Location Strategy of Japanese Multinationals:
Evidence in the ASEAN and China

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30th March 2020

Location strategy of Japanese multinationals: Evidence in the ASEAN and China

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Abstract

In this paper we analyze choices by multinational enterprises in the locations of their overseas business bases focusing on Japanese manufacturing MNEs that extend to the Asian region. We first propose a theoretical model incorporating with firm heterogeneity in which firms face a choice between two locations for their overseas production base. The model predicts that the firms will be sorted in terms of overseas location patterns based on their productivity levels. We then perform an empirical analysis utilizing firm-level data for the period of years 2001 through 2015 from Japanese governmental surveys. Our multinomial logit estimation with the sample of manufacturing firms having an overseas affiliate(s) in China and/or the ASEAN countries indicates that the relative likelihood of having an affiliate(s) in the ASEAN to having one(s) in China is higher for a firm with higher productivity, and so is the relative likelihood of having affiliates in both locations, which is consistent with the predicted location patterns by the theoretical model in a certain case. Our binomial logit estimation also supports the model for its sharper prediction that more productive firms tend to extend to both of the two locations rather than extending to either one.

Keywords: Firm heterogeneity, Multinational enterprises, Location strategy, China, ASEAN

JEL Classification: F23, D21, D22

1. Introduction

For the last two or three decades, multinational enterprises (MNEs) have formed supply chain networks across countries, slicing up their production processes and re-allocating them. In those networks, international trade has been intensified as intra-firm or arm's length transactions based on foreign direct investment (FDI). The Japanese MNEs have also formed regional supply chain networks through East Asian countries. For the last decades, China has been the largest destination of FDI by the Japanese MNEs because of its preferential policies for foreign capital, a large amount of cheap labor force, geographical advantages, and large markets. In particular, China's accession to the WTO (2001) accelerated this movement. The Japanese MNEs also shifted some production processes to the member states of the Association of South East Asian Nations (ASEAN) in the late 1980s and in the last decade. The former shift was caused by a sharp appreciation of the Japanese yen since the Plaza Accord in 1985, and the latter was caused by development of regional integration among ASEAN members, particularly, inauguration of ASEAN Economic Community (AEC) in 2015, and strategies of risk diversification by the Japanese MNEs. They started to re-shift parts of production processes to ASEAN because of a hike of wages and political and institutional risks in China in the last decade.[1]

Many economists have paid attention to the activity of MNEs and recently examine it within the theoretical framework of international trade and FDI incorporating firm heterogeneity. Helpman et al. (2004) point out that firms with low, mid-range, and high productivity become domestic, export, and FDI firms,

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[1] This movement is called "China plus one".

respectively. Nishiyama and Yamaguchi (2010) show that firms become domestic, export, FDI, and reimport firms in ascending order of their productivity.[2] Those studies focus on the relationship between the choice of firm type and productivity and much of them conclude that the productivity of a firm undertaking FDI is higher than that of other types of firm.[3] Some also applied those models to examine the location choice for FDI by MNEs. Among them, Grossman et al. (2006) suggest a North-South model that the most productive firms move both the intermediate and assembly stages into developing countries. Aw and Lee (2008) theoretically and empirically show that the most productive Taiwanese firms in the computer and telecommunications equipment industries invest in both developed and developing countries. Chen and Moore (2010) find that more productive French MNEs tend to invest in relatively tough host countries, considering the effects of the country's own characteristics on the location choices of firms. Han et al. (2012) show that both host country' characteristics and firm heterogeneous factors work in decision making of the location choice using data of the Korean manufacturing MNEs. Rasciute et al. (2014) empirically examine their theoretical model to explain MNEs' location decisions using firm-level FDI data from EU, Norway, Switzerland, Russia, Japan and the US to central and eastern European countries.

The purpose of this paper is to theoretically and empirically investigate the FDI location decision by MNEs considering firm heterogeneity. To this end, we develop a theoretical model to explain MNEs' multi-

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[2] Tomiura (2007) find that FDI firms are distinctively more productive than foreign outsourcers and exporters using the Japanese firm data.

[3] Norbäck (2001) suggests that high tech (or R&D intensive) Swedish firms tend to choose exports rather than FDI to enter developed country markets. Arnold and Hussinger (2010) empirically examine the relationship between productivity and patterns of international trade and production using firm-level data of German manufacturing. Francis et al. (2018) find that more productive firms have larger multinational activities in terms of both scope and scale using European MNEs' data.

location strategies in production. In addition, we apply this model to illustrate the actual FDI location choices

between ASEAN and China by the Japanese MNEs. Compared to the existing papers, this study has the

following theoretical and empirical advantages. Theoretically, our asymmetric-country model with firm

heterogeneity can illustrate two different combinations of the location choice strategies between the higher

and the lower wage countries corresponding to the variable and fixed costs of those countries and firm

productivity. It is applicable for the cases where the relations between the fixed costs and the wage levels in

the host countries are complicated. In discussion of the location choices, this advantage is very important

because inconsistent orders between fixed costs and wage levels across countries are possibly observed.

Empirically we construct a detailed dataset of the location choices and productivity levels for the Japanese

manufacturing firms. Using this dataset, we examine which prediction from our model describes the location

choices of those firms between ASEAN and China since China's accession to the WTO.

The remainder of this paper is organized as follows. The next section 2 describes our theoretical model.

In the following section 3 we describe our empirical analysis including the data, methodology, and estimation

result. The final section 4 concludes the paper with discussion on the limitation of the current analysis and a

potential direction to future extension.

2. The model

We construct a firm-heterogeneity model in which firms engaging in production face decisions regarding

where to locate their plant to sell their goods on the global market, with the goal of examining the relationship

between a firm's productivity and its location strategy. In our model, local affiliates (plants) of home MNEs produce goods for country A and B. In order to focus of our analysis on the behavior of foreign subsidiaries, suppose that head office in the home country does not engage in goods production and there is no consumption market in the home, that is, we omit the production and sales of the goods in the home country from our model. We also assume that homogeneous labor is the only input for production and country A is the lower wage country than country B.

A representative consumer has a constant elasticity of substitution (CES) utility function over varieties,

$U_i = \left(\int_{v \in V} q_i(v)^\rho dv \right)^{1/\rho}$ ($i = A,\ B$), where $0 < \rho < 1$, the measure of the set V represents the mass of available goods, and $q_i(v)$ is the consumption demand of the differentiated goods indexed by v. As usual in the literature, utility maximization yields the following demand function:

$$q_i(v) = \frac{Y_i}{P_i} \left(\frac{p_i(v)}{P_i} \right)^{-\sigma}, \tag{1}$$

where $P_i = \left(\int_{v \in V} p_i(v)^{1-\sigma} dv \right)^{\frac{1}{1-\sigma}}$ is the price index, p_i is the price of the differentiated goods, Y_i is the aggregate expenditure, and $\sigma \equiv (1 - \rho)^{-1} > 1$ is the elasticity of the substitution between any two goods.

