Overseas Production Expansion and Domestic Transaction Networks

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Abstract

In this study, we empirically examine the effects of customers' foreign direct investment (FDI) on their domestic transaction ties and the performance of their suppliers. In particular, we examine the difference in such effects between the first- (direct) and second-tier (indirect) suppliers. To this end, we utilize a unique firm-level survey in Japan that contains information on inter-firm transaction networks matched with FDI data. Our findings can be summarized as follows. There is no evidence that customers' FDI is more likely to suspend their domestic transactions. Rather, direct suppliers' transaction ties with multinational enterprises (MNEs) are more persistent than those with other firms. Although such an effect becomes weak for transactions between direct and indirect suppliers, we did not find a negative effect. Furthermore, customers' FDI has a significantly positive impact on employment growth for both their direct and indirect suppliers.

Keywords: Network, FDI, Japan
JEL Classification: F23; L14; L25

1. Introduction

Firms' internationalization has significant influence on the economy through supply chain linkages. Once firms start to invest abroad and expand their production abroad, they may reorganize sales and procurement strategy at home country. Some of their suppliers may follow them and start to invest abroad to maintain transaction relationship with them. However, small- and medium-sized suppliers with financial constraints may have difficulty in following and lose the transaction relationship. Also, the expansion of production abroad may increase the demand on domestic supplies and strengthen the transaction relationship with domestic suppliers. These changes in the first-tier suppliers further affect business activities in the suppliers to them, i.e., the second-tier suppliers. Through such input-output linkages, internationalization by some firms has influence on the whole economy.

In this study, we empirically examine how firms' foreign direct investment (FDI) affects their suppliers' business activities or performance. Specifically, we first explore whether customers' FDI results in strengthening or suspending their transaction tie with domestic suppliers. Second, it is examined how much multinational enterprises' (MNEs') overseas production expansion affects the corporate performance of their suppliers. Namely, we investigate the effects of customers' FDI on their suppliers in terms of extensive margin (i.e., survival of transaction ties) and intensive margin (i.e., corporate performance). Furthermore, we examine how these effects are different between on the first- and second-tier suppliers. This analysis will contribute to uncovering how firms' FDI affects the economy through supply chains.

To this end, we utilize the unique firm-level survey in Japan that contains the information on the inter-firm transaction network matched with FDI data. Specifically, the information on inter-firm transaction network, i.e., firms' customers and suppliers, is derived from the Tokyo Shoko Research (TSR) data while that on Japanese FDI, i.e., overseas affiliates owned by Japanese firms, is from *Overseas Japanese Companies Data* published by Toyo Keizai (TKZ). Using these data from 2006 to 2011, we examine the effects of firms' FDI on their suppliers' business activities. One important feature of our dataset is to cover not only listed firms but also small- and medium-sized enterprises (SMEs). The inclusion of such firms is crucial for our analysis because we investigate the effects on not only the direct supplier but also the indirect suppliers, the latter of which is likely SMEs.

This study is related to the three strands of studies. First, there are many studies that investigate the impact of FDI on their corporate performance. In regard to the effect

on productivity, while Navaretti et al. (2010) in their study on Italy and France and Hijzen et al. (2011) in their study on France demonstrated that horizontal FDI (HFDI) improves domestic productivity, Hayakawa et al. (2013) in their study on Japan found positively significant effects on productivity in the case of vertical FDI (VFDI). As for the impact on sales and employment, Navaretti and Castellani (2011) found positive impacts on sales and employment through both HFDI and VFDI. Hijzen et al. (2011) and Hayakawa et al. (2013) use French and Japanese firm-level data respectively, and also found that both HFDI and VFDI by French and Japanese firms increase domestic employment. In contrast, Debaera et al. (2010) in their study on Korea reported not finding any positive impact on employment through either FDI type. While these studies focus on the effects of firms' FDI on their performance, we investigate those of firms' FDI on their suppliers' performance.

The second strand of studies is the impact of FDI on their suppliers' behavior. Yamashita et al. (2014) and Nakajima and Ito (2014) investigate to what extent transaction partners' FDI affects the suppliers' decision to invest abroad and the location choice of their FDI. Both studies find strongly positive and significant impact on their suppliers' FDI decision. Ito and Tanaka (2013), which is most closely related to our study, investigates the effect of MNEs' overseas production expansion on their suppliers' employment. Surprisingly, they find MNEs' overseas production has positive impact on their suppliers' employment. Since their dataset is restricted to firms with more than 50 employees, the suppliers in their study are relatively good firms providing key components to MNEs, e.g., MNEs' first-tier suppliers. Different from their study, as mentioned above, our dataset covers even small firms and enables us to differentiate the first- and second-tier suppliers.

Third, our study is also related to the growing literature on the domestic production network. For example, Bernard et al. (2014) develop two-sided heterogeneous network model in terms of productivity and distance. They examine the impact of the extension of high-speed train (shinkansen) on the domestic transaction networks. Fususawa et al. (2015) investigate theoretically and empirically how the import decision by transaction partners affects their reorganization of domestic production network.[1] Fususawa et al. take into account heterogeneity of the degree of relationship specificity as well as efficiency and distance, and find that offshoring induces supplier churning and improves firm's productivity. Our analysis will contribute to adding further evidence on the

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[1] Our study differs from Furusawa et al. (2015) in the sense that we focus on the impact of MNEs' overseas production expansion. Besides, we also focus on the impact on the corporate performance of their suppliers.

reorganization of production network, with differentiating impacts on the first- and second-tier suppliers.[2]

The rest of this paper is organized as follows. The next section discusses our empirical framework. Section 3 explains the data issues. The estimation results are reported in Section 4. Last, Section 5 concludes on this study and provides some policy implication.

2. Empirical Specification

This section explains our empirical framework. In our empirical analysis, we apply data on transaction among firms in Japan to this framework. We first explore what kinds of suppliers are more likely to keep or lose existing transaction tie. To investigate the probability for transaction ties to be broken off, we estimate the following probit model.

$$\Pr(Stop_{ij} = 1) = \Phi(\mathbf{X}_i\boldsymbol{\alpha} + \mathbf{Y}_j\boldsymbol{\beta} + \mathbf{Z}_{ij}\boldsymbol{\gamma})$$

Dependent variable, *Stop* is the dummy variable that takes the value one if transaction tie between supplier i and customer j is broken off between 2006 and 2011. Basically, we examine explanatory variables measured as of 2006.

The vector $\mathbf{X}_i$ consists of variables for supplier's characteristics. We include (a log of) the number of employees, (a log of) the number of plants, agglomeration of firms, and (a log of) the number of customers. Since larger suppliers tend to be more productive than small suppliers are and to produce higher quality products, they are less likely to lose their transaction ties. Thus, we expect the numbers of supplier's employees and plants have negative coefficients. A variable for agglomeration is measured by (a log of) the number of firms in the same four-digit industry and prefecture as a concerned supplier. It is a proxy for the extent of local competition. Suppliers facing a fierce competition are expected to be more likely to lose transaction ties. The number of customers will have a positive effect because suppliers with a large number of customers are easier to switch transaction partners.

