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KEO Discussion Paper No. 137

Impact of Extensive and Intensive Margins of Foreign Direct Investment on Domestic Corporate Performance: Evidence from Japanese Automobile Parts Suppliers[*]

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Abstract

This study investigates the impact of foreign direct investment (FDI) on domestic corporate performance, using firm-level data of Japanese automobile parts suppliers. While previous studies used the propensity score matching method and focused mainly on the impact of the extensive margin of FDI, this study uses data on automobile makers' FDI as an instrumental variable for suppliers' FDI and estimates the impact of both extensive and intensive margins of FDI on domestic corporate performance. We find that while the intensive margin of FDI does not significantly impact corporate performance, the extensive margin positively impacts sales and total factor productivity. This effect is more profound in vertical FDI. Furthermore, the impact of the first flow of FDI is more profound than that of subsequent flows.

Key words: Foreign Direct Investment, Extensive and Intensive margins, Keiretsu network

JEL classification: F21, F23, L62

1. Introduction

In recent years, the impact of foreign direct investment (FDI) on domestic corporate performance has been a central concern among business circles and policy makers. As many firms from developed countries relocate their production sites to low-cost countries, there is concern expressed regarding "hollowing out," a phenomenon that refers to the potential negative employment impact of FDI on the developed economies.[2] On the other hand, firms that relocate labor-intensive production to low-cost countries tend to specialize in skill- or knowledge-intensive production in the home country. Thus, FDI might indirectly improve domestic productivity and promote the home country's exports of skill- or knowledge-intensive goods to its foreign subsidiaries.

Several studies have empirically examined the causal effect of FDI on domestic output, employment, and productivity. Debaera et al. (2010) examined this impact on Korean multinational enterprises (MNEs), Navaretti et al. (2010) on Italian and French MNEs, and Hayakawa et al. (2013) on Japanese MNEs. These studies used the propensity score matching method to tackle the endogeneity problem. This is because,

[2] Ando and Kimura (2015) and Kodama and Inui (2015) decompose the macro-level employment growth rate using job creation and destruction measures and documents the contribution of FDI firms to aggregate-level employment growth rate.

as Helpman et al. (2004) suggested, FDI has a selection effect: high-productivity firms are more likely to become multinationals; thus, to identify the causal effect of FDI, a simple comparison between MNEs and non-MNEs suffers from endogenous bias. Using the propensity score matching method has an advantage because it is applicable even when the appropriate instrumental variables are not available. However, this method has some drawbacks. First, while matching can eliminate selection-induced bias associated with observable firm characteristics, it cannot do so with unobservable characteristics. Second, the previous studies compared the impact of newly investing firms with their counterfactual impact in combination with a difference-in-difference (DID) estimator. In other words, the previous studies focused on the impact of the extensive margin of FDI, namely the change in firms' domestic performance before and after their first foreign investment.

Investigating the extensive margin of FDI restricts our attention to relatively small or young firms since large, established firms have relatively longer experience in FDI. Furthermore, the sales and procurement patterns of foreign subsidiaries change over time. For example, Belderbos et al. (2001) and Kiyota et al. (2008) demonstrated that the local procurement ratio of MNE subsidiaries increases as they accumulate experience in local operations. It means that an MNE subsidiary decreases imports from

its home country as the years of operation increase. Thus, the effect of FDI on production activities in the home country might change as a company's production size increases, suggesting that the impact of extensive margins of FDI might differ from that of intensive margins of FDI, namely in terms of an increase in production in the foreign subsidiaries.

Against this backdrop, the present study investigates the impact on corporate performance of not only the extensive margin of FDI but also the intensive margin, using transaction network data of the Japanese automobile parts industry. Many automobile parts suppliers in Japan are members of an automobile manufacturers' vertical Keiretsu. The automobile Keiretsu foster long-term relationships between assemblers and suppliers[3]. Thus, once automobile manufacturers relocate production sites abroad, some auto parts suppliers follow these manufacturers and also invest abroad. We use the transaction relationship of auto parts suppliers with automobile manufacturers as an instrument of auto parts suppliers' FDI[4]. An FDI decision by

[3] Keiretsu is a business group composed of companies with supply chain partners or an association of companies formed around a bank. The automobile manufacturers' vertical Keiretsu is different from the horizontal Keiretsu, which consists of the groups within the sphere of a main bank, such as Mitsubishi or Mitsui. The automobile Keiretsu members collaborate to carry out R&D projects to ensure stable supply. In the case of the horizontal Keiretsu, cross-shareholding among firms within the same Keiretsu is prevalent. However, this is not the case with automobile manufacturers in the vertical Keiretsu. For example, among 180 Toyota Keiretsu suppliers (members of the suppliers' association for Toyota), there are only 11 suppliers whose shareholding percentage by Toyota was greater than 50 percent in 1991.

[4] Previous studies, such as Head et al. (1995) and Yamashita et al. (2014), demonstrate that the FDI made by a transaction partner is one of the determinants of the decision to invest abroad. For

automobile manufacturers primarily depends on market size or trade costs, and it is unlikely that suppliers' performance affects automobile manufacturers' FDI decisions.

In this study, we focus on the Keiretsu relationship between suppliers and assemblers in the 1990s. This is because Nissan Motor, which ranks second in Japan after Toyota, began to redefine its Keiretsu relationship following the merger of Renault and Nissan Motor in 1999. Before the 1990s, the long-term supplier-assembler Keiretsu relationship was relatively stable; therefore, it is also less likely that automobile makers chose good suppliers and added them as Keiretsu members during our sample periods. Moreover, the timing and size of FDI in automobile production have varied among Japanese auto manufacturers. Thus, we believe that automobile makers' FDI is a good candidate for use as an instrumental variable.

Furthermore, there are two reasons why we focus on Japanese automotive industries. First, the automobile manufacturing industry has been actively investing abroad in the past 30 years, and it has the most developed international production networks. Thus, our research is a good case study for assessing the impact of internationalizing a production network. Second, firms in the automobile industry have

example, while Head et al. (1995) investigated the location choice of Japanese FDI in the U.S., focusing on the Keiretsu, Yamashita et al. (2014) use comprehensive sales-procurement transaction network data.

a broad transaction network both within the industry and across industries. This means that the restructuring of a production network associated with FDI will affect other firms through the intra- and inter-industry transaction networks. Accordingly, exploring the impact of FDI on corporate performance of Japanese automotive parts suppliers is an interesting case study.

The rest of this paper is organized as follows: Section 2 explains the pathway for the impact of FDI on corporate performance by introducing the conceptual framework and summarizing the previous studies. Section 3 provides the empirical methodologies and the treatment of the data used. The empirical results are presented in Section 4, and Section 5 discusses the interpretation. Finally, Section 6 summarizes and concludes this paper.

