliates are established, some existing affiliates are shut down. For example, in the case of Japanese MNEs' overseas affiliates in 2009, while 82 manufacturing affiliates were newly advanced abroad, the number of manufacturing affiliates withdrawing from overseas markets was 305 (Basic Survey of Overseas Business Activities, Ministry of Economy, Trade and Industry). Since around 8,000 manufacturing affiliates exist in the world, about five percent of all manufacturing affiliates are new affiliates or exit from the overseas markets. Such entry and exit of overseas affiliates will be based on the global strategy of MNEs. MNEs have continuingly improved their production and distribution networks through the reallocation of their overseas affiliates.

The entry strategy of their affiliates has been investigated in the academic literature.[1] This literature is called location choice analysis and examines what kinds of firm and regional characteristics have influence on the location decision of overseas plants of MNEs. This literature includes two main topics. The first topic examines various kinds of location factor such as the agglomeration of firms belonging to the same firm group (e.g., Belderbos and Carree, 2002) or investment climate-related elements (free trade zones in the US, Head *et al*., 1999; special economic zones and opening coastal cities in China, Belderbos and Carree, 2002; Objective 1 structural

[1] Recent references are as follows: Head *at al.* (1999) for Japanese MNEs in the US; Belderbos and Carree (2002) for Japanese MNEs in China; Head and Mayer (2004) for Japanese MNEs in Europe; Disdier and Mayer (2004) for French MNEs in Europe; Castellani and Zanfei (2004) for large MNEs in the world; Mayer *et al.*(2010) for French MNEs in the world; Crozet *et al.* (2004) for MNEs in France; and Basile *et al.* (2008) for MNEs in Europe.

funds and cohesion funds in Europe, Basile *et al.*, 2008). The second topic explores the substitution of location by examining inclusive values in the nested logit model: Basile *et al*. (2009); Disdier and Mayer (2004); Mayer *et al.* (2010). For instance, Disdier and Mayer (2004) investigate the location choice of French multinational firms and found the differentiation between Eastern European countries and Western European countriesas a location. These studies contribute to uncovering how MNEs decide the location of their overseas affiliates.

On the other hand, the analysis on exit strategy of their affiliates has been limited to the comparison in exit between foreign-owned plants and indigenous plants. For example, following the pioneer study by Gibson and Harris (1996), which examine the exit of foreign-owned plants in New Zealand, Görg and Strobl (2003), Bernard and Jensen (2007), Bernard and Sjöholm (2003), Van Beveren (2007), Bandick (2010), and Kneller *et al.* (2012) look at evidence from Ireland, the United States, Indonesia, Belgium, Sweden, and Japan, respectively. Although the results are slightly different depending upon the country under inspection, most of the studies show that the survival rate of foreign plants is lower than that of domestic plants. These studies contribute to clarifying the differences in "foot-looseness" of MNEs' overseas plants, but it has remained unknown how MNEs decide the shutdown of their overseas affiliates.

In this paper, by exploiting data on Japanese foreign direct investment (FDI), we empirically examined the exit of MNEs' production affiliates. In particular, our data enable us to differentiate purely exiting affiliates with those just stopping the response. With those data, we compare exit among MNEs' affiliates, not between those and indigenous plants. In other words, rather than exploring how different the exit is between indigenous plants and foreign plants in a country, this paper investigates how

different it is among MNEs' affiliates in the world. With this analysis, we can uncover the effects of affiliate or host country characteristics on the exit of affiliates. For example, due to the larger sunk costs, the relatively large-sized affiliate among affiliates within an MNE might be less likely to be shut down. Obviously, the rapid hike of local wage rates will encourage foreign affiliates to exit. This is the first paper that presents the evidences on the effects of these kinds of characteristics on the exit of MNEs' affiliates. Such analyses are important from the policy point of view because their existence is one of the most important drivers for economic growth in developing countries.

Furthermore, we take into account the existence of multiple affiliates within an MNE. In the analysis of plant exit, some papers examined how the exit of a domestic plant is affected by the existence of the other domestic plants belonging to the same firm, and found their significant interaction in plant exit (see, for example, Baden-Fuller, 1989; Deily, 1991; Dunne *et al*., 2005).[2] Similarly, in this paper, we examine the interaction of overseas affiliates in exit. In particular, we say that our paper is close to Chen (2011), which analyzes the effect of MNEs' existing-network on the location choice of a new affiliate. By using the data of French MNEs' affiliates,she examines how the entry of an affiliate is affected by the existence of the other affiliates in the same firm. This paper is also the first one that conducts the similar analysis in the context of exit of MNEs' affiliates. Namely, by using the data of Japanese MNEs' overseas affiliates, we examine how the exit of an affiliate is affected by the existence of the other affiliates in the same firm.

The existence of the other affiliates within the same MNE has an influence on the

[2] Stafford (1991), Kirkham and Watts (1997), Watts and Kirikham (1999), and Richbell and Watts (2000) are the examples of the descriptive analysis on plant exit in the case of multiple-plant firm.

exit decision on an affiliate in some ways. The one effect is through the mechanics of export platform FDI. Yeaple (2003) and Ekholm *et al.* (2007) explore theoretically the motives of the export platform FDI strategies that adopt one host country as a platform from which to serve third countries. This type of FDI becomes optimal for firms when the host country has good access to those third countries. The validity of this mechanics is confirmed by Blonigen *et al.* (2007) and Ekholm *et al.* (2007). In the context of overseas affiliates' exit, an affiliate will be more likely to be shut down if its MNE has other affiliates with the good access to countries to which that affiliate supplies. The other effect is through the mechanics of complex vertical FDI (VFDI). Blonigen *et al.* (2007) and Hayakawa and Matsuura (2011) examine the mechanics of this type of FDI, of which aim is to get engaged in production process-wise vertical division of labor among multiple overseas affiliates. This type of FDI becomes optimal if countries in which those overseas affiliates locate have large differences in location advantages (e.g. wages) and if trade costs among those countries are low enough. Therefore, in our context, an affiliate will be more likely to exit if its location is less desirable for conducting the vertical division of labor with the other affiliates, say, if the MNE does not have other affiliates with the good access to an affiliate's location. As a result, the direction of the network effects will show which kind of mechanics is stronger.[3]

During a few decades, MNEs have located a large number of overseas affiliates in the world. Hereafter, their exit based on the global reallocation strategy might show a significant increase. Therefore, it is becoming important to clarify the mechanics of exit of MNEs' overseas affiliates. The results on the effects through the existence of

[3] Unlike ours, Chen (2011) investigates these two mechanics separately by differentiating FDI types and affiliates' production process (i.e. finished goods production or intermediate goods production). Unfortunately, our dataset does not allow us to differentiate these.

the other affiliates within the same MNE will uncover the trend of affiliates' location. On the one hand, if MNEs intend to shut down affiliates with good access from the other affiliates, the distribution of overseas affiliates will be regionally dispersed. Then, affiliate or country characteristics become important in determining which affiliate within the region is shut down. On the other hand, if MNEs are more likely to shut down affiliates without good access from the other affiliates, MNEs concentrate their affiliates in a particular region, e.g. Asia, and then supply products to the world from those affiliates. In short, as in the analysis of location choice of MNEs' affiliates, our paper contributes to predicting the future trend of the location distribution of MNEs' affiliates.