The vector $\mathbf{Y}_j$ is composed of customers' characteristics, such as customers' size in terms of (a log of) the number of employees. Customers' size may have negative impact on the survival probability because larger customers have stronger market power and are

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[2] Furthermore, in terms of examining the duration of transactions, our paper is related to the literature that examined the mechanisms for the survival of international transactions (e.g., Besedes and Prusa, 2006ab; Obashi, 2010; Gorg et al., 2012; Nitsch, 2009; Esteve-Perez et al., 2013; Gullstrand and Persson, 2015). These studies find, for example, that international transactions are likely to survive when they are related to exports by more productive firms, countries with larger GDPs, or geographically closer countries.

likely to reorganize transaction networks. As our main variables, we include four dummy variables on customers' FDI status; "Incumbent MNEs" and "New MNEs" are dummy variables that take the value one if a customer is an incumbent MNE and a new MNE, respectively. "DS to incumbent MNEs" and "DS to new MNEs" are dummy variables that take the value one if a customer is not an MNE but a supplier to an incumbent MNE and to a new MNE, respectively (i.e., direct suppliers (DS) to MNEs). These variables are constructed using the information on customers' FDI status in both 2006 and 2011.

When customers invest abroad, they will reconstruct the production structure including procurement sources. If they tend to switch the sources from home country to host countries, domestic transaction tie is likely to stop. Otherwise, it may be strengthened through the rise of customers' production abroad and input demand. For example, VFDI firms will export intermediate goods to their overseas affiliates from home and thus continue to transact with domestic suppliers to produce those intermediate goods. Similarly, through supply chain, such an effect on suppliers to MNEs (i.e., direct suppliers) may affect the transaction tie between direct suppliers and firms supplying to them (i.e., indirect suppliers).

$\mathbf{Z}_{ij}$ is a vector of the variables that capture the relationship between supplier i and customer j. Specifically, we examine the geographical distance between those two firms. The distance to customer firms may have a positive coefficient. Transactions with distant customers require higher transaction cost and thus the transaction tie with distant customers is vulnerable to the negative demand shock. We measure the distance between two firms and the supplier's number of customers as the relative value to their average at a four-digit industry-level because these variables have large heterogeneity across industries. We also introduce two digit-level industry fixed effects.

Second, we investigate the impact of the MNEs' reorganization of their transaction on the labor demand of their suppliers. In general, labor demand function consists of firms' characteristics, demand sizes on their products, and factor prices. Therefore, we specify our equation as follows.

$$\Delta \ln L_i = \mathbf{x}_i \mathbf{\alpha} + \mathbf{y}_s \mathbf{\beta} + \epsilon_i$$

The dependent variable is a log-difference of firm i's employment from 2006 to 2011. A vector of $\mathbf{x}$ includes various firm characteristics while sector s-specific elements are included in a vector of $\mathbf{y}$. Sector s is the one to which firm i belongs. Our variables on firm characteristics are as follows. Incumbent MNEs and New MNEs are dummy variables taking the value one if a concerned firm is an incumbent MNE (i.e., has overseas affiliates as of 2006) and a new MNE (i.e., for the first time invests during 2006-2011), respectively (i.e., different from Incumbent MNE and New MNE dummy variables in the

above probit). As in the above probit model, we introduce logs of the numbers of firm's plants and customers. The average distance to firm i's all customers is also included. These three variables are measured as of 2006.

We capture the role of demand on firms' products by the following variables. First, we introduce log-differences of three sector-level variables during 2005-2010, including output prices, import prices, and total output values. We also introduce the interaction term of import prices with import penetration ratio to take into account the exposure to import competition. Second, customers' FDI status is examined. Specifically, DS is a dummy variable taking the value one if a concerned firm is not an MNE but a supplier to any MNEs (i.e., direct supplier). Similarly, IDS is a dummy variable taking the value one if it is neither an MNE nor a direct supplier but a supplier to a direct suppliers (i.e., indirect supplier). Again, the coefficients for these variables will indicate (on average) how MNEs reconstruct their production structure when investing abroad. If overseas production increases domestic production in MNEs, the demand on domestic employment will increase in not only MNEs but also suppliers to them. Through the supply chain, the demand on employment will also rise in firms who supply their products to the suppliers to MNEs. To control for factor prices, we also introduce a log-difference of province-level wages between 2005 and 2010, in addition to two digit-level industry fixed effects.

3. Data Issues and Data Overview

This section introduces our data sources and how to construct our dataset for empirical analysis. Then, we take a brief overview of our dataset.

3.1 Data Source and Construction Procedure

Our primary data sources are the firm-level survey extracted from the TSR data and Japanese FDI data from *Overseas Japanese Companies Data* published by TKZ from 2006 to 2011. The TSR data comprises three databases. The first one is the TSR company information database, which contains firm-level basic information, such as the name of firms, location, industry classification, sales, the number of employees, and profit. The second one is the TSR company linkage database, which includes the inter-firm linkage among firms located in Japan and enables us to identify suppliers and customers among firms in the TSR data. Although this database provides the maximum 24 suppliers and customers for each individual firm, we complement them with the information reported by their transaction partners.[3] The third is the TSR establishment database. This database

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[3] For example, although Toyota purchases parts and components from hundreds of suppliers, Toyota

provides us geographic information of plants owned by firms in the TSR company information database. We obtain the address information of MNEs' plants. Most of the MNEs have multiple plants in Japan.

One of the features of the TSR data is its coverage. It covers not only listed firms but also SMEs. According to Bernard et al. (2014), compared with census data, the TSR data underrepresent firms with four or less employees. However, the distribution of firms with five or more employees in the TSR sample is close to the full population from census data. On the flip side, since the TSR data do not contain variables such as intermediate input and capital stock, it is impossible to calculate total factor productivity (TFP). In addition, we do not have any information on the volume of transaction.

The TKZ data is the firm-level survey for Japanese firms that own foreign affiliates with more than 20% capital share. Although the TKZ data is not government survey, it is one of the most frequently used data sources for analyses concerning Japanese FDI (see Head et al., 1995; Belderbos and Carree, 2002). The data focus on a survey of approximately five thousand listed and non-listed enterprises, and include their overseas affiliate data on location, investment year, investment type (new establishment, capital investment, and acquisition), amount of capital, total number of employees, number of employees from Japan, earnings, business content, purpose of investment, and funding relationship.

The data construction procedure is as follows; first, we extract manufacturing firms from the 2006 and 2011 editions of the TSR company information database. We focus on firms that report their financial information both in 2006 and in 2011.[4] Second, we match this dataset with the TKZ database and identify firms that own manufacturing affiliates abroad as of year 2006 or start investing abroad from 2006 to 2011. We call the former group of firms "incumbent MNEs" and the latter firms "new MNEs." Third, focusing on intermediate goods producers, we define the direct and indirect suppliers to MNEs. The intermediate goods producers are defined as manufacturing firms in intermediate goods industries identified based on the 2005 version of Input-Output table compiled by Ministry of Internal Affairs and Communications (MIC).[5]

We employ two definitions for direct/indirect suppliers. Our baseline is the narrower definition (Definition I). Among non-MNEs, if at least one of their top three

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can report only up to 24 suppliers. However, by looking at parts and components firms reporting Toyota as a primary customer, we can make up the list of Toyota's suppliers.

[4] This means that we restrict our sample firms only to those that exist in both 2006 and 2011. Exiting rate of firms is around 3%, which is presented in Appendix Table A1, and they are incorporated in the robustness checks in Table 8.