There is a continuum of monopolistically competitive firms with different productivity levels indexed by $\emptyset$. The firm consists of a home head office, which makes the location decision, and one or two plants located in country A and/or B devoted to the production activity. If the goods selling in each market can be produced from either or both of these two countries, there will be the four (2×2) possible combinations of location strategies; $[AA]$, $[BB]$, $[AB]$, and $[BA]$, in theory. We define *strategy* $[ij]$ as the choice set of production locations, with i and j corresponding to destinations specified as country A and B,

respectively. For example, $[BB]$ indicates the location strategy of a firm that serves both countries' market

from a plant only in country B. We, however, exclude $[BA]$, because the profit of a firm adopting this

strategy must be lower than that adopting $[AB]$ due to transport cost. The profit functions of these three

possible strategies; $[AA]$, $[BB]$, $[AB]$, are respectively shown as $\pi_{AA} = (p_A q_A - l_A^A) + (p_B q_B - l_A^B) - f_A$;

$\pi_{BB} = (p_A q_A - w_B l_B^A) + (p_B q_B - w_B l_B^B) - f_B$; and $\pi_{AB} = (p_A q_A - l_A^A) + (p_B q_B - w_B l_B^B) - f_A - f_B$,

where we regard f_i as the fixed cost of forming a plant and a distribution/servicing network in the foreign

market, etc., l_i^j is the labor input to produce goods in country i for the j-country's market, and w_B shows

the wage in country B.[4] To simplify notations, we normalize the wage in country A to one, then w_B also

shows the relative wage $(w_A = 1 < w_B/w_A = w_B)$. The production functions are shown as $\emptyset l_A^A = q_A$,

$\emptyset l_A^B = tq_B$, $\emptyset l_B^A = tq_A$, and $\emptyset l_B^B = q_B$. The per-unit transport cost, $t > 1$, is modeled on the iceberg

formulation.

The profit maximization of the firm adopting each strategy yields the following optimal prices:

$\quad$ *Strategy* $[AA]$: $p_A = \frac{1}{\rho\emptyset}$, $p_B = \frac{t}{\rho\emptyset}$, $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (2a)

$\quad$ *Strategy* $[BB]$: $p_A = \frac{tw_B}{\rho\emptyset}$, $p_B = \frac{w_B}{\rho\emptyset}$, $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (2b)

$\quad$ *Strategy* $[AB]$: $p_A = \frac{1}{\rho\emptyset}$, $p_A = \frac{w_B}{\rho\emptyset}$. $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (2c)

Substituting (2a)-(2c) into the profit functions, we obtain the followings:

$\quad$ *Strategy* $[AA]$: $\pi_{AA}(\varphi) = \frac{m}{\sigma}\left(1 + \frac{y}{\tau}\right)\varphi - f_A$, $\qquad\qquad\qquad\qquad\qquad\qquad$ (3a)

$\quad$ *Strategy* $[BB]$: $\pi_{BB}(\varphi) = \frac{m}{\sigma}\left(\frac{1}{\omega\tau} + \frac{y}{\omega}\right)\varphi - f_B$, $\qquad\qquad\qquad\qquad\qquad\qquad$ (3b)

$$\textit{Strategy } [AB]: \ \pi_{AB}(\varphi) = \frac{m}{\sigma}\left(1 + \frac{y}{\omega}\right)\varphi - f_A - f_B, \tag{3c}$$

where $m \equiv (\rho P_A)^{\sigma-1} Y_A$ suggests the mark-up adjusted demand for the goods to serve country A, $y \equiv$

$P_B{}^{\sigma-1} Y_B / P_A{}^{\sigma-1} Y_A$ denotes the relative demand index, $\tau \equiv t^{\sigma-1} > 1$ is the transport cost index, $\omega \equiv$

$w_B{}^{\sigma-1} = (w_B/w_A)^{\sigma-1} > 1$ is the relative wage index, and $\varphi \equiv \emptyset^{\sigma-1}$ is the productivity index. In *Strategy*

$[AA]$ shown as (3a), firms produce goods in the low-wage country (country A) to serve the local market

and export a part of their production to the high-wage country (country B). That is, in this case, the goods

are produced only in country A mainly to save labor and transport costs, and hence this strategy combines

elements of horizontal FDI and export platform FDI.[5] Next, in *Strategy* $[BB]$ shown as (3b), firms build a

plant in country B to save transport costs rather than production costs. Therefore, this strategy seems to be

motivated mainly by market access incentive. Finally, in the words of Aw & Lee (2008), *Strategy* $[AB]$ is

one of complete FDI, whereby the goods are produced and sold in each country's markets.

We here compare the profits, (3a)-(3c), attainable for a firm with the measure of the productivity index,

φ. In this considering, we examine the both of *Case 1* ($f_A < f_B$) and *Case 2* ($f_A > f_B$), because we consider

that the fixed cost in ASEAN might be either higher or lower than that in China (see footnote 14).

Case 1: $f_A < f_B$

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[5] According to the existing literature of trade and FDI, FDI can roughly be divided into the following types: horizontal FDI (H-FDI); vertical FDI (V-FDI); export-platform FDI (EP-FDI), and complex integration strategy (C-FDI). H-FDI discussed in Markusen (1984) is what is implemented between analogous countries (there are no differences in factor prices between them) to save transport cost. Both V-FDI and EP-FDI are ways to save production costs by moving a part of production process to low-wage countries, but V-FDI firm exports back its producing goods to the home country (see Helpman, 1984), while EP-FDI firm exports to the third-market (see Ekholm et al., 2007). C-FDI is a strategy of MNEs that involves horizontal integration in some countries to save on transport cost and vertical integration in others to take advantage of factor price differentials (see Grossman et al., 2006; Yeaple, 2003; and UNCTAD, 1993, 1998).