The rest of this paper is organized as follows. The next section explains our empirical framework to investigate the exit of Japanese MNEs' affiliates in the world. In Section 3, we present some data issues including data sources and then take a brief look at the exit of Japanese MNEs' affiliates in the world. Section 4 reports our empirical results, and Section 5 concludes on this paper.

2. Empirical Framework

This section first provides the simple conceptual framework to motivate our empirical specification and then explains the detailed specification of our estimation equation. The framework provided here is invaluable to clarify under what kinds of decision problems the empirical equation for our analyses on plants' exit is specified.

2.1. Settings

We begin by specifying the current profit of a firm *j*'s plant *i* in country *r* at year *t*.

Let π_{ijrt} ($\mathbf{x}_{it}$, $\mathbf{m}_{rt}$) be the maximum profits earned by this plant. The profit is a function of a set of plant specific elements **x** (e.g. plant's employment) and a set of country specific elements **m** (e.g. wages).$\mathbf{x}_{it}$and $\mathbf{m}_{rt}$ are row vectors.[4] These elements may be affected by some kinds of exogenous shocks. In the literature, it is assumed that a plant makes a decision to continue operating in a country at the start of each year prior to observing the values of **x**and **m** for that year. Namely, the plant decides to produce in year $t + 1$ by comparing the expected discounted sum of profits from operating, $E(V_{ijrt+1})$, with scrap values F. We simply assume that F is identical across plants. The expected future profits are calculated based on the knowledge of the profit function π_{ijrt+1}, the observed state variables for year t (i.e. ($\mathbf{x}_{it}$, $\mathbf{m}_{rt}$)), and knowledge of the transition process for the state variables (though $\mathbf{m}_{rt}$ should be taken for each firm/plant as exogenous variables). If $E(V_{ijrt+1}) - F \geq 0$, the plant continues in the country and we observe discrete variable $Y_{ijrt+1}= 0$. Otherwise, we observe $Y_{ijrt+1}= 1$. As a result, the empirical model expresses the discrete exit variable in year t+1 as a function of state variables, i.e. $Y_{ijrt+1}(\mathbf{x}_{it}, \mathbf{m}_{rt})$.[5]

The above-outlined framework is the basis for many of the empirical exit studies in the literature (see, for example, Dunne *et al*., 2005).[6] For our analysis, however, it is necessary to depart from this model in order to take into account the existence of multiple plants within the same firm. Indeed, it is natural that the decision of overseas affiliates' exit is made by not such affiliates themselves but their parent firm. Then, the parent makes the decision of affiliate's exit, based on the comparison of the joint

[4] Firm specific elements are another kind of important elements. However, since data on parent firms are not available in this study, we do not consider firm specific elements.

[5] More precisely Y_{ijrt+1} is defined conditional on that $Y_{ijrt+1} = 0$, $k = 0, \ldots, K$. Time t-K is the entry year of this plant.

[6] The general theoretical framework for firms' entry and exit is provided in Ghemawat and Nalebuff (1985), Hopenhayn (1992), Ericson and Pakes (1995) and so on.

expected profits of all plants within the same firm according to affiliate's exit. In addition, we assume that firms need to pay some kind of fixed costs for shutting down their plants rather than get some amount of positive scrap values. In the case of MNEs' affiliates, it is rare that firms can obtain a positive value of revenue. Rather, their exit requires firms to incur some amount of costs when they shut down their affiliates particularly in developing countries.[7] If such costs are greater than the so-called scrap values, firms need to incur some amount of costs in net.

In order to simplify our analysis, we consider this decision problem under some assumptions. First, we assume that a firm does not shut down more than one plant at the same time. Second, firms do not make their decision on entry and exit simultaneously. Then, plant *i* continues if

$$\sum_{l\in R}\sum_{f\in\Omega_{jlt}} E\left(V_{fjlt+1}|\forall q\in R,\forall k\in\Omega_{jqt},Y_{kjqt+1}=0\right)\geq$$
$$\sum_{l\in R}\sum_{f\in\Omega_{jlt}-\{i\}} E\left(\begin{array}{c} V_{fjlt+1}|i\in\Omega_{jrt},Y_{ijrt+1}=1; \\ \forall q\in R,\forall k\in\Omega_{jqt}-\{i\},Y_{kjqt+1}=0\end{array}\right)-F \qquad (1)$$

Ω_{jlt} denotes a set of affiliates in country *l* in firm *j* in year *t*. *R* is a set of countries. Due to the first assumption, we can explore plant *i*'s exit under the condition that the other plants in the same firm remain alive. In other words, we do not examine the number of plants to be shut down. Also, the second assumption enables us to fix sets of affiliates within a firm, i.e. Ω_{jlt}. The left hand side indicates the joint expected profits of all plants within firm *j* under the condition that all plants including plant *i* survive in year *t*+1. The first term of the right hand side indicates the joint expected profits of all plants other than plant *i* under the condition that only plant *i* exits in year *t*+1. Namely, plant *i* continues if and only if the joint expected profits of all plants within the same

[7] For example, suppose that an affiliate obtains 5-year exemption of corporate tax from investment authorities in the host country as investment incentive schemes. If it exits in three year (i.e. less than five years), then it must pay three-year corporate tax to the government of host country as a penalty.

firm are greater than the joint expected profits of the other plants minus the fixed exit cost.

This equation can be rewritten as:

$$E\left(V_{ijrt+1}|\forall q \in R, \forall k \in \Omega_{jqt}, Y_{kjqt+1}=0\right) \geq -F + \sum_{l\in R}\sum_{f\in\Omega_{jlt}-\{i\}}\begin{Bmatrix} E\left(V_{fjlt+1}|i \in \Omega_{jrt}, Y_{ijrt+1}=1;\ \forall q \in R, \forall k \in \Omega_{jqt}-\{i\}, Y_{kjqt+1}=0\right) \\ -E\left(V_{fjlt+1}|\forall q \in R, \forall k \in \Omega_{jqt}, Y_{kjqt+1}=0\right) \end{Bmatrix}. \quad (2)$$

The left hand side is the usual expected profits in plant *i*. The second term of the right hand side captures the difference of the expected profits in the other plants according to plant *i*'s exit, namely "expected exit effects" in the other plants. Plant *i* continues if the expected future profit of plant *i* is as large as or larger than the expected exit effect in the other plants (minus fixed exit cost). We call this expected exit effects "network effects" and discuss more closely later how the network effects affect plants' exit. Based on this framework, we formalize our estimation equation as follows:

$$\text{Prob}\left(Y_{ijrt+1}=1\right)=\Phi\left(\mathbf{x}_{it},\mathbf{m}_{rt},\mathbf{G}_{ijrt}\right), \quad (3)$$

where Φ (•) is the standard normal distribution function. $\mathbf{G}_{ijrt}$ is a set of elements capturing the network effects in the other plants (a row vector).