2. Pathway for the Impact of FDI on Corporate Performance

2.1 Conceptual framework

Before proceeding to the empirical investigation, we introduce the theoretical considerations regarding the impact of FDI on domestic corporate performance. Since the impact of FDI differs substantially depending on its type, we begin by explaining the nature of two types of FDI: horizontal FDI (HFDI) and vertical FDI (VFDI). HFDI

is motivated by the inclination to avoid broadly defined trade costs by establishing production facilities in a foreign market rather than exporting from the home country. In contrast, VFDI seeks to exploit the factor price gap between the home and the foreign countries. Therefore, in VFDI, firms relocate production activities that has a comparative advantage.

The impact of FDI on output and employment in the home country might be either negative or positive depending on whether activities at home and in the foreign country are complements or substitutes. In the case of HFDI, foreign investment substitutes exports from the home country. Therefore, output and employment in the home country decreases. Also, an increase in the number of foreign production sites raises the demand for certain services in the company headquarters at home. In the case of VFDI, a certain portion of the production activities shifts from one country to another, reducing domestic production and employment. However, these negative effects can be offset if the MNEs gain market share due to the cost savings induced by VFDI. In addition, VFDI firms often relocate labor-intensive production to a low-wage country. This stimulates intra-firm trade of intermediate goods from the home country to the foreign country.[5] As a result, domestic production of intermediate goods and the

[5] Many previous studies investigated the complementary relationship between FDI and

associated labor demand increase.

The impact on productivity also differs according to the type of FDI. Since HFDI reduces domestic production, productivity might decline due to the loss of economies of scale. However, if firms invest in locations with a high density of high-tech activities, foreign affiliates can be effective channels for transferring technological knowledge to the home country. Such knowledge transfer from the foreign country has a positive impact on productivity in the home country. In the case of VFDI, investing firms can improve productivity by sharing production across borders..

2.2 Previous studies

In this subsection, we briefly summarize the results of previous studies. Most recent studies classify FDI in developed countries and developing countries as either HFDI or VFDI, as summarized in Table 1. In regard to the effect on productivity, while Navaretti et al. (2010), in their study of Italy and France, and Hijzen et al. (2011), in their study of France, demonstrated that HFDI improves domestic productivity, Hayakawa et al. (2013), in their study of Japan, found that VDFI has positive significant effects on productivity. As for the impact on sales and employment, Navaretti et al. (2010) found

trade. For more details, see Fung et al. (2010), and Nishitateno (2013).

that both HFDI and VFDI had positive impacts on sales and employment. Hijzen et al. (2011) and Hayakawa et al. (2013), using French and Japanese firm-level data, respectively, also found that both HFDI and VFDI by French and Japanese firms increase domestic employment. In contrast, Debaera et al. (2010), in their study of Korea, did not find any positive impact on employment through either FDI type.

== Table 1 ==

The abovementioned previous studies used propensity score matching in combination with a DID estimator; therefore, these studies focused only on the extensive margin of FDI. However, there are some studies that investigated the impact of the intensive margin of FDI by estimating the labor demand function. For example, Harrison and McMillan (2011), in their study of the U.S.; Kambayashi and Kiyota (2015), in their study on Japan; and Muendler and Becker (2010), in their study of Germany, estimated the labor demand function for MNEs' domestic employment and examined whether or not FDI substitutes for domestic employment. These studies estimated the unconditional labor demand function derived from the translog cost function for MNEs and used the factor price in the foreign country as an independent

variable. As a result, the latter studies focus only on the labor substitution caused by the factor price gap between the home and foreign countries.[6] Moreover, these studies restrict their attention to labor demand only for MNEs. They do not compare the impact of the first flow and the subsequent flow of FDI on corporate performance variables[7].

3. Empirical Investigation

3.1. Methodology

We estimate the impact of FDI on firm-level outcome variables, such as sales, employment, value added and productivity using the following regression equation:

$$Y_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 X_{it} + \varepsilon_{it}, \qquad (1)$$

where Y_{it} is the outcome for firm i in year t, FDI_{it} is the dummy variable for FDI or the indicator for the scale of foreign production, X_{it} represents other firm characteristics,

[6] There are some studies that try to capture the overall picture of the contribution of FDI firms to macro-level employment growth. For example, Ando and Kimura (2015) and Kodama and Inui (2015) decomposed the macro-level rate using job creation and destruction indicators and documented the contribution of FDI firms to aggregate-level employment growth rate. However, these studies do not consider endogeneity issues.

[7] Muendler and Becker (2010) investigate the impact of both extensive and intensive margins of FDI on employment for German MNEs. However, their sample firms were restricted to non-MNEs that were to become MNEs during the sample period, implying that it might suffer from selection bias.

and ε_{it} is an error term. In this study, we focus on FDI in the U.S., Canada, the UK, Australia, Thailand, Malaysia, the Philippines, China, and Taiwan because these are the major destination countries for Japanese auto assemblers. Following Kambayashi and Kiyota (2015), in our estimation we use pairs of each firm's FDI to each destination country and corporate performance variables and estimate equation (1) by pooling nine FDI destination countries. Therefore, our sample has three dimensions: parent firm (*i*), FDI destination countries (*j*), and time (*t*)[8]. The equation to be estimated is represented as follows:

$$Y_{it} = \beta_0 + \beta_1 FDI_{it}^{j} + \beta_2 X_{it-1} + \varepsilon_{it}^{j}. \quad (2)$$

When estimating equation (2) via ordinary least squares, the coefficient for FDI need not represent the causal effect of FDI on the outcome variables because of endogenous bias. To isolate a source of variation in a firm's FDI, we use the Keiretsu automobile manufacturers' FDI (*AUTO-FDI*) as an instrumental variable. In addition, as

[8] One might question why FDI variables in the different countries are not placed as independent variables in one equation. There are two reasons. First, if we place several FDI variables as independent variables in one equation, we'll face multicollinearity problems. Second, aggregating country-level FDI indicators at a regional level might be one solution. However, the relationship between automobile manufacturers' FDI and suppliers' FDI should be identified at the country level, not at the regional level. Furthermore, it is hard to find an appropriate weight when aggregating FDI indicators at the regional level. Actually, we present the estimation results at regional-level in Table 12. However, estimation results do not have enough explanatory power.

other instrumental variables, we use the logged GDP for each destination country. In other words, we estimate the following first-stage regression equation:

$$FDI_{it}^{j} = \alpha_1 + \alpha_2 AUTO\_FDI_{it}^{j} + \alpha_3 logGDP_t^{j} + \gamma X_{it-1} + \nu_{it}^{j} \quad (3)$$

To distinguish the impact of the extensive margin and the intensive margin of FDI, we use two different measures of FDI: a dummy variable for FDI and the level of employment in the foreign affiliates (affiliate size). The former is the dummy variable, which takes the value 1 if firms have a foreign affiliate and 0 otherwise, and it is used to capture the extensive margin of FDI. Because our sample includes the decisions to invest in nine countries, represented by pairs of variables of domestic corporate performance and FDI in each destination country, the extensive margin of FDI in this study includes both the decision to engage in FDI for the first time and increases in in the number of affiliates' employees in destination countries for FDI. Affiliate size is the logged number of employees of the foreign affiliates and is used to capture the impact of the intensive margin of FDI.