First, we examine *Case 1* ($f_A < f_B$). In this case, we assume the following three conditions to make our analysis realistic:[6]

$$\omega < \tau, \tag{4a}$$

$$\frac{\tau\omega-1}{\tau-\omega} < y, \tag{4b}$$

$$\frac{1+\tau y}{\omega(\tau+y)} < \frac{f_B}{f_A} < \frac{y(\tau-\omega)}{\tau\omega-1}. \tag{4c}$$

The condition (4a) suggests the situation that transport cost hovers at a high level. The condition (4b) corresponds to the case that the level of y remains at a high level, that is, the demand for the goods serving country B is much larger than that serving country A. Under these conditions, profit functions, (3a)-(3c), in *Case 1* are illustrated as *Figure 1*. Because of the conditions (4a) and (4b), the tangent slope of π_{AB} is steeper than π_{BB} and the tangent slope of π_{BB} is steeper than π_{AA}. The lowest productivity in each of the *strategy* $[AA]$, $[BB]$, and $[AB]$ is respectively given by $\pi_{AA}(\varphi_1) = 0$, $\pi_{AA}(\varphi_2) = \pi_{BB}(\varphi_2)$, and $\pi_{BB}(\varphi_3) = \pi_{AB}(\varphi_3)$ as follows:

$$\varphi_1 = \frac{\sigma}{m}\frac{\tau}{\tau+y}f_A > 0, \tag{5a}$$

$$\varphi_2 = \frac{\sigma}{m}\frac{\tau\omega}{y(\tau-\omega)-(\tau\omega-1)}(f_B - f_A) > 0 \ (\because (4b)), \tag{5b}$$

$$\varphi_3 = \frac{\sigma}{m}\frac{\tau\omega}{\tau\omega-1}f_A > 0. \tag{5c}$$

Under the condition (4c), the pecking order of these productivity levels becomes $\varphi_1 < \varphi_2 < \varphi_3$. We also find that, under the conditions (4b) and (4c), the profit levels at the intersections of π_{AA} and π_{BB}, and π_{BB} and π_{AB} must be positive (i.e., $\pi_{AA}(\varphi_2) = \pi_{BB}(\varphi_2) > 0$ and $\pi_{BB}(\varphi_3) = \pi_{AB}(\varphi_3) > 0$).

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[6] See Appendix, for the details of these conditions.

Each firm compares the profit in each strategy, π_{AA}, π_{BB}, and π_{AB}, and chooses its optimal strategy under the constraint of its productivity level. As a result, in *Case 1*, the firm, which belongs to the lowest ($\varphi_1 < \varphi < \varphi_2$), second-lowest ($\varphi_2 < \varphi < \varphi_3$), and highest productivity group ($\varphi_3 < \varphi$), chooses *Strategy* $[AA]$, $[BB]$, and $[AB]$, respectively.

Case 2: $f_A > f_B$

Second, in *Case 2*, i.e., the case of $f_A > f_B$, we assume the following conditions, besides (4a).

$$y < \frac{\tau\omega - 1}{\tau - \omega},\tag{6a}$$

$$\frac{y(\tau - \omega)}{\tau\omega - 1} < \frac{f_B}{f_A} < \frac{1 + \tau y}{\omega(\tau + y)}.\tag{6b}$$

Under the conditions (4a), (6a), and (6b), profit functions in *Case 2* can be illustrated as *Figure 2*. As shown in this figure, the tangent slope of π_{AB} is steeper than π_{AA} and the tangent slope of π_{AA} is steeper than π_{BB}, because of the conditions (4a) and (6a). In the same way as *Case 1*, we derive the lowest productivity of each strategy as follows:

$$\varphi_1 = \frac{\sigma}{m}\frac{\tau\omega}{1 + \tau y}f_B > 0,\tag{7a}$$

$$\varphi_2 = \frac{\sigma}{m}\frac{\tau\omega}{(\tau\omega - 1) - y(\tau - \omega)}(f_A - f_B) > 0 \quad (\because (6a)),\tag{7b}$$

$$\varphi_3 = \frac{\sigma}{m}\frac{\tau\omega}{y(\tau - \omega)}f_B > 0.\tag{7c}$$

The condition (6b) ensures $\varphi_1 < \varphi_2 < \varphi_3$. In addition, under the conditions (6a) and (6b), $\pi_{BB}(\varphi_2) = \pi_{AA}(\varphi_2) > 0$ and $\pi_{AA}(\varphi_3) = \pi_{AB}(\varphi_3) > 0$. In conclusion, in *Case 2*, the firm belongs to the lowest ($\varphi_1 <$

$\varphi < \varphi_2$), second-lowest ($\varphi_2 < \varphi < \varphi_3$), and highest productivity group ($\varphi_3 < \varphi$) chooses *Strategy* $[BB]$,

$[AA]$, and $[AB]$, respectively, as shown in *Figure 2*.

Figure 2 Profit functions and location strategies in Case 2

Now the question is; which strategy combination in *Case 1* or *Case 2* do Japanese firms adopt in reality?

As shown in *Table 1*, in the actual data of our dataset, Japanese MNEs seem to have adopted both cases in

the observation period (2001-2015). These uncertain results of our theoretical analysis and the actual

observation results motivate us to empirically explore the links between the location strategy of Japanese

MNEs and their productivities.

3. Empirical Analysis

3.1. Empirical Approach

In our empirical analysis we focus on the model's prediction about the relationship between the productivity

of firms and the firms' strategies on the location of their overseas production bases. In particular, we focus

on Japanese manufacturing firms that have an overseas affiliate(s) in China and/or a group of major Southeast

Asian economies (say, the ASEAN), and investigate the relationship between the productivity of those firms

and their location strategies—i.e., having an affiliate(s) only in China, having only in the ASEAN, or having

in both locations. We start with a simple comparison of the average productivity of the firms of those three

cases, and then take a more formal econometric approach to analyze the relationship between the

productivity and overseas location choices of the Japanese manufacturing firms.

3.2. Data

We use confidential firm-level data for the years 2001 through 2015 that have been collected and compiled

through the Basic Survey of Japanese Business Structure and Activities (or BSBSA, *Kigyou Katsudou Kihon*

Chousa) and the Basic Survey on Overseas Business Activities (or BSOBA, *Kaigai Jigyou Katsudou Kihon*

Chousa) by the Ministry of Economy, Trade and Industry of Japan. From the BSOBA data we can identify

whether or not each Japanese parent firm had an overseas affiliate(s) in a particular location (i.e., country)

in each year, and from the BSBSA data we can know the characteristics of the parent firm as of the

corresponding year, which we use to estimate the total factor productivity (TFP) of the parent firm.[7] For the

purpose of the current analysis, we focus on Japanese manufacturing firms that are reported in the BSOBA

data to have had one or more affiliates in either China or any of the nine ASEAN members except for

Singapore,[8] or both of these two locations (China and any ASEAN economy), in a certain year in the 15-

year period of 2001-2015.[9] We focus our location-pattern analysis on China versus the group of the ASEAN

economies due to expected similarity between these two locations in terms of the motivation of Japanese

manufacturing firms to FDI or having an affiliate as well as expected competitiveness between the two

locations in terms of serving the common market of the East and Southeast Asian region, which should fit

an environment that our theoretical model considers.