Although this framework is based on the above-mentioned two kinds of strong assumptions, its generalization and its more detailed examination are quite complicated. Indeed, the theoretical framework becomes quite complicated in the case of multiple plants and changes the results obtained in the case of single plant (see, for example, Whinston, 1988). For example, if the exit of only plant *i* is optimal, the right hand side of (2) should be less than so many kinds of the joint expected profits, depending on how many plants are shut down. Furthermore, even in the case of shutting down two plants, if a firm has a number of plants, there are so many

combinations of two plants to be shut down. Such generalization and examination are beyond our scope here. The aim of this section is to relate the relative position of a plant among all plants within the same firm, with that plant's exit, i.e. network effects. T hus, our reduced-form empirical analysis in this paper does not take into account the number of exit plants and the simultaneous decision on entry and exit.

2.2. Variables

In our model, each kind of elements includes the following. The plant specific elements **x**include its number of employment (Employment), a share of parent's capital (Control Share), and its age (Age). The larger sized-plants are more likely to survive due to the larger operating profit. One may argue that since joint-venture affiliates (affiliates with the lower capital share of parents) are more likely to have been involved with local sales or procurement network, they are able to cope better with negative shocks in the domestic market. On the contrary, the higher capital share enables affiliates to obtain the larger share of operating profits. Thus, the effect of control share is ambiguous.The older plants may be more likely to survive because of much knowledge on international activities.[8]

Country specific elements **m** are GDP, GDP growth, GDP per capita, the number of Japanese affiliates with the same industry as a concerned affiliate, inflation, exchange rate volatility, regulation, and minimum efficient scale. First, the effect of GDP on exit will reflect the motivation of FDI. Namely, GDP is negatively related to affiliates' exit in the case of market-seeking FDI, but not related to that in the case of efficiency-seeking FDI.[9] Not only its level but also its growth will affect the exit

[8] Due to the data unavailability, we cannot examine the roles of affiliates' and their parents' productivity.

[9] Alfaro and Charlton (2009) propose the empirical method to identify FDI types, i.e. horizontal

decision of affiliates through the changes of expected profits. Second, we use GDP per capita as a proxy for general wages, which will be positively related to affiliates' exit. Third, affiliates enjoy various kinds of lower transaction costs in the location with the agglomeration of the same nationality and industry affiliates, resulting in a lower probability of exit. However, due to the fiercer competition among those affiliates, they may escape from such location. Fourth, the high inflation lowers the expected profits through, say, the rise of production cost in the transition process. Thus, the exit will be more likely to be observed in affiliates in higher inflation countries. Fifth, affiliates in countries with the higher volatility of exchange rates are less likely to survive due to the decrease of the expected profits through the more uncertainty. Sixth, affiliates in countries with the more regulated rules of credit, labor, and business may lower the operating profit. On the other hand, in such countries, the exit *per se* may be hard action. Thus, the effects of regulation on exit will be ambiguous. We also examine the role of entry barriers on affiliate exit by including the Minimum Efficient Scale measure; affiliates operating in industries with the higher entry barriers are more likely to survive.

We construct variables on the network effects in the other plants, based on the above discussion. In particular, we shed light on the network effects through trade costs. Specifically, a raw vector of $\mathbf{G}_{ijrt}$ is constructed as follows:

$$\mathbf{G}_{ijrt} = (\mathbf{E}_{jt}\mathbf{W'}_{\mathrm{D}rt} \quad \mathbf{E}_{jt}\mathbf{W'}_{\mathrm{T}rt}),$$

where $\mathbf{W}_{\mathrm{D}rt} = (d_{r1t} \quad \dots \quad d_{rct}), \mathbf{W}_{\mathrm{T}rt} = (\tau_{r1t} \quad \dots \quad \tau_{rct}), \mathbf{E}_{jt} = (e_{j1t} \quad \dots \quad e_{jct}).$

c is a total number of sample countries. d_{rlt} and τ_{rlt} are the (naturally-logged) geographical distance between countries *r* and *l* in year *t* and tariff rates of country *r*

FDI or vertical FDI. However, our data do not allow us to examine the exit of market-seeking FDI and efficiency-seeking FDI separately because the available industrial identification in our dataset is too rough to o that method. Also see footnote 3.

for country l in year t, respectively. Both distance and tariff rates are normalized by the largest distance and highest tariff rates. Since the geographical distance is time-invariant,$d_{rlt} = d_{rl}$ for all t. e_{jlt} is an indicator variable taking unity if firm j has affiliates in country l in year t and zero otherwise. Also, e_{jlt} sets zero if $l = i$. For example, if firm j has other affiliates in countries 3 and 5, an element of $\mathbf{E}_{jt}\mathbf{W'}_{\mathrm{D}rt}$ becomes $(d_{i3} + d_{i5})$. Namely, this indicator measures how geographically close the other affiliates in firm j are to country r. Similarly, $\mathbf{E}_{jt}\mathbf{W'}_{\mathrm{T}rt}$measures how much tariff rates the other plants within the same plant need to pay in exporting to the country in which plant i locates. In order to avoid that the results of these network variables simply reflect the effects of the increase of affiliates, we introduce the number of firm's affiliates in the world as an independent variable.

In considering how the network effects affect plants' exit, it is invaluable to take into consideration two types of FDI, as in Chen (2011). The one is export platform FDI, in which MNEs' strategy is to adopt one host country as a platform to serve third countries (Ekholm *et al.,* 2007). In the case of this type of FDI, if plant i exits, the other plants will supply products to the markets where plant i used to do. Namely, it can be said that those effects are sensitive to how much the other plants substitute for a plant i. Thus, the better access to plant i the other plants have, the more likely plant $i$is to be shut down. This can be said as a substitutability perspective. The other is complex vertical FDI (complex VFDI), in which MNEs get engaged in production process-wise vertical division of labor among their *multiple* overseas plants (see, for example, Hayakawa and Matsuura, 2011). I n this case, if the other plants have better access to plant i, plant i is more likely to be involved into the production process-wise vertical division of labor and thus to survive. This can be said as a complimentary perspective. In sum, there are two countervailing forces. If the substitutability

perspective works more strongly in firms' decision on plants' reallocation, the better access to plant *i* the other plants have, the more likely plant *i*is to be shut down.

3. Data Issues

In this section, we first provide our data sources for empirical analysis and then take a brief overview of Japanese overseas affiliates' exit.