When estimating the impact of the extensive margin of FDI, the endogenous variable in equation (2) is binary; we use an endogenous treatment-effect model. More

formally, the endogenous treatment-effect model is composed of two equations: one is the outcome variable *y*, and the other is the endogenous variable *D*,

$$\mathrm{y} = \mathbf{x}\beta + \gamma \boldsymbol{D} + \varepsilon \qquad (4)$$

$$\boldsymbol{D} = \begin{cases} 1, \text{if } \boldsymbol{w}\eta + v > 0 \\ 0, \text{otherwise} \end{cases}, \qquad (5)$$

where *x* is the covariate that affects the outcome *y* and $\boldsymbol{w}$ is the variable used to model treatment *D*. The error term and *u* are bivariate normal with mean 0 and have the following covariance matrix:

$$\begin{bmatrix} \sigma^2 & \rho\sigma \\ \rho\sigma & 1 \end{bmatrix}$$

Here, $\mathbf{x}$ and $\boldsymbol{w}$ are assumed to have no correlation with the error terms. Since this model cannot consider the nature of the panel data, we convert the outcome variables into the log-difference from year *t*-1 to year *t* (ΔY_{it}). We estimate the model focusing on samples that have no investment in year *t*-1. As for the intensive margin, since an endogenous variable is a continuous variable, we estimate equation (2) by a fixed-effect instrumental variable model.

3.2. Data source

In this study, we combine four types of firm-level data. The first one is the firm-level data acquired from the Basic Survey of Japanese Business Structure and

Activities (BSJBSA) compiled by the Ministry of Economy, Trade and Industry (METI), Japan. This survey began in 1991 and was conducted annually after 1994.[9] The BSJBSA statistically captures an overview of Japanese corporate firms that includes the diversification and globalization of corporate activities and strategies for R&D. As discussed in the introduction, we use this firm-level data for the automobile parts industry for 1991 and for the 1994–2000 period. We exclude suppliers whose shareholding ratio of automobile assemblers is greater than 50 percent since these suppliers might jointly decide with the automobile assemblers to invest abroad.

The other firm-level data are from the Basic Survey of Overseas Business Activities (BSOBA), also compiled by METI. These data are used to link the information on outward FDI to the abovementioned automobile suppliers' firm-level dataset. The BSOBA contains data on Japanese overseas affiliates, including the location, year of establishment, number of employees, and industry classification. The BSOBA also has some qualitative questionnaires that ask each affiliate the primary purpose of FDI or whether an affiliate engages in international division of labor with parent firms. Since microdata for the foreign affiliates are available only after 1995, we

[9] All firms with more than 50 employees and capital of more than 30 million yen are covered in the survey.

complement it with the information we have on the foreign affiliates for the years 1991 and 1994 from the Directory of Japan's Automobile Parts Industry, which is compiled by the Japan Automobile Parts Industry Association (JAPIA). In this study, we exclude affiliates that do not engage in manufacturing activities.[10]

The third firm-level dataset comprises the list of members of Keiretsu supplier associations.[11] The first-tier suppliers of each Japanese automobile manufacturer are included in the list of supplier associations.[12] The list is provided by the Directory of Japan's Automobile Parts Industry, compiled by JAPIA. The fourth dataset comprises the level of automobile overseas production by Japanese assemblers by country and year, which is used as an instrumental variable. This dataset is obtained from the World Motor Vehicle Statistics compiled by the Japan Automobile Manufacturers Association. We match these four firm-level datasets, referring to the name and location of each firm. Some of the automotive parts suppliers belong to more than two automobile manufacturers' Keiretsu groups. For example, in our sample, 120 automotive parts

[10] One might be interested in the exit rate of Japanese affiliates because our sample covers the Asian financial crisis period. However, according to Toyokeizai's Japanese Overseas Companies, the exit rate for the automobile industry was around 1 percent during the 1990s. It increased in 1999, but it was still only 2 percent.

[11] An alternative data source for the transaction network is the firm-level transaction network data collected by the credit survey companies, Teikoku Data Bank and Tokyo Shoko Research. Recent studies, such as Yamahsita et al. (2014), used this dataset to investigate Japanese FDI. While these datasets are more comprehensive, they do not identify the transaction tie that is more important. Therefore, we use the member lists of the Keiretsu supplier associations in this study.

[12] Member firms of associations have meetings from time to time, and they exchange business information. As of 1991, Toyota had 180 suppliers in its network and Nissan Motor had 193.

suppliers belonged to more than two Keiretsu groups in 1991. In such cases, we sum up the oversea production volume of the Keiretsu automobile manufactures to which an automotive parts supplier belongs.

As for firm characteristics, we use sales deflated by the industry-level output deflator, the number of employees, value added (VA), and total factor productivity (TFP) as outcome variables. In this study, we obtain TFP by estimating the production function with the Wooldridge (2009) modification of the Levinshon and Petrin methodology. This method considers the potential co-linearity in the first stage of the Levinsohn and Petrin (2003) estimator.[13] For other firm characteristics, we include the logged age of firms (*Firm age*), the logged capital–labor ratio (*K-L ratio*), R&D intensity (*R&D sales ratio*), and firm size as dummy variables. We also control the logged Keiretsu automakers' domestic production in year t-1 (*Keiretsu-prod*) and the logged number of overseas employees that belong to the same firms and are located in other countries in year *t*-1 (*FDI-other*). The former variable is used to control domestic

[13] Variables for output and input are constructed as follows: real gross output is measured as sales deflated by the output deflator, while intermediate input is the cost of materials deflated by the input deflator. Labor input is measured by the total number of employees. We constructed the net capital stock by deflating the nominal book values of tangible assets with the capital stock deflator. The capital stock deflator is defined as the ratio of the net stock by industry to the book value of the industry-level tangible assets. The net capital stock by industry values are obtained from the Japan Industrial Productivity (JIP) Database 2013, while the book values of capital by industry are obtained by aggregating the individual data obtained from the BSJBSA. All output and input deflators are obtained from the JIP Database 2013.

demand conditions. While the logged level is used for the regression of intensive margins, for the estimation of the impact of extensive margins, the log-difference of Keiretsu automakers' production is used as the control variable. Since some firms have "0" value both in Keiretsu automakers' domestic production and the number of overseas employees, we add "1" and then take the log when constructing *Keiretsu-prod* and *FDI-other*.[14]

3.3. Data overview

Figure 1 indicates the volume of foreign production by Japanese automobile assemblers. This chart suggests a large heterogeneity of foreign production among Japanese automobile assemblers. While Toyota, Nissan Motor, and Honda own large foreign production sites in North America and Europe, foreign production for the remaining assemblers is relatively small. We use this variation as an instrumental variable for our identification.

=== Figure 1: Size of Foreign Production ===

[14] Basic statistics are presented in Table A1.