[5] We calculate the ratio of intermediate demand to total output by sector using Input-Output table. Then, we define sectors with the ratio greater than 75% as intermediate goods industries.

customers are MNEs, they are regarded as the direct suppliers (*DS*) to MNEs. Furthermore, among firms that are neither MNEs nor the direct suppliers of MNEs, if at least one of their top three customers are the direct suppliers to MNEs, we regard them as the indirect suppliers (*IDS*) to MNEs. The other is the broader definition (Definition II). That is, we extract the top five customers. If at least one of these customers are MNEs (the direct suppliers to MNEs), then we regard the supplier to him/her as the direct supplier to MNEs (the indirect suppliers to MNEs).

We obtain firm-level variables (e.g., the numbers of employees, plants, and customers) from the above matched dataset. The data on wages, output prices, import prices, import penetration, and output values examined in our labor demand function estimation are obtained from the 2005 version of Input-Output table and the 2010 version of the extended Input-Output table, which are compiled by MIC and Ministry of Economy, Trade and Industry (METI), respectively. We matched Input-Output table sector classification with TSR industry classification at a four digit-level. As for wage rate, we collect manufacturing average wage by prefecture from census of manufacturers conducted by METI.

Distance between customer firm and supplier firm is calculated by great-circle distance calculator using the information on the latitude and longitude of firm location, which are obtained from CSV address matching service provided by Center for Spatial Information Science, the University of Tokyo. In this computation, we identify each firm's headquarters location. However, large-sized firms, especially MNEs are likely to have multiple plants in their home country. Therefore, only when computing distance with MNEs, we complement plant location information from the TSR establishment database as mentioned above. Specifically, we calculate distance from MNEs to their suppliers, referring to the MNEs' nearest plants to the suppliers. In our analysis on labor demand function, we use the average distance to all customers for each supplier firm.

3.2 Data Overview

This subsection presents the data overview based on the data for 2006 and 2011. Table 1 presents the number of firms in our dataset. There are 1,778 incumbent MNEs and 133 new MNEs. As for the number of their suppliers, according to the definition I, the numbers of the direct and indirect supplier to MNEs are 22,911 and 9,240, respectively. One may argue that the number of observations for the indirect suppliers looks small, compared with the number of the direct suppliers. Actually, there are 15,843 firms whose customers are the direct suppliers to MNEs in our sample. However, since 6,603 firms out of 15,843 firms are also categorized as the direct suppliers, we regard the rest of firms

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as the indirect suppliers (i.e., 9,240 firms) in this table. In other word, the sample in this table for the indirect suppliers is composed of those firms that transact with the direct suppliers of MNEs but do not directly with MNEs. In the definition II of MNEs suppliers, we have 26,091 direct suppliers and 9,159 indirect suppliers. Since we focus on the top five customers in this definition, the numbers of suppliers are larger than those in the definition I.[6]

===   Table 1   ===

Table 2 shows the firm characteristics, i.e., the number of employees, the numbers of suppliers and customers, average distances from/to their suppliers and customers, and growth rates of employment by type of firms. Obviously, MNEs are larger in terms of the number of employees and transact with many suppliers and customers compared with non-MNEs. The numbers of employees and transaction partners also differ between the direct and indirect suppliers. The indirect suppliers have the smaller numbers of employees and transaction partners than the direct suppliers. While average distance from the suppliers is shorter for MNEs than that for the direct and indirect suppliers, MNEs have longer distance to customer firms than the direct and indirect suppliers do. It may imply that MNEs tend to co-locate with their suppliers and sell their products to distant customers. Growth rates of employment also differ according to type of firms. Compared with MNEs, the direct and indirect suppliers have the smaller growth rate in terms of employment. "Other firms" have the lowest growth rates of employment and sales.

===   Table 2   ===

Next, we investigate the survival rate of transaction tie among our sample firms.[7] Panel (a) in Table 3 presents the survival rate by firm size. An overall annual average survival rate is around 96%. The survival rate of transaction tie for suppliers with 300 or more employees is slightly lower than that for smaller suppliers, implying that larger firms are more actively reorganizing transaction relationships. Panel (b) in Table 3

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[6] One may be interested in whether FDI to developing countries, such as East Asian countries, has a different impact or not. Among 1,778 incumbent MNEs, 1,673 firms have affiliates in East Asian countries. As for New MNEs, 119 out of 133 firms have invested in East Asia. Thus, our results are mostly driven by FDI toward East Asian countries.

[7] TSR dataset captures new transaction tie from 2006 to 2011. The total number of transaction has substantially increased from 3.6 million to 4.5 million, which means unrealistically high growth rate. As suggested in Furusawa et al. (2015), potential reason for this increase might be measurement error. Therefore, they exclude firms that enter or exit during sample period and use balanced panel dataset.

summarizes the differences in the survival rate according to MNE status. Obviously, the survival rate of transaction tie with incumbent MNEs are lower than that with non-MNEs. As we confirmed in Table 2, incumbent MNEs are relatively large firms and their number of customers are also larger than that for other firms. Therefore, these results may simply reflect the fact that firms with a larger number of customers are more likely to reorganize transaction relationships. However, the survival rate with new MNEs is slightly higher than that with non-MNEs, although new MNEs have a larger number of customers than non-MNEs. Finally, we checked whether transaction relationship with distant customers are more vulnerable or stable. Panel (c) in table 3 divide our samples depending on the location of customers; whether they locate in the same prefecture or not. We find that the survival rate for transaction relationship with neighboring customers are more stable than that for distant customers.

=== Table 3 ===

4. Estimation Result

This section presents our estimation results. We first report the estimation results of our probit model and then show those of our labor demand function.

4.1 Results of Probit Model

We estimate a probit model for transaction tie to be broken off. The estimation results are presented in Table 4.[8] To highlight the impact of transaction with MNEs, we restrict our sample firms only to direct suppliers, indirect suppliers, and other firms. While column (1) uses the narrower definition of direct suppliers (definition I), the broader definition, namely definition II is used in column (2). In both columns, incumbent and new MNE dummy variables have negatively significant coefficients, indicating that transaction ties with MNEs are less likely to be suspended. In other words, on average, customers' investing abroad increases the probability of keeping transaction with their domestic suppliers. In the case of transaction ties of indirect suppliers, only the coefficient for direct suppliers to incumbent MNEs is negative and significant. This result may indicate the effects of FDI on the indirect suppliers are limited.

=== Table 4 ===

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[8] Summary statistics and correlation matrix are presented in Table A2 and Table A3, respectively.

The results in the other variables are as follows. In both definitions, while the coefficients for the number of suppliers' employees are insignificant, the number of supplier's plants has significantly negative coefficients. As is consistent with our expectation, in column (1), the coefficient for the number of supplier's customers is positively significant, showing flexibility in transaction partners. On the other hand, the coefficients for customer's employment are significantly positive and indicate that transaction with larger-sized customers is more likely to be suspended. In short, transaction ties are more likely to be suspended when suppliers' size in terms of plant number is smaller or when customers' size in terms of employment is larger. The coefficients for distance between supplier and customer are significantly positive, suggesting that transaction ties with longer transport are more likely to be broken off. This result is consistent with that in Nitsch (2009), which examines the duration of international trade. Transaction with more distant partners increases the uncertainty of the fixed transaction costs and may discourage firms from continuing the transaction.