Our data source of Japanese overseas affiliates' exit is the following. In Japan, there are two kinds of firm-level surveys on overseas activities. One is "Basic Survey of Oversea Business Activity" (hereafter we call BSOBA) annually compiled by Ministry of Economy, Trade and Industry (METI). The other is "Oversea Japanese Companies Data" (hereafter we call OJCD data) compiled by a private company, Toyo Keizai INC. The former survey contains the rich information on Japanese overseas affiliates' characteristics, such as affiliates' sales, profit, and cost structure. However, since the response rate is only around 60%, a significant fraction of"exiting" affiliates in BSOBA data is still active and but just stops responding the survey. On the other hand, OJCD data contain the list of exiting affiliates, which further provides us the information on exit form; withdrawal (including bankruptcy and liquidation) or decline in control share. As a result, since we can differentiate purely exiting affiliates with those stopping the response,we use OJCD data for Japanese overseas affiliates' exit. From the sample for estimation, we exclude the affiliates who disappear in the data by stopping responding the survey.

The data sources of each variable are as follows. As for host country characteristics, we obtain the data on GDP, GDP per capita, GDP deflator, and

Japanese affiliates (and country-level dataenough for our analyses). We restrict sample affiliates only to those in manufacturing industry. The industrial sectors include Food, Textile, Paper products, Printing products, Chemicalproducts, Petroleumproducts, Rubberproducts, Non-metallic mineral products, Iron and steel, Non-ferrous metal, Metal products, General machinery, Electric machinery, Transport equipment, Automobile, Precision machinery, and Other manufacturing industries. The basic statistics are provided in Table 1.

inflation from World Development Indicator (World Bank).[10] The index on the regulation of credit, labor, and business is drawn from the Economic Freedom of the World: 2010 Annual Report. The literature analyzing the impacts of exchange rate volatility on trade has applied various kinds of variables for exchange rate volatility.[11] In this paper, following Rose (2000), we use a widely-used indicator, the real exchange rate volatility, which is constructed as the standard deviation of the first-difference of the monthly natural logarithm of bilateral real exchange rates in the five years preceding period *t*. The necessary data for this variable are drawn from International Financial Statistics (International Monetary Fund). For industry attributes, it is desirable to control the differences in efficient scale of production by industries. Following the discussion by Lyons (1980), we use the average value of shipment, which is calculated using the 1995 Census of Manufacturer (METI), as a proxy for Minimum Efficient Scaleby industry. As for the proxy for trade cost, we use bilateral distance and tariff. The data on distance are from CEPII website.[12] Our data source for tariff rates is the World Integrated Trade Solution (WITS), particularly TRAINS raw data.[13]

The sample years of affiliates' exit are from 1991 to 2008. All of the independent variables are one year lagged. Sample host countries are 39 countries, which are listed in Appendix. These countries are selected as those having a relevant number of

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[10] GDP and GDP per capita are deflated by GDP deflator.

[11] In this literature, there are a large number of theoretical and empirical studies (see, for example, McKenzie, 1999; Clark *et al.*, 2004).

[12] http://www.cepii.fr/

[13] In addition, some other sources are used for identifying the best tariff scheme for individual trading partners. In particular, we need to make a list of member countries of the WTO and each RTA. Also, GSP beneficiaries are different across importers. Information on the WTO and RTAs is obtained from the WTO website. We use the "Regional Trade Agreements Information System" for obtaining the RTA member list. As for GSP beneficiaries, we used several documents available on the UNCTAD website in addition to official documents on the national custom's website of each country.

Table 1: Basic Statistics

	N	Mean	SD	p10	p90
Exit	82,630	0.014	0.117	0	0
Employment	82,630	4.836	1.546	2.890	6.745
Relative Employment	82,630	0.549	0.401	0.043	1
Control Share	82,630	0.724	0.279	0.320	1
Age	82,630	2.301	0.746	1.386	3.258
Numebr of affiliates in an MNE	82,630	7.678	11.022	0	21
GDP	82,630	27.041	1.568	25.179	29.711
GDP Growth	82,630	0.054	0.044	0.011	0.096
GDP per capita	82,630	8.424	1.406	6.718	10.311
Number of Japanese affiliates	82,630	5.940	1.150	4.26268	7.328437
Inflation	82,630	0.181	1.688	0.000	0.089
Volatility	82,630	0.049	0.084	0.024	0.056
Regulation	82,630	6.342	1.300	4.700	8.200
Minimum Efficient Scale	82,630	7.099	0.982	5.672359	8.404477
Number of affiliates in the same region	82,630	1.044	1.960	0.000	3.000
Number of affiliates in the same country	82,630	0.558	1.454	0	2
Network effects through distance	82,630	3.085	3.904	0.000	7.886
Network effects through distance (excl. Japan)	82,630	3.933	3.912	0.773465	8.715
Distance from Japan	82,630	8.384	0.724	7.649	9.292
Network effects through tariff	82,630	1.768	2.239	0.000	4.571
Network effects through tariff (excl. Japan)	82,630	2.268	2.245	0.475893	5.065
Tariff rates for Japan	82,630	1.351	2.282	0	5.132

Note: We take logs of Employment, GDP, GDP per capita, Number of Japanese affiliates, Minimum Efficient Scale, and Distance from Japan.

Next, we take a brief overview of Japanese overseas affiliates' exits. Table 2 reports those by regions. Most of the exits occurred in developed countries including North America, NIEs, and Western Europe, in the former half of the 1990s. On the other hand, in the period of Asian currency crisis (i.e. the latter half of the 1990s), the major exit of Japanese affiliates can be observed in Asian developing countries including China and ASEAN, in addition to developed countries. In the 2000s, most of the exits have occurred in China. Taking a look at the exit rate, which is defined as a share of the exit number in the next year in the total number of affiliates in the concurrent year, we can see that it is around 1%. Next, Table 3 reports Japanese overseas affiliates' exit by affiliates' industries. Most of the exits of Japanese overseas affiliates can be observed in textile,

chemical, general machinery, electric machinery, and transport equipment industries. In particular, electric machinery industry shows relatively the large number and the high exit rate.

Table 2: Exit of Japanese Affiliates by Regions

	NAmerica		MSAmerica		ASEAN4		NIES		China		Other Asia		WEurope		EEurope		Oceania		Africa	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
1990	12	2%	1	1%	5	1%	11	1%	0	0%	0	0%	3	1%	0	0%	1	2%		
1991	8	1%	4	2%	4	0%	16	2%	0	0%	0	0%	0	0%	0	0%	2	3%		
1992	7	1%	1	1%	3	0%	9	1%	0	0%	0	0%	6	2%	0	0%	2	3%		
1993	18	2%	3	1%	6	1%	13	1%	0	0%	1	2%	3	1%	0	0%	2	3%		
1994	9	1%	0	0%	3	0%	12	1%	1	0%	1	2%	4	1%	0	0%	1	1%		
1995	17	2%	3	1%	3	0%	13	1%	1	0%	1	2%	13	3%	0	0%	3	4%		
1996	13	2%	1	1%	7	1%	13	1%	0	0%	1	2%	7	2%	0	0%	2	3%		
1997	23	3%	2	1%	4	0%	16	2%	5	0%	0	0%	5	1%	0	0%	0	0%		
1998	21	3%	3	2%	12	1%	21	2%	14	1%	1	1%	8	2%	0	0%	0	0%		
1999	31	4%	3	2%	18	1%	17	2%	19	1%	3	3%	9	2%	1	7%	3	4%		
2000	21	3%	5	3%	9	1%	16	2%	9	1%	1	1%	7	2%	0	0%	0	0%		
2001	17	2%	3	2%	14	1%	16	2%	19	1%	2	2%	7	2%	1	6%	3	4%	0	0%
2002	31	4%	0	0%	16	1%	15	2%	16	1%	2	2%	12	3%	1	5%	1	2%	0	0%
2003	10	2%	2	1%	14	1%	10	1%	18	1%	2	1%	13	4%	0	0%	2	4%	0	0%
2004	13	2%	1	1%	15	1%	9	1%	18	1%	0	0%	9	3%	2	10%	0	0%	0	0%
2005	5	1%	1	1%	19	1%	8	1%	19	1%	1	1%	6	2%	0	0%	1	2%	0	0%
2006	5	1%	2	1%	16	1%	8	1%	26	1%	2	1%	7	2%	0	0%	0	0%	0	0%
2007	13	3%	2	2%	31	2%	31	5%	48	3%	1	0%	11	4%	0	0%	0	0%	1	13%