To explore the characteristics of FDI by Japanese automobile assemblers and automobile suppliers, we look closely at the procurement pattern of their foreign affiliates. Table 2 reports the ratio of procurement origin for foreign affiliates owned by Japanese automobile assemblers and auto parts suppliers. Two things are noteworthy. First, the ratio of procurement from Japan both for auto manufacturers and auto suppliers ranges from 35 percent to 50 percent. One might argue that the FDI by parts suppliers is more horizontal than vertical because the suppliers are relatively small and they invest abroad to maintain their transactions with the Keiretsu assemblers rather than continuing to export. However, this result indicates that auto suppliers import a sizable amount of intermediate goods from Japan. Second, for auto manufacturers, the ratio of procurement from third countries is quite small. Specifically, the ratios for affiliates in Asia and North America are almost “0”. The ratio for auto suppliers’ affiliates in Asia and North America is slightly higher than that for auto manufacturers. However, it is still less than 5 percent. Affiliates in Europe procure more from third countries both for auto manufacturers and auto suppliers. The ratios of procurement from third countries for affiliates are 10 percent and 20 percent for auto assemblers and auto parts suppliers, respectively. This is probably because cross-border transactions within European countries are much easier than those within other regions due to the

EU's Single Market Program.

=== Table 2: Ratio of procurement origin by region and industry ===

Table 3 presents basic statistics for firm characteristics in our sample. The data show that MNEs have higher sales, a higher number of employees, and higher TFP. This might reflect the fact that only firms with higher productivity are able to invest abroad and become MNEs as suggested by previous theoretical and empirical studies, such as Helpman et al. (2004) and Mayer and Ottaviano (2008). As for the difference in firm characteristics, according to Keiretsu affiliation, similar patterns have been found: Keiretsu firms are larger in terms of both sales and employment and have a higher *K-L* ratio and TFP.

=== Table 3: Firm characteristics ===

Table 4 provides the number of MNEs and Keiretsu suppliers. Among approximately 900 sample firms, about 300 firms belong to the Keiretsu supplier

associations. Two things are noteworthy. First, while one-third of the Keiretsu suppliers are MNEs, the proportion of MNEs among non-Keiretsu suppliers is less than 10 percent. This is probably because Keiretsu suppliers are larger and have higher TFP than non-Keiretsu suppliers as indicated in Table 3. Second, both Keiretsu and non-Keiretsu suppliers have actively invested abroad from 1991 to 2000. Specifically, the number of MNEs among non-Keiretsu suppliers has more than doubled.

=== Table 4: Number of MNEs and Keiretsu suppliers ===

As a preliminary analysis, we estimate the conditional logit model for location choice for FDI by Japanese automotive parts suppliers. Our sample consists of nine countries, and we use automobile production by Keiretsu assemblers, non-Keiretsu Japanese assemblers, and non-Japanese assemblers as independent variables. We also include the number of foreign affiliates of the Japanese auto parts suppliers and the distance from Japan. While the former three variables are demand factors for auto suppliers, the number of auto parts suppliers is the proxy variable for the industry agglomeration. Table 5 provides the estimation results for the conditional logit model. The results suggest that while non-Keiretsu assemblers' production has no significant impact, the

volume of foreign production by the Keiretsu assemblers always has significant coefficients. This suggests that the Keiretsu assembler–supplier tie is one of the important determinants of the location choice of suppliers' FDI. These results do not change even when we control the production volume of non-Japanese assemblers and the agglomeration of Japanese auto parts suppliers as in columns (2) and (3).

=== Table 5: Location choice ===

4. Estimation Results

First, to explore the determinants of FDI, we estimate equations (3) and (5). Estimation results are presented in Table 6. While columns (1), (2), and (3) use FDI dummy variables as dependent variables and estimate the probit model, the number of workers in foreign affiliates (affiliate size) is used as a dependent variable and estimate the fixed effect model in columns (4), (5), and (6). These results correspond to the determinants of the FDI extensive margin and the FDI intensive margin, respectively. The estimation results suggest that Keiretsu automobile manufacturers' FDI (*AUTO-FDI*) has a significant positive impact on FDI decision by auto parts suppliers both in terms of the extensive margin and intensive margin of FDI. We confirm that the

LR test and F-test statistics reject the null hypothesis for the joint insignificance of all the covariates. We use the specifications in columns (4) and (6) for the impact of the extensive and intensive margins of FDI.[15]

=== Table 6: First-stage estimation ===

Next, we estimate equations (2) and (3) and equations (4) and (5) simultaneously to examine the impact of the extensive margin of FDI. The baseline results are presented in Panel (a) in Table 7. For all outcome variables, namely sales, employment, value added (VA), and TFP, the coefficient of FDI is positive and significant, suggesting that starting to invest abroad or launching production operations in a new location has a positive impact on corporate performance at home. In contrast, Panel (b) in Table 7 presents the results of the impact of the intensive margin of FDI. The coefficients for affiliate size are all positive but insignificant for all outcome variables. These results might imply that while FDI has a positive impact on corporate performance at first, this

[15] One may be concerned that trade and investment policy might affect the decision to conduct FDI. As for investment policy, Japan has concluded a Bilateral Investment Treaty (BIT) with some developing countries. However, among our sample countries, there is no new treaty made and entered into during our sample periods. For trade policy, although Japan did not conclude any free trade agreement in our sample period, ASEAN countries substantially reduced import tariffs in the late 1990s. We include the import tariff rate of automobile parts and components for host countries as an independent variable in equations (3) and (5). However, we find no significant impact on firm-level FDI decision.

effect might not last long.

=== Table 7 ===

As we discussed in Section 2, the impacts of FDI might differ according to the type of FDI. Specifically, we focus on the impact of VFDI. In our FDI data from the BSOBA, there are qualitative questionnaire items that ask each foreign affiliate whether they engage in international division of labor or full-scale local production. We define affiliates that engage in international division of labor as VFDI, and in this empirical exercise, we exclude HFDI from our sample. The results are presented in Table 8. While the impact of the intensive margin of FDI is again insignificant, the extensive margin of FDI has a positive effect on corporate performance. Furthermore, compared with the size of coefficients in Panel (a) of Table 7, the coefficients for sales, VA, and TFP are slightly larger, suggesting that FDI with international division of labor stimulates more intra-firm trade of intermediate goods from the home country, and as a result, corporate performance improves. However, the impact of the intensive margin of FDI is again insignificant.

=== Table 8 ===

We also conduct three robustness checks. First, we compare the impact of the first FDI and the subsequent FDIs. Since we estimate equation (4) using a pair of parent performance variables and the FDI by country and then pool the nine-country FDI pairs, the effect of the extensive margin of FDI includes not only the impact of the first FDI but also the impact of an increase in the number of foreign affiliates. As we mentioned, most previous studies that used the propensity score matching methodology focused on performance changes when firms started foreign production. To highlight the effect of the first FDI, we estimate equation (4) by focusing on firms that have at least one foreign affiliate in year $t-1$. The results are presented in Table 9. The coefficients for FDI are significant only in case of column (2), namely the impact on employment at home. Furthermore, the size of the coefficient for employment is smaller than that of the baseline result presented in column (2) in Table 7. These results imply that the impact of FDI on corporate performance is mainly driven by the first investment.