In columns (3) and (4), we include changes in the numbers of MNEs' overseas affiliates and their FDI destination countries (i.e., host countries), both of which are proxy for overseas production expansion in incumbent MNE customers. Since coefficients of these variables are negatively significant, MNEs' overseas production expansion strengthens domestic transaction networks. The results in the other variables are little changed compared with those in columns (1) and (2). In column (5), a transaction partners' employment growth rate is included as an independent variable. As indicated in table 2, employment growth rate substantially differs by type of firms, which may bring the heterogeneity of the survival rates for different transaction partners. We find a negative and significant coefficient for customers' employment growth rate, suggesting that transaction ties with growing firms are more likely to continue.

One may be interested in whether the transaction relationships differ from industry to industry. In the literature of international trade, for example, product-level analysis has shown that differentiated goods or parts and components in machinery industry tend to be traded in longer period, and transaction ties in that industry are less likely to be suspended (Besedes and Prusa, 2006ab; Obashi, 2010). Thus, the stability of transition ties will vary by industries. To examine this difference, we split our sample into three groups; labor intensive industry (LI), capital intensive-material producing industries (Material), and capital intensive-machinery industries (Machinery).[9] The results are

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[9] "LI" includes Food, Textile, Wood, Paper and Paper products, Non-metallic mineral products and other manufacturing. "Material" consists of Chemical, Oil and Coal products, Primary metal manufacturing industries. "Machinery" is composed of Metal products, Machinery, Electric machinery and Transport equipment.

shown in Table 5 and do not change so much compared with our baseline results although the coefficient for DS to New MNEs is positively significant in material industries.

=== Table 5 ===

The stability of transaction tie with MNEs or direct suppliers may differ according to supplier's number of customers. For example, if a supplier transacts with only one customer, and he or she is an MNE, that supplier may try to maintain a transaction with that MNE. As in the following equation, we include the interaction terms of MNEs and direct suppliers dummy variables with the logged number of supplier's customers (a vector of which is denoted by $\mathbf{C}$);

$$\Pr(Stop_{ij} = 1) = \Phi(\mathbf{X}_i\boldsymbol{\alpha} + \mathbf{Y}_j\boldsymbol{\beta} + \mathbf{D}_j\mathbf{C}_i\ \boldsymbol{\eta} + \mathbf{Z}_{ij}\boldsymbol{\gamma}),$$

where $\mathbf{D}_j$ is the matrix of dummy variable which takes one if their customer is MNE or direct supplier. The marginal effect for interaction terms in non-linear model, such as probit is known to be complex non-linear function. Thus, we calculate the marginal effects at the mean value for all variables, except for the number of customers, following Eslava et al. (2013). Since the number of customers is normalized by its industry average, we evaluate it at 0.5, 1 and 1.5 from column (1) to (3) in Table 6. The results show that the marginal effect of incumbent MNEs, new MNEs, and direct suppliers of incumbent MNEs become slightly smaller as the number of customers increases, suggesting that the transaction tie with MNEs, new MNEs or the direct suppliers are more stable when a concerned supplier has a smaller number of customers.

=== Table 6 ===

To check the robustness of the results, we conduct two additional estimations. First, some of our sample firms may suffer from the Great East Japan Earthquake (GEJE) that occurred in March 11 2011. Since TSR provides the account closing date in their data set, we check it for the data of 2011 and exclude those firms whose account closing date is from April 2011 and onward. These results are presented in column (1) and (2) in Appendix A6 and we confirm major results do not change so much. Second, when we define the direct and indirect suppliers, we focus on the intermediate goods manufacturing industries, which are defined based on the input-output table. However, one may be concerned that there might be heterogeneity in terms of sales partners within a roughly-defined industry. Therefore, we look at the top three customer firms' industry, and if none of them is wholesale and retail trade industry, we define these firms as intermediate goods

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manufactures. Only among these manufactures, we again identify direct and indirect suppliers. The result with this alternative definition are presented in column (3) and (4) in Appendix A6 and these results are quite similar to the baseline results.

4.2 Results of Labor Demand Function Estimation

Table 7 presents the estimation results of labor demand function.[10] In column (1), dummy variables for direct suppliers (DS) and indirect suppliers (IDS) have positively significant coefficients, suggesting that the direct and indirect suppliers to MNEs have higher employment growth rate than other firms. This result is consistent with what we observed in Table 2.[11] MNEs *per se* have higher employment growth rate, as indicated in the coefficients for Incumbent and New MNEs. The coefficient for Agglomeration is significantly negative, indicating the negative effect of tougher competition on firm-level demand on employment. As in the standard economic theory, the larger demand size measured by output values, the higher output prices, and the lower wage rates significantly raise employment growth rates. The significantly negative coefficient for import prices is not consistent with our expectation. Although the industries with higher import penetration ratio have the higher import price elasticity of labor demand, considering that the average import penetration is around 0.15, the average elasticity still becomes negative ($-0.025 = -0.044+0.15*0.159$). However, when we exclude the interaction term, the coefficient of import price become insignificant as shown in column (2).

=== Table 7 ===

As in our previous probit analysis, we estimate various models. While column (3) includes two digit-level industry fixed effects instead of variables for industry characteristics, four-digit industry fixed effects and prefecture fixed effect are controlled in column (4). Column (5) uses the alternative definition of suppliers (definition II). These results particularly on firm-specific variables are unchanged so much compared with those in column (1).

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[10] Summary statistics and correlation matrix are presented in Table A4 and Table A5, respectively.
[11] One may argue that positive impacts on DS and IDS are because some of direct and indirect suppliers are exporters and expand exports to MNEs' overseas affiliates. Unfortunately, our data do not have information on export and import. Instead, we utilize the data for year 2014, which contain export and import information, and found that the exporter ratios for direct suppliers, indirect suppliers, and "other firms" are 6.3%, 3.5%, and 3.8%, respectively. These figures suggest that the source of good performance of direct and indirect suppliers may not be attributable to export expansion to customers' overseas affiliates.

In Table 8, we include changes in the numbers of MNEs' overseas affiliates and their FDI destination countries (i.e., host countries), both of which are proxy for overseas production expansion in incumbent MNE customers. For direct suppliers, these variable show their incumbent MNE customers' production expansion, while those for indirect suppliers indicate the expansion in the incumbent MNEs to which they indirectly supply. In addition, those MNEs' average employment growth rates are also included. While a coefficient of change in the number of MNEs' affiliates is positive but insignificant, changes in the number of FDI destination countries and employment growth rates have positive and significant coefficient. These results suggest that the impacts of customers' FDI on their employment are heterogeneous in the sense that they depend on customers' business conditions.

=== Table 8 ===

Further estimation results are provided in Table 9. From columns (1) to (3) in Table 9, we estimate the demand function by industries. The results for capital intensive-material producers differ from those for other industries in the sense that the coefficient for IDS is insignificantly estimated. Furthermore, since we use balanced panel dataset, one may concern our results suffer from sample selection bias. We estimated Heckman model in columns (4) and (5) in Table 9.[12] To deal with exclusion restrictions, we put credit scores in TSR financial dataset into the selection equation. Credit score is constructed on the basis of the TSR researchers' periodic interviews for each firm and reflects financial health of firms. Compared with baseline results, estimates in our main variables do not much change. In particular, in these Heckman estimations, all coefficients reported are significantly estimated. As other robustness checks, we conduct two additional estimations as in the probit model estimation. The first is to exclude those firms that suffer from GEJE. And the second is to use the different definition of intermediate goods manufacturers. These results are presented in Appendix Table A8 and these are quite similar to the baseline results.