Source:Authors' calculation using "Oversea Japanese Companies Data" compiled by Toyo Keizai INC

Notes: Columns (I) and (II) report the number of exit and an exit rate, respectively. The exit rate is defined as a share of the exit number in the next year in the total number of affiliates in the concurrent year.NAmerica, MSAmerica, WEurope, and EEurope indicate North America, Middle and South America, Western Europe, and Eastern Europe, respectively.

Table 3: Exit of Japanese Affiliates by Industries

	Food		Textile		Wood		Paper and Paper products		Printing		Chemicals		Petroleum		Rubber		Non-Metalic Mineral products	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
1990	2	1%	2	1%	0	0%	0	0%	0	0%	6	2%	0	0%	1	1%	3	4%
1991	1	1%	3	1%	0	0%	0	0%	1	3%	2	1%	0	0%	1	1%	0	0%
1992	1	1%	2	1%	0	0%	0	0%	0	0%	1	0%	0	0%	2	1%	0	0%
1993	0	0%	5	2%	2	4%	3	7%	1	3%	7	2%	0	0%	2	1%	1	1%
1994	3	1%	2	1%	3	5%	0	0%	0	0%	2	0%	0	0%	2	1%	1	1%
1995	4	2%	3	1%	0	0%	0	0%	0	0%	6	1%	0	0%	1	1%	0	0%
1996	2	1%	2	1%	1	2%	2	4%	0	0%	3	1%	0	0%	0	0%	1	1%
1997	3	1%	5	1%	1	2%	1	2%	0	0%	4	1%	0	0%	3	1%	2	1%
1998	7	2%	7	2%	2	3%	0	0%	4	9%	7	1%	0	0%	3	1%	1	1%
1999	8	3%	16	4%	0	0%	1	2%	1	2%	8	1%	0	0%	3	1%	6	3%
2000	3	1%	2	0%	1	2%	0	0%	0	0%	13	2%	0	0%	2	2%	2	1%
2001	7	2%	13	3%	0	0%	1	2%	2	5%	4	1%	4	1%	0	0%	1	1%
2002	6	2%	9	2%	2	3%	1	2%	1	2%	16	2%	0	0%	2	1%	1	1%
2003	5	2%	2	0%	2	3%	0	0%	0	0%	10	1%	0	0%	3	2%	2	1%
2004	3	1%	6	1%	0	0%	0	0%	0	0%	11	1%	0	0%	1	1%	1	1%
2005	1	0%	13	3%	3	6%	0	0%	0	0%	8	1%	0	0%	1	1%	0	0%
2006	1	0%	9	2%	2	5%	0	0%	2	6%	10	1%	0	0%	1	1%	5	4%
2007	5	2%	11	3%	1	3%	3	5%	2	7%	19	2%	0	0%	1	1%	7	5%

Table 3: Exit of Japanese Affiliates by Industries (Conti.)

	Iron and Steel		Non-ferrous Metal		Metal Products		General Machinery		Electric Machinery		Transport Equipment		Automobile		Precision Machinery		Other Manufacturing	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
1990	2	2%	0	0%	1	1%	0	0%	13	2%	2	3%	0	0%	0	0%	1	1%
1991	3	3%	1	1%	3	2%	5	2%	7	1%	0	0%	5	2%	1	1%	1	1%
1992	0	0%	0	0%	1	1%	5	1%	8	1%	0	0%	4	1%	2	2%	2	1%
1993	2	2%	0	0%	3	2%	3	1%	9	1%	2	3%	1	0%	1	1%	4	2%
1994	0	0%	0	0%	1	1%	5	1%	6	1%	1	1%	0	0%	1	1%	4	2%
1995	1	1%	3	2%	3	2%	6	2%	17	2%	1	1%	6	1%	0	0%	3	1%
1996	0	0%	1	1%	2	1%	6	1%	13	1%	2	2%	6	1%	2	2%	1	0%
1997	1	1%	0	0%	0	0%	5	1%	16	2%	1	1%	6	1%	1	1%	6	3%
1998	3	2%	6	4%	5	2%	6	1%	16	2%	0	0%	7	1%	3	2%	3	1%
1999	2	1%	2	1%	4	2%	15	3%	18	2%	1	1%	12	2%	1	1%	6	2%
2000	0	0%	3	2%	5	2%	8	1%	17	2%	2	2%	8	1%	1	1%	1	0%
2001	2	2%	1	1%	3	1%	5	1%	25	3%	3	3%	7	1%	1	1%	3	2%
2002	1	1%	3	2%	7	3%	7	1%	22	2%	4	8%	4	1%	4	3%	4	3%
2003	3	3%	1	1%	2	1%	11	2%	16	2%	1	3%	6	1%	3	2%	4	4%
2004	0	0%	1	1%	1	0%	7	1%	23	2%	0	0%	9	1%	3	2%	1	1%
2005	0	0%	2	2%	1	0%	8	1%	18	2%	0	0%	2	0%	3	2%	0	0%
2006	0	0%	1	1%	1	0%	6	1%	21	2%	0	0%	3	0%	1	1%	3	2%
2007	3	2%	4	3%	9	3%	20	3%	31	4%	0	0%	11	1%	6	5%	5	3%

Source: Authors' calculation using "Oversea Japanese Companies Data" compiled by Toyo Keizai INC

Notes: Columns (I) and (II) report the number of exit and an exit rate, respectively. The exit rate is defined as a share of the exit number in the next year in the total number of affiliates in the concurrent year.

4. Empirical Result

This section reports the estimation results of our probit model on exit. We first report those for the model without the network effects in the other plants and then those for the model with such effects. We also conduct some other estimation.