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[7] From the two survey datasets we identify and match the information on the parent firms using the common firm ID numbers.
[8] Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam.
[9] We limit our sample parent firms to those that do *not* have an overseas affiliate(s) in any countries or regions other than China and the ASEAN.

3.3. Location Patterns and Average Total Factor Productivity

We first conduct a quick examination on whether there is an observed relationship between a parent firm's productivity and the pattern of the location of its overseas affiliate(s) in the following three cases: affiliate(s) in China only, affiliate(s) in the ASEAN (any of the nine ASEAN members) only, and affiliates in both China and ASEAN. For it we categorize our sample parent Japanese firms into three groups corresponding to the three cases, and simply compare across the groups the average of the TFP estimated for each single firm belonging to each group.[10]

The comparison is presented in Table 1. Following the very first column indicating data years, the first three columns show the number of parent firms in our sample that have an overseas affiliate(s) in China only, those that have one(s) in the ASEAN only, and those that have ones in both of these locations, respectively, as of each year between 2001 and 2015.[11] The number of firms having an overseas affiliate(s) increased in every group during this 15-year period, but the increase was the most significant in the first group (an affiliate(s) in China only), whereas the number in the second group (an affiliate(s) in the ASEAN only) was stable relative to the other two groups.

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[10] The TFP of each parent firm is estimated using the BSBSA data and following the approach proposed by Levinsohn and Petrin (2003). We estimate the value-added TFP defining value-added as the sum of each firm's operational profits, total wages, rents, depreciation, and tax and dues. We use the tangible fixed assets as the proxy of capital. For labor inputs, following Morikawa (2010) we use person-hours calculated using data on the industry-level average hours worked that are available from the Monthly Labour Survey by the Ministry of Health, Labour and Welfare (https://www.mhlw.go.jp/english/database/db-l/monthly-labour.html). We exclude the observations of parent firms for which zero or a negative value is reported for the number of regular workers, tangible fixed assets, or total wages.

[11] We exclude the year of 2008 due to possible impacts of the global financial crisis on the overseas activities of Japanese manufacturing firms.

The next three columns of the table show the average TFP of the firms in each of these three groups.

Although the gaps in the average TFP between the groups are not very wide, it was a stable relationship

during the 15-year period (except for the year 2011[12]) that the average TFP was the highest for the group of

parent firms having overseas affiliates in both China and ASEAN (third group), the lowest for the group of

firms having an affiliate(s) in China only (first group), and in between for the group of firms having an

affiliate(s) in the ASEAN only (second group). Indeed, the average TFP of the firms that have affiliates in

both of the two locations was always higher than the average TFP of the firms having an affiliate(s) in either

of the two in every single year during the period, and this should be "quick and casual" evidence for our

theoretical model's prediction on a firm's TFP and overseas location strategy.

3.4. Econometric Analysis

3.4.1. Empirical Model

We now perform a more formal empirical analysis on the relationship between the productivity of Japanese

manufacturing firms and their overseas location patterns (i.e., having an affiliate(s) only in China, only in

the ASEAN, or in both locations) that is predicted by our theoretical model. We employ the multinomial

logit (MNL) model to test the prediction. More concretely, let us consider the following conditional

probability of firm i in choosing its overseas location pattern:

$$P(y_i = j | x_i) = \pi_{ij}, \ j = 1, 2, 3$$

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[12] In 2011, the average TFP of the firms in the second group (affiliates in the ASEAN only) was lower than that of the firms in the first group (affiliates in China only). The average TFP of the firms in the third group (affiliates in both) was the highest as in other years, however.

$$\pi_{ij} = \frac{\exp(x_i'\beta_j)}{\sum_{h=1}^{3} \exp(x_i'\beta_j)}$$

where $y_i=1$ when the firm has an overseas affiliate(s) in China only (pattern 1), $y_i=2$ when it has an affiliate(s) in the ASEAN only (pattern 2), and $y_i=3$ if it has one(s) in both China and the ASEAN (pattern 3). x_i indicates the vector of the characteristics of firm i. Without the loss of generality, let us take the pattern 1 as the benchmark and assume $\beta_1 = 0$ to simplify the probability function as follows:

$$\pi_{i1} = \frac{1}{1 + \sum_{h=2}^{3} \exp(x_i'\beta_h)}$$

$$\pi_{ij} = \frac{\exp(x_i'\beta_j)}{1 + \sum_{h=2}^{3} \exp(x_i'\beta_h)}, \quad j = 2, 3$$

Using panel data, we estimate the model in the following odds-ratio form:

$$\ln\left(\frac{\pi_{ijt}}{\pi_{i1t}}\right) = \beta_{tfp,j} \cdot \ln(tfp_{it}) + \beta_{size,j} \cdot \ln(size_{it}) + \beta_{age,j} \cdot \ln(age_{it}) + \gamma_{S,j}' \cdot S_i + \gamma_{T,j}' \cdot T_t, j = 2, 3 \qquad (8)$$

where tfp_{it} is the TFP of firm i at year t that is estimated as described in the preceding subsection 3.3, $size_{it}$ is the size of the firm measured as the total number of employees, and age_{it} is the firm's age as of year t. S_i is the vector of sector/industry dummies that capture time-invariant industry-specific factors that commonly affect every firm in that industry, and T_t is the vector of time dummies that capture year-specific shocks that commonly affect all firms.[13] Based on our preliminary finding from the comparison of the group-average TFP of the firms presented in the subsection 3.3, we expect $\hat{\beta}_{tfp,j} > 0$ for both $j = 2, 3$, and this should be testing the prediction of our theoretical model in Case 2 with the ASEAN as the location A and China as the location B. Although we have a direct measure of neither the fixed costs (f_A, f_B) nor demand sizes in the two locations, we believe that this is a convincing interpretation.[14]

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[13] More on the industries and time periods is described in the following subsection.
[14] The fixed entry costs to China should have been lowered in 2001 and afterward due to the country's accession to the WTO (note that our data period is between 2001 and 2015). Also, China should be larger than the group of

3.4.2. Estimation Result

Using the data on Japanese manufacturing firms described in the previous section 3.2., we estimate the equation (8), the log of the odds-ratio form of the MNL model. For the estimation, we separate the entire 15-year data period into four subperiods (simply "periods" hereinafter) as there might have been some changes in overall environment or trends in the business expansion overseas of Japanese manufacturing firms during this first 15 years in the twenty-first century. More concretely, we separate the 15-year period into the "pre-crisis" period of 2001 through 2007 and the "post-crisis" of 2009 through 2015,[15] and further split each of these two periods into halves. We thus separate the 15 years into the following four periods: 2001 through 2004 (4 years) as the period 1, 2005 through 2007 (3 years) as the period 2, 2009 through 2012 (4 years) as the period 3, and 2013 through 2015 (3 years) as the period 4. The estimation is performed separately for each of these four periods.