=== Table 9 ===

Estimation results so far may suffer from endogeneity bias because there might be a reverse causality; only good suppliers are able to transact with MNEs or direct suppliers. To deal with this issue, we use propensity score-weighted least squares, so called inverse

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[12] Coefficients in selection equation can be found in Table A7.

probability weighted (IPW) regression based on Hirano and Imbens (2001). We define propensity score p_i as the probit estimate of the probability to transact with MNEs or direct suppliers using variables for firm characteristics. Then, we calculate the weight, $\omega_i = \sqrt{D_i/p_i + (1 - D_i)/(1 - p_i)}$, where D_i is the dummy variable for direct supplier or indirect suppliers. Then we use this weight in the estimation. One of the features of this method is to utilize all the observations. To carry out IPW regression, we split our sample into two groups; treatment group and control group. To assess the performance of the direct suppliers, we regard the indirect suppliers and other firms as a control group. Similarly, other firms are regarded as a control group when evaluating the performance of the indirect suppliers. The results are presented in Table 10 and show the robustness of our results. From the quantitative point of view, columns (1) and (3) indicate that direct and indirect suppliers have higher employment growth rates by 14% (=exp(0.131)−1) and 4% (=exp(0.131)−1), respectively.

=== Table 10 ===

5. Conclusion

Firms' outward FDI has induced anxieties about the hollowing out of domestic industries. Against this backdrop, many studies have investigated "effects" of outward FDI and have shown non-negative effects on domestic performance in at least FDI firms *per se*. On the other hand, this paper examined the effects on the performance in FDI firms' transaction partners, i.e., whether the non-negative effects in FDI firms spread to the direct and indirect suppliers to them through supply chain linkages. Specifically, we first explored whether customers' FDI results in strengthening or suspending their transaction tie with domestic direct and indirect suppliers. Second, we examined how much MNEs' overseas production expansion affects the corporate performance of the direct and indirect suppliers to them.

Our results can be summarized as follows. There is no evidence that customers' FDI is more likely to suspend their domestic transaction. Rather, direct suppliers' transaction ties with MNEs are more persistent than those with other firms are. Although such an effect becomes weak for transaction between the direct and indirect suppliers, we did not find at least the negative effect. Furthermore, customers' FDI has significantly positive impact on performance (i.e., employment growth) in both the direct and indirect suppliers to them. In short, firms' investing abroad improves firm performance in not only

themselves but also their domestic direct and indirect transaction partners. These results become strong support for the policy to further encourage firms to invest abroad.

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Table 1. The Number of Firms According to Firm Types

	Definition I	Definition II
Incumbent MNEs	1,778	1,778
New MNEs	133	133
Direct supplier	22,911	26,091
to incumbent MNEs	22,483	25,641
to new MNEs	428	450
Indirect suppliers	9,240	9,159
to incumbent MNEs	9,150	9,082
to new MNEs	90	77
Other firms	59,101	56,002
Total	93,163	93,163

Source: Authors' computation

*Note*s: In this table, we use mutually exclusive definition of suppliers; for example, while the direct suppliers to incumbent MNEs are non-MNEs supplying to incumbent MNEs, the direct suppliers to new MNEs are non-MNEs supplying to new MNEs but not to incumbent MNEs.

Table 2. Average Firm Characteristics According to Firm Types

	Number of Employees	Distance to Suppliers	Distance to Customers	Number of Suppliers	Number of Customers	Growth of Employment	Growth of Sales
Definition I							
Incumbent MNEs	1155.05	142.46	228.11	110.83	91.29	-0.009	-0.113
New MNEs	366.34	150.36	210.97	35.76	44.96	0.120	-0.020
Direct supplier (incumbent MNEs)	62.92	175.49	193.16	6.71	7.64	-0.039	-0.151
Direct supplier (new MNEs)	33.86	162.41	164.59	5.31	6.41	-0.025	-0.118
Indirect suppliers (incumbent MNEs)	26.82	181.30	195.59	4.08	5.11	-0.037	-0.173
Indirect suppliers (new MNEs)	20.18	227.62	140.43	3.82	4.82	-0.115	-0.203
Other firms	42.71	215.31	241.47	5.63	6.85	-0.079	-0.187
Total	67.68	200.65	224.56	7.79	8.53	-0.063	-0.175
Definition II							
Incumbent MNEs	1155.05	142.46	228.11	110.83	91.29	-0.009	-0.113
New MNEs	366.34	150.36	210.97	35.76	44.96	0.120	-0.020
Direct supplier (incumbent MNEs)	62.56	177.38	195.19	6.81	7.90	-0.040	-0.152
Direct supplier (new MNEs)	31.73	172.73	163.84	5.31	6.36	-0.035	-0.139
Indirect suppliers (incumbent MNEs)	24.74	179.50	194.57	3.84	4.67	-0.039	-0.176
Indirect suppliers (new MNEs)	19.10	184.67	145.79	3.81	4.08	-0.101	-0.192
Other firms	42.07	216.94	243.38	5.56	6.76	-0.080	-0.188
Total	67.68	200.65	224.56	7.79	8.53	-0.063	-0.175

Source: Authors' computation

Table 3. Survival Ratio of Transaction Ties

Panel (a) Supplier Size in Terms of the Number of Employees

	Continune	New	Stop	Total	Survival ratio
-299	181,322	88,144	45,095	314,561	96.0%
300-	40,760	18,931	10,937	70,628	95.8%
Total	222,082	107,075	56,032	385,189	96.0%

Panel (b) MNE Status

	Continune	New	Stop	Total	Survival ratio
Non-MNEs	188,990	92,083	47,103	328,176	96.0%
Incumbent MNEs	31,831	14,314	8,642	54,787	95.7%
New MNEs	1,370	795	336	2,501	96.1%
Total	222,191	107,192	56,081	385,464	96.0%

Panel (c) Co-location with transaction partners

	Continune	New	Stop	Total	Survival ratio
Other prefecture	129,212	70,501	35,729	235,442	95.7%
Same prefecture	92,979	36,691	20,352	150,022	96.4%
Total	222,191	107,192	56,081	385,464	96.0%

Source: Authors' computation

Table 4. Estimation Results of Probit Model: Excluding MNEs (Marginal Effects)

	(1)	(2)	(3)	(4)	(5)
Supplier characteristics					
log (Employee)	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
log (# of plants)	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
log (# of customers)	0.009***	0.013***	0.009***	0.009***	0.009***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Agglomeration	0.003***	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Customer characteristics					
log (Employee)	0.010***	0.011***	0.010***	0.010***	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
log (# of plants)	0.003	0.002	0.003	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
log (# of customers)	-0.006**	-0.006**	-0.006**	-0.005**	-0.005**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Emp-growth					-0.079***
					(0.002)
Incumbent MNEs	-0.092***	-0.070***	-0.091***	-0.091***	-0.091***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
New MNEs	-0.117***	-0.100***	-0.117***	-0.117***	-0.109***
	(0.017)	(0.014)	(0.017)	(0.017)	(0.017)
DS to incumbent MNEs	-0.061***	-0.061***	-0.062***	-0.061***	-0.062***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
DS to new MNEs	-0.003	0.017	-0.004	-0.003	-0.008
	(0.022)	(0.018)	(0.022)	(0.022)	(0.021)
D. (# of MNEs' overseas affiliates)			-0.002***		
			(0.001)		
D. (# of MNEs' host countries)			0.001		
			(0.001)		
D. (# of DS customers' overseas affiliates)				-0.006***	
				(0.001)	
D. (# of DS customers' host countries)				-0.001	
				(0.002)	
Bilateral characteristics					
log (Distance)	0.012***	0.012***	0.012***	0.012***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Definition of Suppliers	I	II	I	I	I
Number of Observations	186,079	186,079	186,079	186,079	184,931
log LL	-90105	-90274	-90095	-90093	-88392
Pseudo R2	0.0156	0.0137	0.0157	0.0157	0.0260

Notes: A dependent variable is the dummy variable that takes the value one if transaction tie is broken off between 2006 and 2011. Figures in parentheses are robust standard errors. *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. Industry and Prefecture fixed effects are included.