4.1. Baseline Results

Our baseline results without the network effectsare provided in column (I) in Table 4. In this specification, we include only year dummy variables. Firstly, the results in affiliate characteristics are as follows. As is consistent with our expectation, the larger-sized affiliates are less likely to be shut down. This result is also consistent with the results obtained in the usual analysis on plants' exit listed in the introductory section. Specifically, affiliates with 10% larger size have 2% lower probability of exit. The less likely exit can be detected in affiliates with the higher capital share of parents, indicating that the larger share of operating profits is more dominant factor than the better knowledge on local markets acquired from the local partner firms. The coefficient for affiliates' age is estimated to be insignificant. In addition, the coefficient for the number of affiliates in each MNE, which can be taken as a parent characteristic, is estimated to be significantly positive, indicating that the affiliates in the MNEs with a larger number of affiliates in the world are more likely to be shut down.

Table 4: Probit Results (Marginal Effect)

	(I)	(II)	(III)	(IV)
Affiliate characteristics				
Employment	-0.002	-0.002		
	[0.0003]***	[0.0003]***		
Relative Employment			-0.006	-0.006
			[0.0010]***	[0.0010]***
Control Share	-0.007	-0.009	-0.007	-0.009
	[0.0013]***	[0.0013]***	[0.0014]***	[0.0013]***
Age	0.000	0.000	-0.001	-0.001
	[0.0006]	[0.0006]	[0.0005]*	[0.0005]**
Parent characteristics				
Number of affiliates in an MNE	0.00007	0.00005	-0.00007	-0.00010
	[0.0000]**	[0.0000]	[0.0000]*	[0.0000]**
Country characteristics				
GDP	0.0007	0.0008	0.0007	0.0008
	[0.0003]**	[0.0003]**	[0.0003]**	[0.0003]**
GDP Growth	0.02	0.02	0.02	0.02
	[0.0116]*	[0.0113]	[0.0117]*	[0.0115]
GDP per capita	0.003	0.003	0.004	0.003
	[0.0005]***	[0.0005]***	[0.0005]***	[0.0005]***
Number of Japanese affiliates	-0.0007	-0.0007	-0.0005	-0.0006
	[0.0004]	[0.0004]*	[0.0004]	[0.0004]
Inflation	-0.0002	-0.0001	-0.0002	-0.0002
	[0.0003]	[0.0003]	[0.0003]	[0.0003]
Volatility	0.002	0.003	0.002	0.003
	[0.0049]	[0.0047]	[0.0049]	[0.0048]
Regulation	0.0002	0.0006	0.0001	0.0005
	[0.0005]	[0.0005]	[0.0005]	[0.0005]
Minimum Efficient Scale	-0.002		-0.002	
	[0.0004]***		[0.0004]***	
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	No	No	Yes	Yes
Log-likelihood	-5867	-5814	-5881	-5841
Number of observations	82,630	82,630	82,630	82,630
Pseudo R-squared	0.0348	0.0436	0.0326	0.0392

Notes: The dependent variable takes unity if an affiliate exits and zero otherwise. The parentheses are robust standard errors. *** and ** show 1% and 5% significance, respectively.

The results in host country characteristics are as follows. The coefficient for GDP is estimated to be positively significant, which is a result unfavorable for market-seeking

FDI.[14] As is consistent with this result, GDP growth has significantly positive effect on the exit. GDP per capita has significantly positive coefficient, indicating that Japanese MNEs are likely to shut down their affiliates in high wage countries. For example, affiliates in countries with 10% higher wages have 3% higher probability of exit. The coefficient for Number of Japanese affiliates is insignificant, indicating the benefits from the same-nationality plant agglomeration (lower transaction costs) are offset by its costs (tougher competition). Inflation and exchange rate volatility have insignificant coefficients, which imply no significant impacts on the expected profits of affiliates. We do not find a significant effect of regulation, indicating its neutral contribution to the exit of affiliates. The coefficient for Minimum Efficient Scale is estimated to be significantly negative. Namely, the higher entry barriers decrease the exit probability of the affiliate exit.

We also conduct some more estimation. In column (II), we introduce an industry dummy variable, which forces us to drop an industry-specific time-invariant variable, Minimum Efficient Scale. Except for GDP growth and the number of Japanese affiliates, the results are qualitatively unchanged. The affiliates in countries with the larger agglomeration of Japaneseaffiliates are less likely to be shut down. In columns (III) and (IV), we explore the relative employment size of an affiliate in same-firm's overseas affiliates, instead of its absolute size. Specifically, the relative employment size is a ratio of an affiliate's employment to the largest affiliate's employment (do not include the employment in Japan due to the data unavailability). Namely, this variable of the relative employment size includes information on not only an affiliate but also the other

[14] We also try to include industrial value-added instead of industry-invariant GDP, of which data are drawn from UNIDO Industrial database. We obtain insignificant coefficients for the industrial value-added.

affiliates in the same firm. In this sense, this variable may play a role of exploring not only affiliate characteristics but also the network effects. The coefficient for this new variable is estimated to be significantly negative, indicating that relatively large-sized affiliates among same firm's affiliates are less likely to be shut down. As mentioned just above, since this variable includes more information, we use this relative size variable in the following analyses. The noteworthy differences with the previous results are as follows. The coefficient for Age turns out to be significantly negative, implying that the older affiliates are less likely to be shut down, maybe due to the more knowledge on the local economy. Also, the coefficient for Number of affiliates in an MNE turns out to be significantly negative; the affiliates in the MNEs with a larger number of affiliates in the world are less likely to be shut down.

4.2. Network Effects

In this subsection, we examine the network effects on affiliates' exit. But before that, we simply examine the effects of existence of affiliates within the same region belonging to the same firm. Specifically, columns (II) and (III) include variables of "Number of affiliates in the same region" and of "Number of affiliates in the same country", which are the numbers of affiliates within the same region and country belonging to the same firm, respectively. Indeed, our network variables do not take the existence of same-firm's affiliates within the same country into account. Thus, "Number of affiliates in the same country" complements our network variables. Also, we examine the case of the same region, of which effects might be seen as the middle effects between those captured by the case of the same country and those captured by our network variables. The results in the previous variables are qualitatively unchanged. While the coefficient for Number of

affiliates in the same region is estimated to be insignificant, that for Number of affiliates in the same country is significantly positive. Thus, MNEs are more likely to shut down some of affiliates if they have a larger number of affiliates within the same country.