The result of the estimation is presented in Table 2. Following the very first column for the variable headings, the first pair of columns shows the result of estimation for the period 1 sample, the second pair of columns for the period 2, the third pair for the period 3, and the last pair of columns shows the result for the period 4. In each column pair, the first (or left) column shows the result of estimation for the log odds ratio of the probability of the overseas affiliate pattern 2 (in the ASEAN only) to that of the benchmark pattern 1 (in China only) (i.e., $\ln(\pi_{i2}/\pi_{i1})$), and the second (or right) column shows that of the probability of the pattern

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the ASEAN members as a market while the gap may not be extremely large. These should fairly fit the key assumptions of Case 2 of the theoretical model.

[15] As mentioned in an earlier footnote, we have excluded the year 2008 from our sample.

3 (affiliates in both China and the ASEAN) and the pattern 1 (i.e., $\ln(\pi_{i3}/\pi_{i1})$). All the estimation includes the

dummies indicating twelve industries in manufacturing[16] (eleven dummies, indeed) and the dummies

indicating three or four single years in each period (two or three dummies, indeed). Although it is not

statistically significant in the middle two periods (and it is not very significant economically, either, in the

period 3), the coefficient estimate on a firm's TFP is positive for both odds ratios of the patterns 2 to 1 and

of the patterns 3 to 1, as expected from the theoretical model (as mentioned in the previous subsection 3.4.1.).

This indicates that the likelihood of a Japanese manufacturing to locate its overseas affiliate(s) in the ASEAN

(only) relative to its likelihood to locate in China (only) tends to increase as the firm is more productive, and

so does the likelihood of a firm to locate in both locations relative to its likelihood to locate only in China.[17]

This estimation result thus supports overall the prediction of our theoretical model on a firm's productivity

and its overseas location pattern or strategy (particularly in its Case 2 described by Figure 2 with the location

"A" as the ASEAN and "B" as China). It is also noticeable that in the estimation for $\ln(\pi_{i3}/\pi_{i1})$ between the

patterns 1 (China only) and 3 (both), the influence of the size of a parent firm is significant, indicating that

a larger parent firm tends to have a higher likelihood to have affiliates in both locations relative to its

likelihood to have one(s) only in China. It is understandable as larger firms should have a larger motivation

to expanding their overseas business activities to multiple locations. The influence of the parent firm size is

not evident on the location choice between either one, however.

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[16] Manufacturing industries are classifies into the following twelve groups: Textiles; Lumber, wood, paper, and pulp; Chemicals, petroleum and coal; Rubber; Iron/steel and non-ferrous metals; Metal products; General machinery; Electric machinery; Transport machinery; Precision machinery; Food; and Others.
[17] Although not directly estimated through the MNL model, using this estimation result we can also know the impact of a firm's TFP on the odds ratio of its locating in both locations to its locating only in the ASEAN (i.e., π_{i3}/π_{i2}). We discuss it in the concluding section.

3.4.3. Estimation for Binomial Choices on One versus Two Locations

Although we believe that our theoretical model reasonably explains the choices or patterns of Japanese manufacturing firms in terms of their overseas affiliate locations, especially in its Case 2 with the ASEAN as "country A" and China as "country B," we cannot know whether what the model assumes for the countries A and B truly apply to the ASEAN and China, as we do not have directly measures of key variables in the model such as fixed costs for firms to expand their business in each location and the size of product demand in each market. Nevertheless, the model gives a clear prediction about the relationship between the productivity and overseas location choices of firms under much less restrictive conditions: a group of firms with high(er) productivity will choose to locate its overseas affiliates in two economies rather than one. We thus extend our empirical analysis to testing this prediction by reframing our empirical model into a binomial-choice setting. That is, we modify the odds-ratio form of our MNL model (equation (8)) to the following binomial model:

$$\ln\left(\frac{\pi_{i2t}}{\pi_{i1t}}\right) = \beta_{tfp} \cdot \ln(tfp_{it}) + \beta_{size} \cdot \ln(size_{it}) + \beta_{age} \cdot \ln(age_{it}) + \gamma_S' \cdot S_i + \gamma_T' \cdot T_t \qquad (9)$$

where the option 1 is locating an overseas affiliate(s) in either one of two economies (say, the ASEAN and China) whereas the option 2 is locating affiliates in both of these economies. For the logit estimation of the equation (9), we re-group our sample firms in the pattern 1 (affiliate(s) in China only) and those in the pattern 2 (affiliate(s) in the ASEAN only) in the previous MNL estimation into one integrated group (for the option 1, having an affiliate(s) in either one economy), and maintain the sample firms in the pattern 3 (affiliates in

both) as the group for the option 2. In the same manner as for the MNL estimation described above, we separate the entire 15-year sample periods into the four 2-/3-year periods and perform the estimation in each period separately.

The result of the estimation is presented in Table 3. Following the very first column for variable headings, the first column shows the estimation result for the first period of 2001-04, the second column for the second period of 2005-07, the third for the period 3 of 2009-12, and the last column shows the result for the period 4 of 2012-15. The result indicates that the likelihood of have their overseas affiliates in both of the two locations (i.e., China and the ASEAN) relative to that of having one(s) in either of them was higher for a Japanese manufacturing firm with higher productivity. This evidence supports the prediction of our theoretical model, whereas the estimated coefficient is not statistically significant for any period. The estimated impact of a firm's TFP was relatively larger in the earlier (or pre-crisis) periods 1 and 2 while it was much smaller in the later (or post-crisis) two periods. In addition, the estimation indicates that the parent firm size in terms of employment had a significant impact on the choice between only one location and two, consistently across the four periods, and this should reasonably indicate that a larger parent firm tends to extend its business to multiple overseas locations rather than a single.[18]

4. Conclusion and Discussion

In this paper we analyze choices by multinational enterprises in the locations of their overseas business bases

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[18] We have found a similar impact of the size of a parent firm on its choice between an affiliate(s) in China only and ones in both China and the ASEAN in the MNL estimation presented in Table 2.

focusing on Japanese manufacturing MNEs that extend to the Asian region. We first propose a theoretical model incorporating with firm heterogeneity in which firms face a choice between two locations for their overseas production base. The model predicts that the firms will be sorted in terms of overseas location patterns based on their productivity levels. We then perform an empirical analysis utilizing firm-level data for the period of years 2001 through 2015 from Japanese governmental surveys. Our multinomial logit estimation with the sample of manufacturing firms having an overseas affiliate(s) in China and/or the ASEAN countries indicates that the relative likelihood of having an affiliate(s) in the ASEAN to having one(s) in China is higher for a firm with higher productivity, and so is the relative likelihood of having affiliates in both locations, which is consistent with the predicted location patterns by the theoretical model in a certain case. Our binomial logit estimation also supports the model for its sharper prediction that more productive firms tend to extend to both of the two locations rather than extending to either one.