=== Table 9 ===

Second, we exclude firms that belong to only one automobile Keiretsu group. Since these suppliers might have strong relationships with automobile manufacturers, they might decide to invest abroad together with the manufacturers. The results are presented in Table 10 and the major results do not change.

=== Table 10 ===

Third, we change the threshold level of the shareholding ratio of automobile assemblers. Specifically, we exclude auto parts suppliers whose capital share of Keiretsu auto manufacturers is greater than 20 percent and results are presented in Table 11. Again, the major results are in keeping with the baseline results.[16]

=== Table 11 ===

5. Discussion

[16] For other robustness checks, first, we split our samples into Asian countries (East and Southeast Asian countries) and Developed countries (the UK, the U.S., Canada, and Australia). However, the major results do not differ by region. Second, we exclude FDI to China and estimate the same regression model. While Japanese automobile manufacturers started to invest in most of the region in our sample before 1990, FDI to China was an exception. Since Japanese automobile manufacturers started to invest in China in the mid 1990s, some auto parts manufacturers might start to invest in China in consultation with Keiretsu auto manufacturers in our sample periods. However, the major results are in keeping with the baseline results.

Why are the effects of FDI significant only in the case of the extensive margin and not in the case of the intensive margin? This might reflect the procurement pattern of MNE subsidiaries. Perhaps, once firms start to invest abroad, they increase the export of intermediate goods to their overseas subsidiaries. For example, Nishitateno (2013) investigated the relationship between FDI and exports, focusing on Japanese automotive parts suppliers from 1993 to 2008, and reports that automotive parts suppliers' FDI complements their export. Nishitateno (2013) concludes that this result might reflect the fact that Japanese auto parts suppliers have expanded overseas production and their growing market penetration enables them to increase demand for some parts produced in Japan (the market penetration effect). Thus, as they increase the export associated with FDI, firms expand domestic production capacity and raise their productivity.

On the other hand, according to Belderbos et al. (2001) and Kiyota et al. (2008), as overseas subsidiaries learn more about local suppliers, some overseas subsidiaries substitute imported supplies from the home country with local procurement (the substitution effect). Belderbos et al. (2001) report that this effect is more pronounced in the case of greenfield investments. According to the BSOBA, as of 1995, 88 percent of overseas affiliates in the automotive parts industry have been established as greenfield investments. Since the substitution effect offsets the market penetration effect, the

impact of the intensive margin of FDI might become insignificant.

One might be concerned that these empirical analyses ignore the effect of the global sourcing strategy by automobile assemblers. Affiliates of automobile manufacturers in ASEAN, North America, and Europe might procure parts and components from suppliers located in neighboring countries. Since our analysis uses auto manufacturers' FDI as an instrument of auto suppliers' FDI in each destination country, we do not consider the global sourcing strategy. This might lead to an underestimation of the impact of auto manufacturers' FDI on suppliers' FDI. However, as indicated in Table 2, the ratio of auto manufacturers' imports from a third country is less than or near 10 percent, suggesting that global sourcing is not significantly large, at least in our sample period. Moreover, we construct the new data by pooling auto manufacturers' and auto suppliers' FDI according to region, namely ASEAN and North America, and we estimate equations (2) and (3) and equations (4) and (5).[17] We include the average GDP or the GDP growth rate by region as regional characteristics instead of country characteristics. Estimation results are presented in Table 12. In the first-stage regression, auto manufacturers' FDI (*Auto-FDI*) has no significant impact on the FDI decision. As for the size of affiliates for auto suppliers, *Auto-FDI* has a positive

[17] Since our sample contains only one European country, the UK, we do not include Europe in the analysis at the regional level.

coefficient when firm characteristics are controlled. However, the estimates in the second-stage regression for the intensive margin of FDI are again insignificant.

=== Table 12 ===

6. Concluding Remarks

This study investigates the impact of FDI on corporate performance in the home country, focusing on the Japanese automobile parts industry. This study differs from previous studies in that it uses the instrumental variable technique to deal with the issue of reverse causality and uses the supplier–customer transaction relationship as an instrument of automotive suppliers' FDI. This is in contrast to most previous studies that use the propensity score matching method and focus only on the impact of the extensive margin of FDI on corporate performance at home. Our approach enables us to investigate the impact of both the extensive margin and the intensive margin of FDI.

Using the Japanese automobile industry Keiretsu relationships, our empirical analysis reveals that the extensive margin of FDI has a positive impact on sales, employment, value added, and TFP. Furthermore, the impact of the extensive margin of FDI is larger when we focus on VFDI. In addition, comparing the impact of FDI

between the first FDI and subsequent FDIs, we find that the impact of the first FDI on corporate performance is more profound than that of the subsequent FDIs. In contrast, the impact of the intensive margin of FDI sometimes has positive coefficients, but they are basically not significant. We conclude that the impacts of FDI on corporate performance are mainly driven by the extensive margin of FDI, especially when firms first start to invest abroad. These results might reflect the procurement pattern of MNE affiliates. As they learn more about local suppliers, they tend to substitute imports from their parent company with local procurement. Therefore, the impact of the intensive margin of FDI might be insignificant. Finally, it should be also noted that we find no negative impact of FDI on domestic corporate performance. “Hollowing out” is one of the central concern about the impact of FDI. However, there is no supporting evidence that FDI hollow out the employment at home country.

Although our study presents interesting findings, it also suggests various avenues for future research. First, although we find evidence that the extensive margin of FDI has a positive and significant impact on corporate performance, its mechanics and the numerical magnitude have not yet been fully explored and remain a black box. Identifying the source of gains in productivity requires more detailed data and sophisticated identification strategies. Second, the applicability of our results to other

industries is at issue. As discussed, the automobile industry has the most developed international production and distribution network. Thus, we believe that our evidence from automotive parts suppliers has important implications. However, the nature of the international production network might differ from one industry to another, leading to variation in the impact of FDI by industry. Therefore, it is also important to compare the impact of FDI on other industries.