Table 5. Estimation Results of Probit Model: Excluding MNEs, Estimation by Industry (Marginal Effects)

	(1)	(2)	(3)
Supplier characteristics			
log (Employee)	-0.002	0.006**	-0.003**
	(0.002)	(0.002)	(0.001)
log (# of plants)	-0.003	-0.020***	-0.013***
	(0.004)	(0.007)	(0.004)
log (# of customers)	0.010*	-0.029***	0.023***
	(0.005)	(0.010)	(0.005)
Agglomeration	0.006***	0.003	0.003
	(0.002)	(0.003)	(0.002)
Customer characteristics			
log (Employee)	0.014***	0.012***	0.006***
	(0.001)	(0.002)	(0.001)
log (# of plants)	-0.000	-0.001	0.007**
	(0.003)	(0.005)	(0.003)
log (# of customers)	-0.007*	0.002	-0.011***
	(0.004)	(0.007)	(0.004)
Incumbent MNEs	-0.087***	-0.088***	-0.095***
	(0.005)	(0.008)	(0.004)
New MNEs	-0.124***	-0.083*	-0.119***
	(0.030)	(0.049)	(0.023)
DS to incumbent MNEs	-0.057***	-0.068***	-0.065***
	(0.006)	(0.011)	(0.005)
DS to new MNEs	-0.010	0.179***	-0.068**
	(0.037)	(0.052)	(0.033)
Bilateral characteristics			
log (Distance)	0.012***	0.009***	0.013***
	(0.001)	(0.001)	(0.001)
Industry	LI	Material	Machinery
Number of Observations	74,958	27,349	83,772
log LL	-36721	-12629	-40592
Pseudo R2	0.0150	0.0166	0.0191

Notes: A dependent variable is the dummy variable that takes the value one if transaction tie is broken off between 2006 and 2011. Figures in parentheses are robust standard errors. *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. Industry and Prefecture fixed effects are included.

Table 6. Marginal Effects of Interaction Terms of the Customer Type Dummies with the Number of Supplier's Customers

	(1) relative # of customers=0.5	(2) relative # of customers=1	(3) relative # of customers=1.5
Customer characteristics			
Incumbent MNEs	-0.084***	-0.083***	-0.082***
	(0.003)	(0.003)	(0.003)
New MNEs	-0.101***	-0.100***	-0.099***
	(0.012)	(0.012)	(0.012)
DS to incumbent MNEs	-0.053***	-0.052***	-0.052***
	(0.004)	(0.003)	(0.003)
DS to new MNEs	-0.016	-0.016	-0.016
	(0.026)	(0.026)	(0.025)
log LL	-90103		
Pseudo R2	0.0156		

Notes: Figures in parentheses are robust standard errors. *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. Industry and prefecture fixed effects are included. "relative # customers" means the number of customers normalized by industry average.

Table 7. Estimation Results for Labor Demand Function: All Firms

	(1)	(2)	(3)	(4)	(5)
Firm-specific variables					
Incumbent MNEs	0.066***	0.066***	0.057***	0.053***	0.069***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
New MNEs	0.193***	0.193***	0.176***	0.164***	0.195***
	(0.033)	(0.033)	(0.033)	(0.034)	(0.033)
DS	0.026***	0.027***	0.017***	0.009**	0.026***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
IDS	0.032***	0.032***	0.020***	0.011***	0.031***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
log (# of plants)	-0.024***	-0.024***	-0.031***	-0.031***	-0.024***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
log (# of customers)	0.004	0.004	0.011***	0.013***	0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
log (Average distance to customers)	0.008*	0.009*	0.005	0.007	0.008*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Sector-specific variables					
Agglomeration	-0.006***	-0.006***	-0.005***	0.001	-0.006***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)
Agglomeration of MNEs	0.000***	0.000***	-0.001***	-0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
D. log (Outputs)	0.017***	0.019***	0.018***		0.017***
	(0.004)	(0.004)	(0.006)		(0.004)
D. log (Output price)	0.124***	0.129***	-0.015		0.121***
	(0.020)	(0.020)	(0.025)		(0.020)
D. log (Import price)	-0.044***	-0.008	0.017		-0.045***
	(0.014)	(0.012)	(0.017)		(0.014)
* Import Penetration	0.159***		0.053		0.159***
	(0.045)		(0.050)		(0.045)
D. log (Wage)	-0.331***	-0.326***	-0.396***		-0.326***
	(0.083)	(0.083)	(0.083)		(0.083)
Definition of suppliers	I	I	I	I	II
Observations	87,565	87,565	87,565	89,226	87,565
R-squared	0.004	0.004	0.012	0.025	0.004
Industry FE (4-digit)	No	No	No	Yes	No
Industry FE (2-digit)	No	No	Yes	No	No
Prefecture FE	No	No	No	Yes	No

Notes: A dependent variable is a log-difference of firm's employment from 2006 to 2011. Figures in parentheses are robust standard errors. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent level, respectively. "D.X" indicates the difference in X from 2005 to 2010.

Table 8. Estimation Results for Labor Demand Function: All Firms, Extension (1)

	(1)	(2)	(3)	(4)
Firm-specific variables				
Incumbent MNEs	0.066***	0.066***	0.066***	0.066***
	(0.011)	(0.011)	(0.011)	(0.011)
New MNEs	0.193***	0.193***	0.193***	0.193***
	(0.033)	(0.033)	(0.033)	(0.033)
DS to incumbent MNEs	0.026***	0.025***	0.025***	0.026***
	(0.004)	(0.004)	(0.004)	(0.004)
DS to new MNEs	0.030*	0.030*	0.029*	0.029*
	(0.016)	(0.016)	(0.016)	(0.016)
IDS to incumbent MNEs	0.032***	0.033***	0.032***	0.032***
	(0.004)	(0.004)	(0.004)	(0.004)
IDS to new MNEs	-0.004	-0.003	-0.004	-0.004
	(0.019)	(0.019)	(0.019)	(0.019)
D. (# of MNEs' overseas affiliates)		0.001		
		(0.001)		
D. (# of MNEs' host countries)			0.005***	
			(0.002)	
Customers' employment growth rate				0.018***
				(0.006)
D. (# of DS customers' overseas affiliates)		-0.001		
		(0.001)		
D. (# of DS customers' host countries)			0.003*	
			(0.002)	
DS customers' employment growth rate				0.017**
				(0.007)
log (# of plants)	-0.024***	-0.024***	-0.024***	-0.024***
	(0.005)	(0.005)	(0.005)	(0.005)
log (# of customers)	0.004	0.004	0.004	0.004
	(0.004)	(0.004)	(0.004)	(0.004)
log (Average distance to customers)	0.008*	0.009*	0.009*	0.009*
	(0.005)	(0.005)	(0.005)	(0.005)
Sector-specific variables				
Agglomeration	-0.006***	-0.006***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Agglomeration of MNEs	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
D. log (Outputs)	0.017***	0.017***	0.017***	0.017***
	(0.004)	(0.004)	(0.004)	(0.004)
D. log (Output price)	0.124***	0.124***	0.123***	0.122***
	(0.020)	(0.020)	(0.020)	(0.020)
D. log (Import price)	-0.044***	-0.044***	-0.044***	-0.043***
	(0.014)	(0.014)	(0.014)	(0.014)
* Import Penetration	-0.331***	-0.333***	-0.330***	-0.332***
	(0.083)	(0.083)	(0.083)	(0.083)
D. log (Wage)	0.159***	0.159***	0.159***	0.159***
	(0.045)	(0.045)	(0.045)	(0.045)
Observations	87,565	87,565	87,565	87,565
R-squared	0.004	0.004	0.004	0.004