Finally, we would like to discuss the limitation of the current analysis and potential direction of our future work by taking up a "puzzle" that we face. In our logit estimation we do not directly examine the relationship between the productivity of firms and their overseas location choices between the ASEAN only (pattern 2 in our MNL estimation) and both China and the ASEAN (pattern 3). However, we can know it from the result of our MNL estimation, as from the equation (8) the odds ratio of the pattern 3 to the pattern 2 is derived in the following manner:

$$\ln\left(\frac{\pi_{i3t}}{\pi_{i2t}}\right) = \ln\left(\frac{\pi_{i3t}}{\pi_{i1t}}\right) - \ln\left(\frac{\pi_{i2t}}{\pi_{i1t}}\right)$$

$$= (\beta_{tfp,3} - \beta_{tfp,2}) \cdot \ln(tfp_{it}) + (\beta_{size,3} - \beta_{size,2}) \cdot \ln(size_{it}) + (\beta_{age,3} - \beta_{age,2}) \cdot \ln(age_{it})$$

$$+(\gamma'_{S,3} - \gamma'_{S,2}) \cdot S_i + (\gamma'_{T,3} - \gamma'_{T,2}) \cdot T_t$$

From this formula, we should expect $\hat{\beta}_{tfp,3} - \hat{\beta}_{tfp,2} > 0$ as our theoretical model predicts that firms with

higher productivity will choose to locate their affiliates in both China and the ASEAN rather than in the

ASEAN only. However, the result of our MNL estimation (presented in Table 2) implies $\hat{\beta}_{tfp,3} - \hat{\beta}_{tfp,2} <$

0 especially for the period 1 (2001-04) and period 4 (2013-15), which indicates that, with firm size being

controlled, the relative likelihood of a Japanese manufacturing firm's locating an overseas affiliate only in

the ASEAN to its locating them in both China and the ASEAN was *higher* for a more productive firm in the

early 2000s and the more recent mid 2010s. One possible reason for this that we can conjecture, especially

for the early-2000s period, is the following: In an earlier time such as 1990s, the ASEAN countries may have

been of the major target destinations of Japanese manufacturing firms for their overseas operations. The

costs and thus the required productivity for the firms to locate an affiliate in the ASEAN were higher than is

it today, so those firms that set up an affiliate in that early period were very productive. Relatively non-large

firms among those productive firms may have remained only in that one location (the ASEAN). Our data for

the early-2000s period might pick up such productive firms that had put an affiliate(s) in the ASEAN in an

earlier period,[19] since in our data we can only know whether each firm had an overseas affiliate(s), either

new or existing, as of each year, whereas our theoretical model describes a firm's location choice for their

new affiliate (i.e., entry). Due to the limitation of the data to which we had access for the purpose of the

current analysis, we have no way to conduct more detailed investigation for this conjecture. On the other

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[19] This conjecture is indeed consistent with the positive and significant coefficient estimate on the parent firm's age for the ASEAN/China odds ratio in the period 1 (see Table 2).

hand, the puzzle found for the mid-2010s period could be related to possible relocation and

(re-)concentration of the overseas affiliates of Japanese manufacturing firms, which the current theoretical

model does not take into account. This puzzle may suggest us the significance of more extended or deeper

theoretical and empirical analysis on firms' overseas location (and relocation) strategies, hoping that we be

able to obtain access to more detailed data on Japanese firms and their overseas affiliates.

Appendix: Parameter constraints and profit functions

In Appendix, we show how parameter constraints, i.e., the conditions (4a-c), relate to profit functions in

Case 1 illustrated in *Figure 1* in detail.[20]

A.1 Tangent slope

First, we confirm the connection between the tangent slopes of profit functions and the conditions (4a) and

(4b). Comparing the coefficient of φ in (3a) with (3b), in (3b) with (3c), and in (3a) with (3c), we find that;

(α) under the conditions (4a) and (4b), the tangent slope of π_{BB} is steeper than π_{AA},

(β) the tangent slope of π_{AB} is steeper than π_{BB} ($\because \tau > 1$ and $\omega > 1$),

(γ) the tangent slope of π_{AB} is steeper than π_{AA}, because of the condition (4a).

Proofs:

Subtracting the coefficients of φ in (3b) from (3a), we have

$$\frac{m}{\sigma}\left(\frac{1}{\omega\tau} + \frac{y}{\omega}\right) - \frac{m}{\sigma}\left(1 + \frac{y}{\tau}\right) = \frac{m}{\sigma}\left(\frac{1 + \tau y - \omega\tau - \omega y}{\omega\tau}\right) = \frac{m}{\sigma}\left[\frac{y(\tau - \omega) - (\tau\omega - 1)}{\omega\tau}\right]. \tag{A1}$$

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[20] The links between the conditions (4a), (6a), and (6b) and profit functions in *Case 2* can be confirmed in analogy with *Case 1*.

If $\omega < \tau$ and $\tau\omega - 1 < y(\tau - \omega)$, the sign of (A1) is positive (note that $\tau\omega - 1 > 0$). Therefore, under the conditions (4a) and (4b), the tangent slope of π_{BB} is steeper than that of π_{AA} as noted in (α).

Next, as for (β), subtracting the coefficients of φ in (3c) from (3b), we derive

$$\frac{m}{\sigma}\left(1 + \frac{y}{\omega}\right) - \frac{m}{\sigma}\left(\frac{1}{\omega\tau} + \frac{y}{\omega}\right) = \frac{m}{\sigma}\left(\frac{\omega\tau - 1}{\omega\tau}\right). \tag{A2}$$

The sign of (A2) must be positive ($\because \tau > 1$ and $\omega > 1$), and hence the tangent slope of π_{AB} is steeper than that of π_{BB}.

Subtracting the coefficients of φ in (3c) from (3a), we obtain

$$\frac{m}{\sigma}\left(1 + \frac{y}{\omega}\right) - \frac{m}{\sigma}\left(1 + \frac{y}{\tau}\right) = \frac{m}{\sigma}\left[\frac{y(\tau - \omega)}{\omega\tau}\right]. \tag{A3}$$

The sign of (A3) is positive under the condition (4a). Therefore, as noted in (γ), the tangent slope of π_{AB} is steeper than that of π_{AA}. ∎

A.2 Pecking order of the lowest productivity in each strategy

Second, regarding the pecking order of φ_1, φ_2, and φ_3, considering the condition (4c), we can confirm

that $\varphi_1 < \varphi_2 < \varphi_3$.