Table 5: Probit Results on Network Effects (Marginal Effect)

	(I)	(II)	(III)	(IV)	(V)	(VI)
Affiliate characteristics						
Relative Employment	-0.006	-0.006	-0.007	-0.007	-0.007	-0.007
	[0.0010]***	[0.0010]***	[0.0010]***	[0.0010]***	[0.0010]***	[0.0010]***
Control Share	-0.009	-0.009	-0.008	-0.008	-0.008	-0.008
	[0.0013]***	[0.0013]***	[0.0013]***	[0.0013]***	[0.0013]***	[0.0013]***
Age	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	[0.0005]**	[0.0005]**	[0.0005]	[0.0005]	[0.0005]	[0.0005]
Parent characteristics						
Number of affiliates in an MNE	-0.00011	-0.00014	-0.00001	-0.00001	-0.00001	-0.00001
	[0.0000]**	[0.0000]***	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Country characteristics						
GDP	0.0008	0.0007	0.0007	0.0007	0.0009	0.0007
	[0.0003]**	[0.0003]**	[0.0003]**	[0.0003]**	[0.0004]**	[0.0003]**
GDP Growth	0.02	0.02	0.01	0.01	0.01	0.01
	[0.0115]	[0.0114]	[0.0113]	[0.0112]	[0.0114]	[0.0112]
GDP per capita	0.004	0.004	0.003	0.003	0.003	0.003
	[0.0005]***	[0.0005]***	[0.0005]***	[0.0005]***	[0.0006]***	[0.0005]***
Number of Japanese affiliates	-0.0006	-0.0008	-0.0012	-0.0012	-0.0014	-0.0012
	[0.0004]	[0.0004]*	[0.0004]***	[0.0004]***	[0.0005]***	[0.0004]***
Inflation	-0.0002	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0003]
Volatility	0.003	0.003	0.003	0.003	0.004	0.004
	[0.0048]	[0.0048]	[0.0047]	[0.0047]	[0.0048]	[0.0047]
Regulation	0.0005	0.0006	0.0006	0.0005	0.0009	0.0007
	[0.0005]	[0.0005]	[0.0005]	[0.0005]	[0.0007]	[0.0005]
Network effects						
Number of affiliates in the same region	0.0001					
	[0.0002]					
Number of affiliates in the same country		0.0008	0.0011	0.0011	0.0011	0.0011
		[0.0003]***	[0.0002]***	[0.0002]***	[0.0002]***	[0.0002]***
Network effects through distance			-0.0009			
			[0.0001]***			
Network effects through distance (excluding Japan)					-0.0009	
					[0.0001]***	
Distance from Japan					-0.001	
					[0.0010]	
Network effects through tariff				-0.0017		
				[0.0002]***		
Network effects through tariff (excluding Japan)						-0.0017
						[0.0002]***
Tariff rates for Japan						0.00094
						[0.0004]**
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Log-likelihood	-5836	-5840	-5813	-5811	-5812	-5809
Number of observations	82,630	82,630	82,630	82,630	82,630	82,630
Pseudo R-squared	0.0400	0.0393	0.0438	0.0441	0.0439	0.0445

Notes: The dependent variable takes unity if an affiliate exits and zero otherwise. The parentheses are robust standard errors. *** and ** show 1% and 5% significance, respectively.

In columns (III) and (IV), we explore our variables of network effects through tariff

rates and geographical distance. Due to the high correlation between those two kinds of variables (97%), we examine those separately. The number of Japanese affiliates has significantly negative coefficients. The coefficients for two kinds of network variables are estimated to be significantly negative. Due to the high correlation, we cannot interpret the roles of networks through distance and tariff rates separately. Thus, we safely interpretthis estimation result as indicating that affiliates in countries to which the other same-firm affiliates have better market access are more likely to be shut down. In other words, if the other affiliates within the same firm can substitute well for an affiliate, such an affiliate is less likely to survive. In this sense, we can say that the substitutability perspective works more strongly in Japanese MNEs' decision on their overseas affiliates' reallocation.

We also examine the network effects isolating the role of home production plants or headquarters, i.e. establishments in Japan. Specifically, in a vector of $\mathbf{E}_{jt}$, e_{jlt} sets zero not zero not only if $l = i$ but also if l = Japan. Instead, we introduce independent variables of geographical distance from Japan and tariff rates for products from Japan. The results are reported in columns (V) and (VI). The network variables excluding the elements of Japan have negatively significant coefficients. While the coefficient for distance from Japan is estimated to be insignificant, that for tariff rates for Japan is positively significant. The positive result in tariff rates for Japan indicates that affiliates in countries with better access from Japan in terms of tariff rates are more likely to survive maybe due to the lower trade costs for importing parts and components from Japan.

4.3. Some Other Estimation

We conduct some more kinds of estimation. Two of those are to focus on the typical

FDI conducting mostly the production process-wise vertical division of labor (see, for example, Kimura, 2006). Specifically, we first focus on the exit of affiliates in machinery industries (general machinery, electric machinery, transport equipment, automobile, and precision machinery), which are major industries for Japanese complex VFDI. The results are reported in columns (I) and (II) in Table 6 and are qualitatively unchanged with Table 5. The network variables have significantly negative coefficients. Our second focus goes to the exit of affiliates in Asia, which is again major destination for Japanese complex VFDI. The estimation results are provided in columns (III) and (IV). One noteworthy difference with Table 5 is that coefficients for GDP and Number of Japanese affiliates are estimated to be insignificant. Nevertheless, the results on the network variables do not change. In sum, it is interesting that, even in the case of Japanese FDI conducting mostly the production process-wise vertical division of labor, the substitutability perspective works more strongly in MNEs' decision on their overseas affiliates' reallocation.

Table 6: Estimation for FDI Conducting Active Vertical Division of Labor

	Machinery Industries		Asia	
	(I)	(II)	(III)	(IV)
Affiliate characteristics				
Relative Employment	-0.009	-0.009	-0.006	-0.006
	[0.0014]***	[0.0014]***	[0.0011]***	[0.0011]***
Control Share	-0.007	-0.007	-0.006	-0.006
	[0.0020]***	[0.0019]***	[0.0015]***	[0.0015]***
Age	-0.001	-0.001	0.001	0.001
	[0.0008]	[0.0008]	[0.0006]	[0.0006]
Parent characteristics				
Number of affiliates in an MNE	0.00009	0.00009	-0.00002	-0.00002
	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Country characteristics				
GDP	0.0010	0.0010	0.0006	0.0006
	[0.0004]**	[0.0004]**	[0.0012]	[0.0012]
GDP Growth	0.018	0.017	0.009	0.008
	[0.0170]	[0.0169]	[0.0140]	[0.0139]
GDP per capita	0.003	0.003	0.003	0.003
	[0.0007]***	[0.0007]***	[0.0007]***	[0.0007]***
Number of Japanese affiliates	-0.0015	-0.0014	-0.0013	-0.0013
	[0.0006]**	[0.0006]**	[0.0011]	[0.0011]
Inflation	0.0001	0.0001	-0.0061	-0.0066
	[0.0004]	[0.0004]	[0.0085]	[0.0086]
Volatility	0.009	0.008	0.011	0.007
	[0.0059]	[0.0059]	[0.0348]	[0.0347]
Regulation	0.0009	0.0008	-0.0003	-0.0003
	[0.0007]	[0.0007]	[0.0012]	[0.0012]
Network effects				
Number of affiliates in the same country	0.0011	0.0011	0.0009	0.0009
	[0.0004]***	[0.0003]***	[0.0002]***	[0.0002]***
Network effects through distance	-0.0012		-0.0008	
	[0.0002]***		[0.0002]***	
Network effects through tariff		-0.0022		-0.0015
		[0.0003]***		[0.0003]***
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
Log-likelihood	-2845	-2844	-3465	-3464
Number of observations	39,240	39,240	57,265	57,265
Pseudo R-squared	0.0514	0.0518	0.0450	0.0453

Notes: The dependent variable takes unity if an affiliate exits and zero otherwise. The parentheses are robust standard errors. *** and ** show 1% and 5% significance, respectively. Machinery industries include general machinery, electric machinery, transport equipment, automobile, and precision machinery. Asia consists of Thailand, Malaysia, Indonesia, Philippines, Taiwan, Korea, Singapore, China, India, Vietnam, Sri Lanka, and Bangladesh.