Notes: A dependent variable is a log-difference of firm's employment from 2006 to 2011. Figures in parentheses are robust standard errors. *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. A specification used in this table is the same as in column (1) in Table 7.

Table 9. Estimation Results for Labor Demand Function: All Firms, Extension (2)

	(1)	(2)	(3)	(4)	(5)
Firm-specific variables					
Incumbent MNEs	0.016	0.070***	0.059***	0.031***	0.033***
	(0.024)	(0.026)	(0.014)	(0.011)	(0.011)
New MNEs	0.340***	0.137**	0.111***	0.146***	0.148***
	(0.084)	(0.057)	(0.040)	(0.033)	(0.033)
DS	0.011*	0.030***	0.016***	0.019***	0.018***
	(0.006)	(0.010)	(0.005)	(0.004)	(0.004)
IDS	0.039***	0.005	0.011**	0.025***	0.026***
	(0.007)	(0.011)	(0.005)	(0.004)	(0.004)
log (# of plants)	-0.018**	-0.024	-0.040***	-0.043***	-0.043***
	(0.007)	(0.017)	(0.008)	(0.005)	(0.005)
log (# of customers)	-0.006	0.024	0.029***	-0.025***	-0.026***
	(0.005)	(0.015)	(0.006)	(0.004)	(0.004)
log (Average distance to customers)	0.010	0.019	-0.003	0.011**	0.011**
	(0.006)	(0.017)	(0.007)	(0.005)	(0.005)
Sector-specific variables					
Agglomeration	-0.009***	-0.013**	0.001	-0.005***	-0.005***
	(0.002)	(0.005)	(0.002)	(0.001)	(0.001)
Agglomeration of MNEs	-0.000	0.000	-0.001***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
D. log (Outputs)	0.069***	0.037*	0.012*	0.022***	0.022***
	(0.009)	(0.021)	(0.007)	(0.004)	(0.004)
D. log (Output price)	0.133***	0.016	0.053	0.089***	0.086***
	(0.031)	(0.054)	(0.040)	(0.021)	(0.021)
D. log (Import price)	-0.080***	-0.008	0.031	-0.042***	-0.042***
	(0.030)	(0.060)	(0.020)	(0.015)	(0.015)
* Import Penetration	0.409***	-0.008	0.082	0.130***	0.130***
	(0.090)	(0.171)	(0.056)	(0.046)	(0.046)
D. log (Wage)	-0.539***	-0.086	-0.128	-0.356***	-0.352***
	(0.116)	(0.248)	(0.137)	(0.086)	(0.086)
Definition of suppliers	I	I	I	I	II
Estimation Method	OLS	OLS	OLS	Heckit	Heckit
Industry	LI	Material	Machinery	All	All
Observations	42,920	6,837	37,808	100,004	100,004
R-squared	0.005	0.006	0.004		

Notes: A dependent variable is a log-difference of firm's employment from 2006 to 2011. Figures in parentheses are robust standard errors. *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. "D.X" indicates the difference in X from 2005 to 2010. Coefficients of selection equation in Heckman model are presented in Table A7.

Table 10. Estimation Results for Labor Demand Function: IPW Regression

	Excluding MNEs		Excluding MNEs&DS	
	(1)	(2)	(3)	(4)
DS	0.131***	0.055***		
	(0.027)	(0.021)		
IDS			0.043***	0.044***
			(0.006)	(0.006)
log (# of plants)	-0.067***	-0.043***	-0.021***	-0.023***
	(0.011)	(0.013)	(0.006)	(0.006)
log (# of customers)	-0.001	0.007	0.010**	0.009**
	(0.008)	(0.011)	(0.005)	(0.005)
log (Average distance to customers)	0.003	0.002	0.008	0.007
	(0.011)	(0.010)	(0.005)	(0.005)
Agglomeration	-0.015***	-0.014***	-0.006***	-0.006***
	(0.003)	(0.003)	(0.001)	(0.001)
Agglomeration of MNEs	0.000	0.000	0.000**	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
D. log (Outputs)	0.019**	0.017**	0.026***	0.025***
	(0.009)	(0.008)	(0.006)	(0.006)
D. log (Output price)	0.098**	0.111**	0.123***	0.115***
	(0.048)	(0.043)	(0.024)	(0.024)
D. log (Import price)	0.031	-0.009	-0.051***	-0.050***
	(0.035)	(0.031)	(0.016)	(0.016)
* Import Penetration	0.174**	0.223***	0.148***	0.142***
	(0.078)	(0.073)	(0.042)	(0.042)
D. log (Wage)	-0.194	-0.179	-0.455***	-0.468***
	(0.183)	(0.169)	(0.089)	(0.092)
Estimation method	I	II	I	II
Number of Observations	85,679	85,679	63,493	60,421
R-squared	0.008	0.006	0.003	0.003

Notes: A dependent variable is a log-difference of firm's employment from 2006 to 2011. Figures in parentheses are robust standard errors. *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. "D.X" indicates the difference in X from 2005 to 2010.