Appendix

Table A1: Basic Statistics

variable	# of obs	mean	sd	p25	p75
Extensive margin					
ΔlnSales	51920	0.002	0.159	-0.075	0.078
ΔlnEmp	51920	-0.012	0.107	-0.051	0.024
ΔVA	51652	0.037	0.345	-0.113	0.179
ΔTFP	51652	0.047	0.339	-0.100	0.188
FDI dummy	51920	0.003	0.057	0.000	0.000
Auto-FDI	51920	2.881	4.795	0.000	8.007
FDI-other	51920	0.723	1.941	0.000	0.000
KL-ratio	51920	1.370	0.128	1.288	1.447
Δkeiretsu-prod	51920	-0.014	0.070	0.000	0.000
R&D sales ratio	51920	0.007	0.015	0.000	0.006
variable	# of obs	mean	sd	p25	p75
Intensive margin					
lnSales	1690	10.714	1.267	9.927	11.344
lnEmp	1690	7.230	1.166	6.604	7.845
VA	1690	9.181	1.315	8.423	9.898
TFP	1690	2.149	0.356	1.955	2.384
Affiliate size	1690	5.331	1.309	4.554	6.193
Auto-FDI	1690	9.650	5.031	9.473	13.120
FDI-other	1690	5.139	2.931	4.111	7.118
KL-ratio	1690	1.317	0.068	1.271	1.354
Keiretsu-prod	1690	13.081	4.996	14.018	15.610
R&D sales ratio	1690	0.027	0.025	0.006	0.041

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Table 1: Summary of previous studies that use the propensity score matching method

		Type of FDI	Sales	TFP	Emp
Debere et al. 2010	South Korea	HFDI	n.a.	n.a.	+
		VFDI	n.a.	n.a.	
Hijzen et al, 2011	France	HFDI		+	+
		VFDI			
Naveretti et .al, 2010	France	HFDI	+		+
		VFDI	+		+
	Italy	HFDI	+	+	+
		VFDI			+
Hayakawa et al. 2013	Japan	HFDI			+
		VFDI		+	+

Table 2: Ratio of foreign affiliates' procurement origin by region in 1995

Automobile assember	Procurement origin		
location of affiliates	Local	Japan	Third country
North America	59%	40%	0%
Asia	57%	41%	1%
Europe	47%	41%	11%

Auto Parts manufacturer	Procurement origin		
location of affiliates	Local	Japan	Third country
North America	59%	37%	4%
Asia	45%	49%	6%
Europe	44%	35%	21%

Note: Asia includes East Asia, Southeast Asia and South Asian countries. North America is composed of the United States of America and Canada. Europe consists of Western and Eastern European countries.

Source: Author's calculation based on the Basic Survey of Overseas Business and Activities.

Table 3: Firm Characteristics: MNEs and Keiretsu suppliers

	Sales	# of Employees	K-L ratio	TFP
non-MNEs	8,611	278	1.374	1.754
	(18187.0)	(471.6)	(0.139)	(0.430)
MNEs	64,758	1,715	1.333	2.078
	(133341.3)	(3560.0)	(0.076)	(0.378)

	Sales	# of Employees	K-L ratio	TFP
non-Keiretsu	7,022	236	1.372	1.705
	(17124.3)	(405.8)	(0.149)	(0.439)
Keiretsu	34,655	948	1.360	1.967
	(91060.1)	(2431.8)	(0.098)	(0.386)

Note: Figures in parentheses are standard deviation. Unit for sales is millions of Yen.

Source: Author's calculation based on linked firm-level database.

Table 4: Number of Keiretsu suppliers and MNEs

		non-Keiretsu suppliers			Keiretsu suppliers		
	Total	Sub-total	non-MNEs	MNEs	Sub-total	non-MNEs	MNEs
1991	866	540	523	17	326	239	87
1994	878	541	519	22	337	243	94
1995	941	587	564	23	354	248	106
1996	929	580	553	27	349	236	113
1997	932	586	556	30	346	227	119
1998	927	586	548	38	341	215	126
1999	930	585	546	39	345	212	133
2000	879	546	509	37	333	206	127

Source: Author's calculation based on linked firm-level database.

Table 5: Conditional logit model for FDI location choice

	(1)	(2)	(3)
Automobile production	0.0858***	0.101***	0.0704***
by Keiretsu assembler	(0.0216)	(0.0214)	(0.0223)
Automobile production	0.000217	0.0229	-0.00959
by non-Keiretsu assembler	(0.0187)	(0.0192)	(0.0201)
Automobile production		0.284***	0.185***
by non-Japanese assemblers		(0.0507)	(0.0549)
# of Japanese auto parts			0.561***
suppliers			(0.101)
Distance from Japan	-1.409***	-1.514***	-0.953***
	(0.112)	(0.108)	(0.151)
Observations	3,630	3,630	3,630

Note:

1) Standard errors in parentheses.

2) ***, **, and * indicates statistical significance at 1, 5, and 10 percent levels, respectively.

Table 6: FDI decision by auto parts suppliers

VARIABLES	(1) Probit FDI dummy	(2) Probit FDI dummy	(3) Probit FDI dummy	(4) Fixed Effect Affiliate size	(5) Fixed Effect Affiliate size	(6) Fixed Effect Affiliate size
Auto-FDI	0.00016***	0.00001**	0.00001**	0.0160***	0.0147**	0.0137**
	(0.00003)	(0.00001)	(0.00001)	(0.0059)	(0.0059)	(0.0059)
GDPgrowth			-0.00077			
			(0.00059)			
GDP						0.1058
						(0.0926)
FDI-other $_{t-1}$		0.00007***	0.00007***		0.0480***	0.0464***
		(0.00002)	(0.00002)		(0.0130)	(0.0131)
Firm age		0.00013*	0.00013*		3.9489***	4.0086***
		(0.00008)	(0.00007)		(1.3134)	(1.3143)
KL-ratio $_{t-1}$		-0.00012	-0.00012		-1.1201*	-1.1385*
		(0.00024)	(0.00024)		(0.6543)	(0.6544)
R&D sales ratio $_{t-1}$		0.00202*	0.00197*		-0.2396	-0.2224
		(0.00116)	(0.00114)		(0.8818)	(0.8818)
Constant				4.9066***	-8.8237*	-11.7446**
				(0.0691)	(5.1303)	(5.7318)
Year FF	Yes	Yes	Yes	Yes	Yes	Yes
Country FF	Yes	Yes	Yes	No	No	No
Firm-country FF	No	No	No	Yes	Yes	Yes
Observations	51,906	51,906	51,906	1,690	1,690	1,690
Number of id				352	352	352
R-squared	0.152	0.286	0.287	0.1209	0.1402	0.1411
LR Chi2	316.7	596.9	599.0			
F test				26.16	15.43	14.49

1) Standard errors in parentheses.

2) ***, **, and * indicate statistically significance at 1, 5, and 10 percent levels, respectively.

3) Coefficients in the probit model are converted into marginal effects.