Proofs:

Using (5a) and (5b), we obtain the followings:

$$\varphi_2 - \varphi_1 = \frac{\sigma}{m}\left[\frac{\tau\omega}{y(\tau - \omega) - (\tau\omega - 1)}(f_B - f_A) - \frac{\tau}{\tau + y}f_A\right] = \frac{\sigma}{m}\frac{\tau}{y(\tau - \omega) - (\tau\omega - 1)}\frac{\omega(\tau + y)f_B - (1 + \tau y)f_A}{\tau + y}. \tag{A4}$$

Considering $y(\tau - \omega) - (\tau\omega - 1) > 0$ (condition (4b)), we find that the sign of (A4) depends on the sign

of $\omega(\tau + y)f_B - (1 + \tau y)f_A$. If $\omega(\tau + y)f_B > (1 + \tau y)f_A \leftrightarrow \frac{1 + \tau y}{\omega(\tau + y)} < \frac{f_B}{f_A}$, then the sign of (A4) becomes

positive, i.e., $\varphi_2 > \varphi_1$, under the condition (4c). Next, from (5b) and (5c), we also derive

$$\varphi_3 - \varphi_2 = \frac{\sigma}{m}\left[\frac{\tau\omega}{\tau\omega - 1}f_A - \frac{\tau\omega}{y(\tau - \omega) - (\tau\omega - 1)}(f_B - f_A)\right] = \frac{\sigma}{m}\frac{\tau\omega}{\tau\omega - 1}\frac{y(\tau - \omega)f_A - (\tau\omega - 1)f_B}{y(\tau - \omega) - (\tau\omega - 1)}. \tag{A5}$$

Therefore, if $y(\tau - \omega)f_A > (\tau\omega - 1)f_B \leftrightarrow \frac{f_B}{f_A} < \frac{y(\tau - \omega)}{\tau\omega - 1}$, the sign of (A5) becomes positive, i.e., $\varphi_3 > \varphi_2$,

because of the condition (4c). Finally, we can easily find that $\varphi_3 > \varphi_1$ from (5a) and (5c). ∎

A.3 Profit levels at the intersection points

Third, we confirm the profit levels at the intersections of π_{AA} and π_{BB}, and π_{BB} and π_{AB}. From a conclusion, under the condition (4b) and (4c), the signs of both $\pi_{AA}(\varphi_2) = \pi_{BB}(\varphi_2)$ and $\pi_{BB}(\varphi_3) = \pi_{AB}(\varphi_3)$ become positive as proved below.

Proofs:

Substituting (5b) into (3b), we have

$$\pi_{BB}(\varphi_2) = \frac{m}{\sigma}\left(\frac{1}{\omega\tau} + \frac{y}{\omega}\right)\frac{\sigma}{m}\frac{\tau\omega}{y(\tau-\omega)-(\tau\omega-1)}(f_B - f_A) - f_B = \frac{\omega(\tau+y)f_B - (1+\tau y)f_A}{y(\tau-\omega)-(\tau\omega-1)}.$$

Considering the conditions of (4b) and (4c), we find that $\pi_{BB}(\varphi_2) > 0$. Note that, substituting (5b) into (3a), we can confirm that $\pi_{AA}(\varphi_2) = \pi_{BB}(\varphi_2)$. Substituting (5c) into (3c), we have

$$\pi_{AB}(\varphi_3) = \frac{m}{\sigma}\left(1 + \frac{y}{\omega}\right)\frac{\sigma}{m}\frac{\tau\omega}{\tau\omega-1}f_A - f_A - f_B = \frac{1+\tau y}{\tau\omega-1}f_A - f_B.$$

Considering $(\tau\omega - 1)f_B < y(\tau - \omega)f_A$ (derived from (4c)) and $y(\tau - \omega)f_A < (1 + \tau y)f_A$ ($\because 1 + \tau y - y(\tau - \omega) = 1 + \omega y > 0$), we find that $(\tau\omega - 1)f_B < y(\tau - \omega)f_A < (1 + \tau y)f_A$. Therefore, we confirm that $f_B < \frac{1+\tau y}{\tau\omega-1}f_A \leftrightarrow \pi_{AB}(\varphi_3) > 0$. We find that $\pi_{BB}(\varphi_3) = \pi_{AB}(\varphi_3)$ by substituting (5c) into (3b). ■

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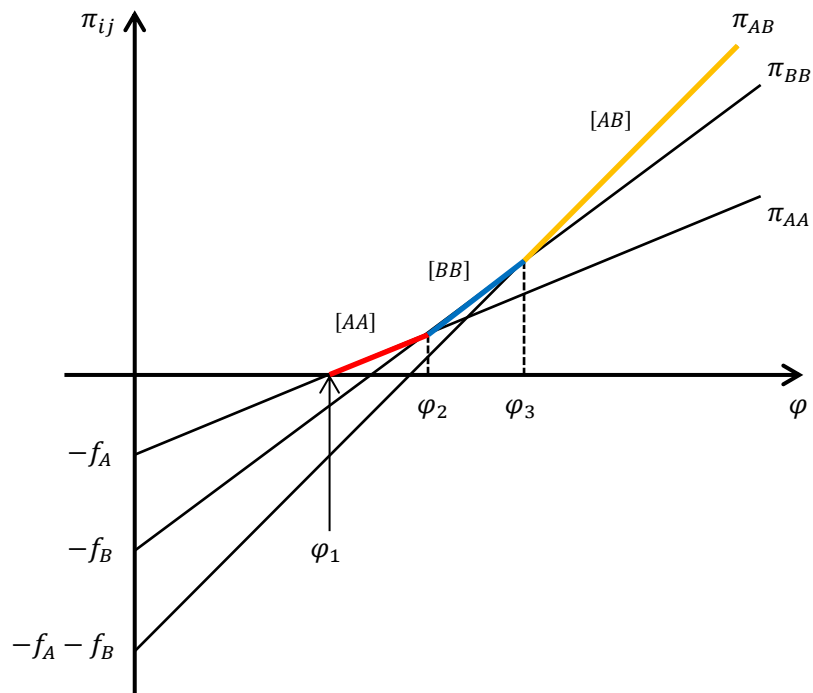*Figure 1 Profit functions and location strategies in Case 1*