The other robustness checks are as follows. First, in order to increase the sample

number of exit affiliates, in addition to those listed in exit list, we count the affiliates who stop responding, asexit affiliates. The results under this new definition are reported in columns (I) and (II). Second, in addition to industry dummy, we include host country dummy variables, which control not only host country-specific time-invariant elements but also time-invariant elements in the relationship between host country and Japan. The results are reported in columns (III) and (IV). Third, in order to avoid suffering from omitted variable-biases more seriously, we introduce affiliate fixed effect, estimated by linear probability model. Then, a variable of Age is dropped due to the perfect multi-colinearity. The results are reported in columns (V) and (VI). In sum, in all of these kinds of estimation, the results on the network variables are again unchanged. Thus, we conclude that affiliates in countries to which the other same-firm affiliates have better market access are more likely to be shut down. The substitutability perspective works more strongly in Japanese MNEs' decision on their overseas affiliates' reallocation.

Table 7: Some More Robustness Checks

	Other Definition of Exit		Host Country Dummy		Fixed Effect	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Affiliate characteristics						
Relative Employment	-0.014	-0.014	-0.007	-0.007	-0.015	-0.015
	[0.0019]***	[0.0019]***	[0.0010]***	[0.0010]***	[0.0024]***	[0.0024]***
Control Share	-0.035	-0.035	-0.008	-0.008	-0.007	-0.007
	[0.0024]***	[0.0024]***	[0.0013]***	[0.0013]***	[0.0047]	[0.0047]
Age	-0.002	-0.002	-0.001	-0.001		
	[0.0010]**	[0.0010]**	[0.0005]*	[0.0005]		
Parent characteristics						
Number of affiliates in an MNE	0.0005	0.0005	0.000001	-0.000001	-0.0001	-0.0002
	[0.0001]***	[0.0001]***	[0.0000]	[0.0000]	[0.0001]	[0.0001]
Country characteristics						
GDP	0.003	0.003	0.020	0.020	-0.028	-0.027
	[0.0006]***	[0.0006]***	[0.0136]	[0.0136]	[0.0184]	[0.0184]
GDP Growth	0.013	0.013	0.006	0.006	0.005	0.005
	[0.0216]	[0.0216]	[0.0126]	[0.0126]	[0.0144]	[0.0144]
GDP per capita	0.007	0.007	-0.020	-0.020	0.059	0.059
	[0.0009]***	[0.0009]***	[0.0142]	[0.0141]	[0.0187]***	[0.0187]***
Number of Japanese affiliates	-0.0046	-0.0045	0.0096	0.0092	-0.0138	-0.0141
	[0.0008]***	[0.0008]***	[0.0024]***	[0.0024]***	[0.0026]***	[0.0026]***
Inflation	-0.00014	-0.00013	-0.00039	-0.00038	0.00005	0.00006
	[0.0005]	[0.0005]	[0.0003]	[0.0003]	[0.0003]	[0.0003]
Volatility	0.012	0.010	0.000	0.000	0.005	0.004
	[0.0087]	[0.0087]	[0.0056]	[0.0056]	[0.0076]	[0.0076]
Regulation	0.001	0.001	0.002	0.002	0.001	0.001
	[0.0009]*	[0.0009]	[0.0013]	[0.0013]	[0.0015]	[0.0015]
Network effects						
Number of affiliates in the same country	0.001	0.001	0.001	0.001	0.001	0.001
	[0.0005]	[0.0005]*	[0.0002]***	[0.0002]***	[0.0007]*	[0.0007]*
Network effects through distance	-0.003		-0.001		-0.001	
	[0.0002]***		[0.0001]***		[0.0003]***	
Network effects through tariff		-0.006		-0.002		-0.002
		[0.0004]***		[0.0002]***		[0.0006]***
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	No	No
Country dummy	No	No	Yes	Yes	No	No
Affiliate dummy	No	No	No	No	Yes	Yes
Log-likelihood	-15049	-15043	-5760	-5759	72362	72361
Number of observations	85,338	85,338	82,129	82,129	82,630	82,630
Pseudo R-squared	0.0433	0.0437	0.0514	0.0515		
R-squared (Overall)					0.0012	0.0013

Notes: The dependent variable takes unity if an affiliate exits and zero otherwise. The parentheses are robust standard errors. *** and ** show 1% and 5% significance, respectively. In addition to affiliates listed in exit list, columns of "Other Definition of Exit" include the affiliates who stop responding, as exit affiliates. The column of "Host Country Dummy" reports the results of the estimation for equations with host country dummy variables. In columns of "Fixed Effect", we introduce affiliate dummy variables, estimated by linear probability model.

5. Implication

By setting up and shutting down their overseas affiliates, MNEs have established their production and distribution networks in the world. The entry strategy of their affiliates has been investigated in the academic literature of location choice, but it has remained unknown how MNEs decide the shutdown of their overseas affiliates. In this paper, by exploiting data on Japanese foreign direct investment, we empirically examined the exit of MNEs' production affiliates. In particular, we explore not only the effects of affiliate or host country specific characteristics on the exit of affiliates but also how the exit of an affiliate is affected by the existence of the other affiliates belonging to the same parent firm. As a result, we found that affiliates in countries to which the other same-firm affiliates have better market access are more likely to be shut down.

Our results imply that, as trade liberalization proceeds, the distribution of overseas affiliates in each MNE will be regionally dispersed. Then, country characteristics become important in determining which affiliate within each region will be shut down. The affiliates locating in countries without the large agglomeration of Japanese affiliates will be more likely to be shut down. The same is true for affiliates locating in the higher wage countries. Also, we found that the higher probability of affiliates' exit in countries with multiple affiliates within the same country. In this case, affiliate characteristics become important in determining which affiliate within each country will be shut down. One important element is affiliates' size. The relatively large-sized affiliates among same firm's affiliates are more likely to survive.

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Appendix

Sample Countries

Region	Countries
NAmerica	USA; CAN
MSAmerica	BRA; MEX; VEN; COL; ARG; CHL; PER
ASEAN	THA; MYS; IDN; PHL; VNM
NIES	TWN; KOR; SGP
China	CHN
Other Asia	IND; LKA; BGD
WEurope	GBR; DEU; FRA; ESP; ITA; NLD; IRL; PRT; SWE; AUT; DNK; GRC; NOR
EEurope	HUN; FIN
Oceania	AUS; NZL
Africa	ZAF