Table 7: The impact of FDI on corporate performance: baseline results

	Panel (a)	Extensive Margin		
	(1)	(2)	(3)	(4)
VARIABLES	Δ lnSales	Δ lnEmp	Δ lnVA	Δ TFP
FDI dummy	0.1082***	0.0914***	0.2209***	0.2073***
	(0.0158)	(0.0112)	(0.0322)	(0.0319)
FDI-other $_{t-1}$	-0.0004	-0.0020***	-0.0003	0.0014*
	(0.0004)	(0.0003)	(0.0009)	(0.0009)
Firm age	-0.0213***	-0.0153***	-0.0331***	-0.0207***
	(0.0014)	(0.0010)	(0.0028)	(0.0027)
KL-ratio $_{t-1}$	0.0457***	0.1076***	0.0604***	-0.0176*
	(0.0052)	(0.0038)	(0.0105)	(0.0104)
Δ*Keiretsu-prod*	0.1656***	0.0667***	0.1988***	0.1470***
	(0.0103)	(0.0075)	(0.0210)	(0.0207)
R&D sales ratio $_{t-1}$	0.2877***	-0.1952***	-0.2386**	-0.0721
	(0.0477)	(0.0346)	(0.0968)	(0.0953)
Year dummy	Yes	Yes	Yes	Yes
Firm size dummy	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes
Observations	51,920	51,920	51,652	51,652
	Panel (b)	Intensive Margin		
	(1)	(2)	(3)	(4)
VARIABLES	lnSales	lnEMP	VA	TFP
Affiliate size	0.1635	0.0591	0.1635	0.1082
	(0.0994)	(0.0654)	(0.1607)	(0.1521)
FDI-other $_{t-1}$	-0.0048	0.0032	-0.0145	-0.0177*
	(0.0060)	(0.0039)	(0.0097)	(0.0092)
Firm age	-0.0081	0.1671	-0.5954	-0.7547
	(0.5524)	(0.3631)	(0.8926)	(0.8447)
Keiretsu-prod $_{t-1}$	-0.2424	-1.1593***	-0.6852**	0.2332
	(0.2135)	(0.1404)	(0.3450)	(0.3265)
KL-ratio $_{t-1}$	0.5464***	0.2203***	0.5539***	0.3508***
	(0.0627)	(0.0412)	(0.1014)	(0.0959)
R&D sales ratio $_{t-1}$	0.1506	0.1930	0.2884	0.0796
	(0.2438)	(0.1602)	(0.3939)	(0.3728)
Year fixed effect	Yes	Yes	Yes	Yes
Firm size dummy	Yes	Yes	Yes	Yes
Firm-country fixed effect	Yes	Yes	Yes	Yes
Observations	1,669	1,669	1,669	1,669
Number of id	331	331	331	331
Hansen J test	0.0583	0.206	0.652	0.983

1) Standard errors in parentheses.

2) ***, **, and * indicate statistically significance at 1, 5, and 10 percent levels, respectively.

Table 8: The impact of FDI on corporate performance: Case of VFDI

	Panel (a)	Extensive Margin		
	(1)	(2)	(3)	(4)
VARIABLES	⊿lnSales	⊿lnEmp	⊿lnVA	⊿TFP
FDI dummy	0.1204***	0.0901***	0.2218***	0.2665***
	(0.0229)	(0.0165)	(0.0471)	(0.0525)
FDI_other $_{t-1}$	-0.0002	-0.0019***	0.0017**	-0.0001
	(0.0004)	(0.0003)	(0.0009)	(0.0009)
Firm age	-0.0213***	-0.0152***	-0.0206***	-0.0371***
	(0.0014)	(0.0010)	(0.0027)	(0.0030)
KL-ratio $_{t-1}$	0.0458***	0.1076***	-0.0176*	0.0738***
	(0.0052)	(0.0038)	(0.0104)	(0.0114)
⊿*Keiretsu_prod*	0.1658***	0.0667***	0.1477***	0.2471***
	(0.0104)	(0.0075)	(0.0207)	(0.0226)
R&D sales ratio $_{t-1}$	0.2863***	-0.1963***	-0.0775	-0.2465**
	(0.0478)	(0.0347)	(0.0955)	(0.1044)
Year dummy	Yes	Yes	Yes	Yes
Firm size dummy	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes
Observations	51,829	51,829	51,562	51,562
	Panel (b)	Intensive Margin		
	(1)	(2)	(3)	(4)
VARIABLES	lnSales	lnEMP	VA	TFP
Affiliate size	0.4725	-0.1443	0.2058	-0.3516
	(0.5048)	(0.2686)	(0.6704)	(0.8609)
FDI_other $_{t-1}$	0.0114	0.0103	0.0150	-0.0117
	(0.0136)	(0.0072)	(0.0181)	(0.0232)
Firm age	-1.1300	1.3532	-0.1188	4.1357
	(1.5678)	(0.8341)	(2.0821)	(2.6737)
Keiretsu_prod $_{t-1}$	0.8859*	0.1677	0.6943	-0.9783
	(0.4983)	(0.2651)	(0.6617)	(0.8498)
KL-ratio $_{t-1}$	-1.2109	-0.6796	0.0249	0.2364
	(0.8729)	(0.4644)	(1.1593)	(1.4887)
R&D sales ratio $_{t-1}$	0.2216	-0.1177	0.3304	-0.5502
	(0.7416)	(0.3945)	(0.9849)	(1.2648)
Year fixed effect	Yes	Yes	Yes	Yes
Firm size dummy	Yes	Yes	Yes	Yes
Firm-country fixed effect	Yes	Yes	Yes	Yes
Observations	319	319	319	319
Number of id	75	75	75	75
Hansen J test	0.247	0.0406	0.601	0.282

1) Standard errors in parentheses.

2) ***, **, and * indicate statistically significance at 1, 5, and 10 percent levels, respectively.

Table 9: Robustness check; Excl. First FDI

Extensive Margin				
	(1)	(2)	(3)	(4)
VARIABLES	Δ lnSales	Δ lnEmp	Δ TFP	Δ lnVA
FDI dummy	-0.0073	0.0736***	-0.0407	-0.0274
	(0.0240)	(0.0115)	(0.0347)	(0.0379)
Observations	6,440	6,440	6,422	6,422
Intensive Margin				
	(1)	(2)	(3)	(4)
VARIABLES	lnSales	lnEMP	TFP	VA
Affiliate size	0.1635	0.0591	0.1082	0.1635
	(0.0994)	(0.0654)	(0.1521)	(0.1607)
Observations	1,669	1,669	1,669	1,669
Number of id	331	331	331	331
Hansen J test	0.0583	0.206	0.983	0.652

1) Standard errors in parentheses.

2) ***, **, and * indicate statistically significance at 1, 5, and 10 percent levels, respectively.

3) Control variables, such as *FDI-other, Firm-age, KL-ratio, Keiretsu-prod, R&D-sales-ratio* are included.

Table 10: Robustness check; Excl. suppliers that belong to only one Keiretsu

Extensive Margin				
	(1)	(2)	(3)	(4)
VARIABLES	Δ lnSales	Δ lnEmp	Δ TFP	Δ lnVA
FDI dummy	0.1063***	0.1233***	0.2501***	0.2645***
	(0.0208)	(0.0143)	(0.0410)	(0.0418)
Observations	38,649	38,649	38,431	38,431
Intensive Margin				
	(1)	(2)	(3)	(4)
VARIABLES	lnSales	lnEMP	TFP	VA
Affiliate size	0.0865	0.0512	0.1007	0.1429
	(0.1134)	(0.0776)	(0.1988)	(0.2095)
Observations	1,224	1,224	1,224	1,224
Number of id	247	247	247	247
Hansen J test	0.0971	0.360	0.882	0.630

1) Standard errors in parentheses.

2) ***, **, and * indicate statistically significance at 1, 5, and 10 percent levels, respectively.

3) Control variables, such as *FDI-other, Firm-age, KL-ratio, ⊿Keiretsu-prod, R&D-sales-ratio* are included.