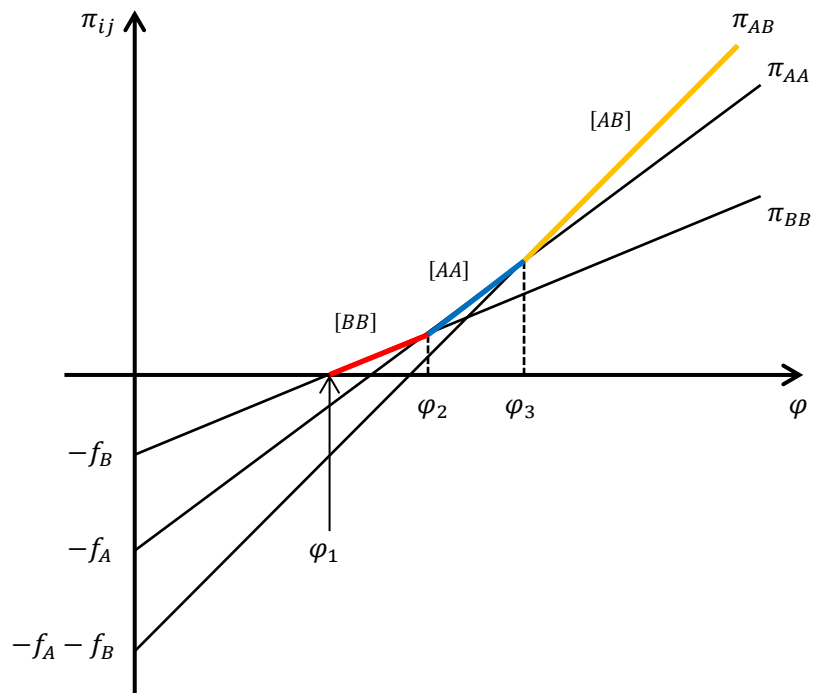*Figure 2 Profit functions and location strategies in Case 2*

Table 1. Average Productivity and Overseas Affiliate Location Patterns of Japanese Manufacturing Firms

Year	Number of Firms			Average TFP		
	(1) China only	(2) ASEAN only	(3) Both	(1) China only	(2) ASEAN only	(3) Both
2001	151	237	197	9.954	10.123	10.416
2002	176	230	255	9.896	10.122	10.452
2003	232	208	275	9.974	10.131	10.463
2004	317	212	348	10.050	10.155	10.466
2005	379	217	363	8.871	8.967	9.175
2006	422	226	389	8.969	9.005	9.311
2007	565	299	461	8.974	8.980	9.313
2009	691	313	471	10.312	10.320	10.721
2010	764	338	498	10.431	10.484	10.890
2011	858	351	571	10.649	10.501	10.907
2012	976	397	650	10.412	10.451	10.849
2013	1039	459	683	9.485	9.528	9.894
2014	992	468	695	9.482	9.527	9.905
2015	1016	496	744	9.442	9.465	9.859

Notes: Japanese manufacturing firms that have an overseas affiliate(s) only in either or both of China and the group of the ASEAN member countries except for Singapore are identified from the Basic Survey of Japanese Business Structure and Activities (BSBSA) and the Basic Survey on Overseas Business Activities (BSOBA). The firms are categorized into three groups: (1) having an affiliate(s) in China only, (2) having an affiliate(s) in the ASEAN only, and (3) having affiliates in both China and the ASEAN. The total factor productivity (TFP) of each parent firm is estimated using the BSBSA data following the approach by Levinsohn and Petrin (2003). The average TFP is the average of the estimated TFP of the individual firms in each group in each year.

Table 2. Result of the Multinomial Logit (MNL) Estimation on Firm Productivity and Overseas Location Patterns

	Period 1 (2001-04)		Period 2 (2005-07)		Period 3 (2009-12)		Period 4 (2013-15)	
	ASEAN/ China	Both/ China	ASEAN/ China	Both/ China	ASEAN/ China	Both/ China	ASEAN/ China	Both/ China
TFP	0.511*** (0.125)	0.360*** (0.128)	0.098 (0.107)	0.161 (0.101)	-0.012 (0.075)	0.013 (0.072)	0.166** (0.081)	0.094 (0.080)
Size	-0.054 (0.061)	0.691*** (0.062)	-0.043 (0.112)	0.650*** (0.048)	0.037 (0.041)	0.767*** (0.038)	-0.025 (0.042)	0.863*** (0.040)
Age	0.162* (0.084)	0.104 (0.080)	0.112 (0.078)	0.170** (0.071)	0.098 (0.059)	0.205*** (0.053)	0.110* (0.065)	0.033 (0.056)
Constant	-4.592 (1.098)	-8.106*** (1.117)	-1.848** (0.881)	-6.443*** (0.837)	-1.444** (0.687)	-6.258*** (0.658)	-2.817*** (0.718)	-6.920*** (0.696)
Industry dummies?	Yes		Yes		Yes		Yes	
Year dummies?	Yes		Yes		Yes		Yes	
N	2,832		3,316		6,882		6,585	
Psuedo R²	0.131		0.106		0.119		0.131	

Notes: The model is for a multinomial choice among the three options (patterns) of having an overseas affiliate(s) in China only (pattern 1, benchmark), having one(s) in the ASEAN only (patterns 2), and having ones in both locations (patterns 3). The odds-ratio form of the model expressed as the equation (8) in the main text is estimated. The left column for each period indicates the result of the estimation on the odds ratio of the patterns 2 to 1, and the right column indicates the result on the odds ratio of the patterns 3 to 1. Dummies indicating twelve (12) manufacturing industries and those indicating three (3) or four (4) single years in each period are included in the estimation. The standard errors are in parentheses. *, **, and *** indicate the significance at the level of 10%, 5%, and 1%, respectively.

Table 3. Result of the Binomial Logit Estimation on One vs. Two Locations

	Period 1 (2001-04)	Period 2 (2005-07)	Period 3 (2009-12)	Period 4 (2013-15)
	Both / Either	Both / Either	Both / Either	Both / Either
TFP	0.110 (0.112)	0.125 (0.094)	0.016 (0.069)	0.042 (0.076)
Size	0.710** (0.053)	0.666*** (0.044)	0.755*** (0.036)	0.870*** (0.037)
Age	0.036 (0.071)	0.131* (0.067)	0.175*** (0.050)	-0.002 (0.053)
Constant	-6.627*** (0.980)	-6.440*** (0.775)	-6.436*** (0.624)	-6.654*** (0.658)
Industry dummies?	Yes	Yes	Yes	Yes
Year dummies?	Yes	Yes	Yes	Yes
N	2,832	3,316	6,882	6,585
Psuedo R^2	0.161	0.145	0.165	0.187

Notes: The model is for a binomial choice between the two options (patterns) of having an overseas affiliate(s) in one location of either China or the ASEAN (option 1, benchmark) and having ones in two locations of both China and the ASEAN (option 2). The odds-ratio form of the model expressed as the equation (9) in the main text is estimated. Dummies indicating twelve (12) manufacturing industries and those indicating three (3) or four (4) single years in each period are included in the estimation. The standard errors are in parentheses. *, **, and *** indicate the significance at the level of 10%, 5%, and 1%, respectively.