Table 11: Robustness check; Excl. Keiretsu parent share>20%

Extensive Margin				
	(1)	(2)	(3)	(4)
VARIABLES	Δ lnSales	Δ lnEmp	Δ TFP	Δ lnVA
FDI dummy	0.1141***	0.0826***	0.2067***	0.2154***
	(0.0191)	(0.0138)	(0.0389)	(0.0393)
Observations	49,462	49,462	49,203	49,203
Intensive Margin				
	(1)	(2)	(3)	(4)
VARIABLES	lnSales	lnEMP	TFP	VA
Affiliate size	0.1566	0.0166	0.1397	0.1548
	(0.1231)	(0.0736)	(0.1837)	(0.1906)
Observations	1,170	1,170	1,170	1,170
Number of id	233	233	233	233
Hansen J test	0.0966	0.0522	0.503	0.978

1) Standard errors in parentheses.

2) ***, **, and * indicate statistically significance at 1, 5, and 10 percent levels, respectively.

3) Control variables, such as *FDI-other, Firm-age, KL-ratio, ⊿Keiretsu-prod, R&D-sales-ratio* are included.

Table 12: Estimating the impact of FDI by pooling data at the regional level

Panel (a) First stage estimation results						
	Probit	Probit	Probit	Fixed Effect	Fixed Effect	Fixed Effect
VARIABLES	FDI dummy	FDI dummy	FDI dummy	Affiliate size	Affiliate size	Affiliate size
Auto-FDI	0.00092***	0.00002	0.00002	0.0889	0.0689	0.1571**
	(0.00012)	(0.00001)	(0.00001)	(0.0566)	(0.0567)	(0.0754)
Country control	No	No	Yes	No	No	Yes
Firm control	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	No	No	No
Firm-region FE	No	No	No	Yes	Yes	Yes
Observations	8,320	8,320	8,320	1,050	1,050	1,050
R-squared				0.1711	0.1915	0.1945
Pseudo-R2	0.122	0.253	0.253			
LR chi2	105.7	218.5	218.5			
Number of id				214	214	214
F test				24.44	13.90	13.22

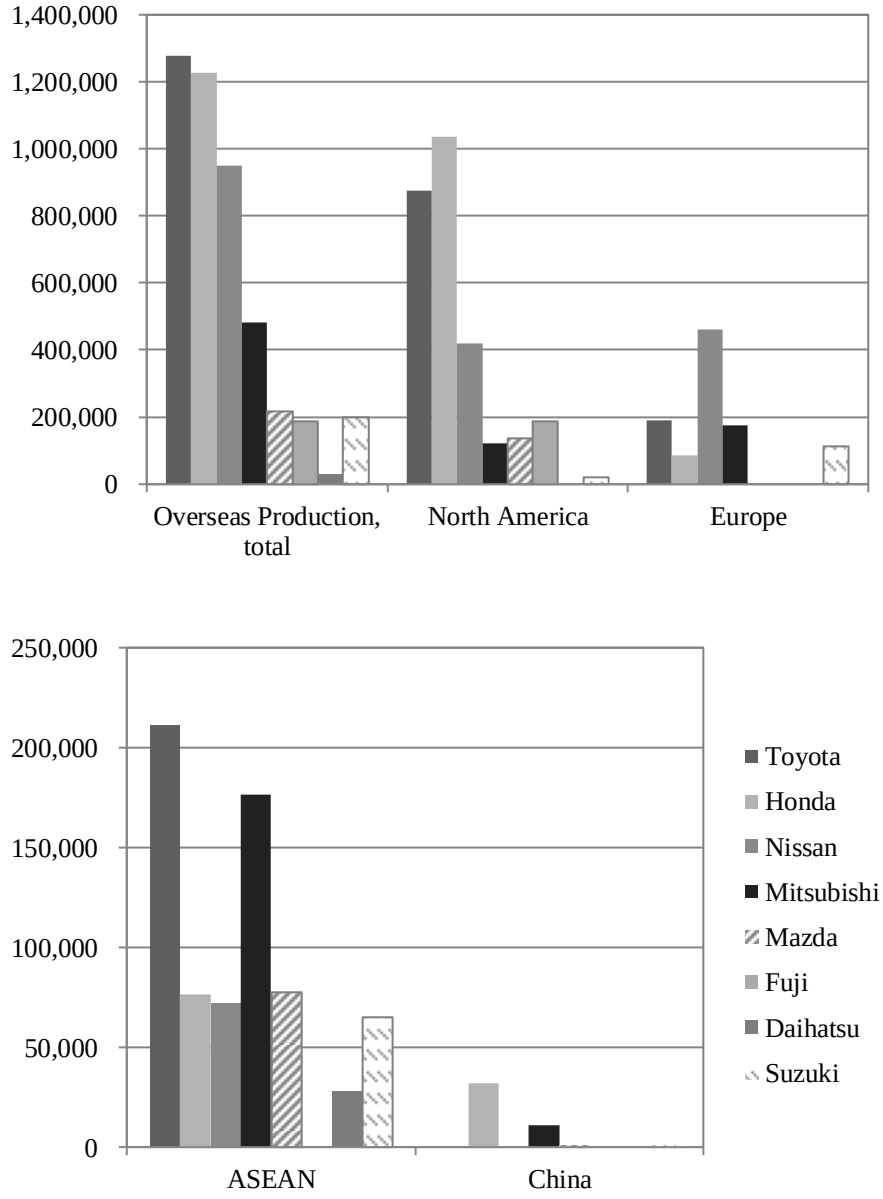
Panel (b)	Second Stage: Extensive Margin			
	(1)	(2)	(3)	(5)
VARIABLES	Δ lnSales	Δ lnEmp	Δ TFP	Δ lnVA
FDI dummy	-0.0400	0.0867***	0.1990***	0.2115***
	(0.0307)	(0.0182)	(0.0529)	(0.0527)
Year dummy	Yes	Yes	Yes	Yes
Firm size dummy	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes
Observations	9,672	9,672	9,620	9,620

Panel (c)	Second Stage: Intensive Margin			
	(1)	(2)	(3)	(5)
VARIABLES	lnSales	lnEMP	TFP	VA
Affiliate size	-0.1561	-0.0915	0.0425	-0.0476
	(0.1244)	(0.0843)	(0.1728)	(0.1792)
Year fixed effect	Yes	Yes	Yes	Yes
Firm size dummy	Yes	Yes	Yes	Yes
Firm-country fixed effect	Yes	Yes	Yes	Yes
Observations	1,038	1,038	1,038	1,038
Number of id	202	202	202	202
Hansen J test	0.0583	0.206	0.983	0.652

1) Standard errors in parentheses and ***, **, and * indicate statistically significance at 1, 5, and 10 percent levels, respectively.

2) Control variables, such as *FDI-other, Firm-age, KL-ratio, ⊿Keiretsu-prod, R&D-sales-ratio* are included in Panel (b) and Panel (c).

Figure 1: Volume of Japanese automobile production by region and automobile assemblers in 2000



Source: World Motor Vehicle Statistics (Japan Automobile Manufacturers Association)