Appendix. Additional Tables

Table A1. Survival Rate of Firms by the Number of Employees

	-99	100-299	300-999	1000	Total
Continue	112,359	7,397	2,129	689	122,574
Exit	19,377	761	229	66	20,433
Total	132,297	7,685	2,285	740	143,007
Survival rate	2.9%	2.0%	2.0%	1.8%	2.9%

Source: Authors' computation

Table A2. Descriptive Statistics for Probit Model

	Mean	Sd	p10	p90
Direct suppliers				
Bilateral characteristics				
Stop	0.194	0.396	0.000	1.000
log (Distance)	3.735	1.761	1.519	6.154
Supplier characteristics				
log (Employee)	3.657	1.378	1.946	5.416
log (# of plants)	0.889	0.429	0.693	1.386
log (# of customers)	0.910	0.356	0.470	1.348
Agglomeration	3.029	1.312	1.386	4.673
Customer characteristics				
log (Employee)	5.309	2.347	2.485	8.634
log (# of plants)	1.210	0.733	0.693	2.303
log (# of customers)	1.016	0.450	0.441	1.604
Emp-growth	-0.024	0.446	-0.340	0.312
Incumbent MNEs	0.115	0.319	0.000	1.000
New MNEs	0.003	0.052	0.000	0.000
DS to incumbent MNEs	0.066	0.247	0.000	0.000
DS to new MNEs	0.001	0.037	0.000	0.000
D. (# of MNEs' overseas affiliates)	0.102	1.582	0.000	0.000
D. (# of MNEs' host countries)	0.020	0.694	0.000	0.000
D. (# of DS customers' overseas affiliates)	0.061	1.043	0.000	0.000
D. (# of DS customers' host countries)	-0.001	0.485	0.000	0.000

Source: Authors' computation

Table A3. Correlation Matrix for Variables for Probit Model

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]
[1] Stop	1																	
[2] log (Distance)	0.061	1																
[3] log (Employee)	0.018	0.181	1															
[4] log (# of plants)	-0.01	0.083	0.533	1														
[5] log (# of customers)	0.025	0.146	0.57	0.359	1													
[6] Agglomeration	-0.01	-0.15	-0	0.028	0.04	1												
[7] log (Employee)	0.03	0.039	0.013	-0.05	-0.1	0.074	1											
[8] log (# of plants)	0.021	0.013	-0	-0.03	-0.08	0.044	0.763	1										
[9] log (# of customers)	0.011	0.045	-0.05	-0.05	-0.09	0.028	0.598	0.494	1									
[10] Emp-growth	-0.12	-0.02	0.01	0.009	0.004	0.02	-0	-0.02	0.005	1								
[11] Incumbent MNEs	-0.05	-0.05	-0.07	-0.06	-0.17	0.043	0.473	0.39	0.333	0.013	1							
[12] New MNEs	-0.01	-0.02	-0.03	-0.02	-0.03	0.007	0.023	0.016	0.042	0.013	-0.03	1						
[13] DS to incumbent MNEs	-0.04	-0.05	-0.18	-0.08	-0.17	0.036	-0.03	-0.05	-0.04	0.009	-0.14	-0.02	1					
[14] DS to new MNEs	-0	-0.01	-0.03	-0.01	-0.03	0.004	-0.02	-0.02	-0.01	-0	-0.02	-0	0.061	1				
[15] D. (# of MNEs' overseas affiliates)	-0.02	-0.03	-0.01	-0.01	-0.02	0.022	0.105	0.093	0.095	0.065	0.178	-0	-0.02	-0	1			
[16] D. (# of MNEs' host countries)	-0.02	-0.02	-0.01	-0	-0.01	0.013	0.01	-0.01	0.068	0.081	0.078	-0	-0.01	-0	0.748	1		
[17] D. (# of DS customers' overseas affiliates)	-0.01	-0.02	-0.04	-0.02	-0.04	0.015	-0.01	-0	-0.01	0.001	-0.03	-0	0.223	0.029	-0.01	-0	1	
[18] D. (# of DS customers' host countries)	-0.01	-0.02	-0.01	-0	-0	0.011	-0.04	-0.03	-0.02	0.019	9E-04	1E-04	-0.01	0.02	2E-04	1E-04	0.615	1

Source: Authors' calculation.

Table A4. Descriptive Statistics for Labor Demand Function

	Mean	Sd	p10	p90
D. log (Employment)	-0.063	0.441	-0.483	0.305
Incumbent MNEs	0.019	0.137	0.000	0.000
New MNEs	0.001	0.038	0.000	0.000
DS to Incumbent MNEs	0.241	0.428	0.000	1.000
DS to new MNEs	0.008	0.087	0.000	0.000
DS_inc_aff	0.204	1.968	0.000	1.000
DS_inc_country	0.043	0.883	0.000	0.000
DS_emp_growth	-0.010	0.275	-0.034	0.086
IDS to incumbent MNEs	0.169	0.374	0.000	1.000
IDS to new MNEs	0.004	0.065	0.000	0.000
IDS_inc_aff	0.160	1.600	0.000	0.000
IDS_inc_country	-0.005	0.744	0.000	0.000
IDS_emp_growth	-0.006	0.120	0.000	0.040
log (# of plants)	0.756	0.337	0.693	1.099
log (# of customers)	1.017	0.458	0.447	1.577
log (Average distance to customers)	1.004	0.370	0.501	1.402
Agglomeration	3.234	1.360	1.386	4.934
Agglomeration of MNEs	9.451	17.043	0.000	26.000
D. log (Outputs)	-0.213	0.363	-0.501	0.231
D. log (Output price)	0.064	0.089	-0.048	0.174
D. log (Import price)	-0.019	0.151	-0.165	0.140
* Import Penetration	-0.010	0.051	-0.038	0.010
D. log (Wage)	-0.027	0.021	-0.048	0.004

Source: Authors' computation

Table A5. Correlation Matrix for Variables for Labor Demand Function

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]
[1]	D. log (Employment)	1																						
[2]	Incumbent MNEs	0.017	1																					
[3]	New MNEs	0.016	-0.01	1																				
[4]	DS to Incumbent MNEs	0.03	-0.08	-0.02	1																			
[5]	DS to new MNEs	0.008	-0.01	-0	0.032	1																		
[6]	DS_inc_aff	0.009	-0.02	-0	0.182	0.019	1																	
[7]	DS_inc_country	0.013	-0.01	-0	0.083	0.037	0.743	1																
[8]	DS_emp_growth	0.011	0.005	0.002	-0.05	0.015	0.113	0.152	1															
[9]	IDS to incumbent MNEs	0.031	-0.07	-0.02	0.173	0.026	0.03	0.01	0.019	1														
[10]	IDS to new MNEs	0.002	-0.01	-0	0.005	0.033	-0.01	-0	-0.01	0.085	1													
[11]	IDS_inc_aff	0.004	-0.01	-0	0.035	0.005	0.086	0.061	0.019	0.223	0.029	1												
[12]	IDS_inc_country	0.006	4E-04	1E-04	-0.02	0.003	0.048	0.093	0.017	-0.01	0.038	0.602	1											
[13]	IDS_emp_growth	0.008	0.004	0.001	5E-04	0.008	0.012	0.011	0.06	-0.04	0.007	0.119	0.171	1										
[14]	log (# of plants)	-0.01	0.206	0.037	0.091	0.007	0.027	0.012	0.004	0.029	-0	0.009	-0.01	0.003	1									
[15]	log (# of customers)	0.013	0.297	0.057	0.101	0.018	0.026	0.012	-0.01	0.027	0.003	0.002	-0.01	-0	0.267	1								
[16]	log (Average distance to customers)	0.009	0.059	0.013	0.059	-0	0.003	-0	-0.03	0.003	-0	-0	-0.02	-0.01	0.093	0.351	1							
[17]	Agglomeration	-0.01	0.003	-0	0.03	0.007	0.023	0.015	0.005	0.03	0.001	0.012	0.014	0.012	-0.01	0.048	-0.08	1						
[18]	Agglomeration of MNEs	0.014	0.111	0.022	0.069	0.006	0.031	0.015	0.004	-0.01	-0.01	0.005	0.002	-0	0.042	0.083	-0.06	0.308	1					
[19]	D. log (Outputs)	0.001	0.028	0.007	-0.11	-0.03	-0.02	-0.01	-0.01	-0.15	-0.02	-0.05	-0.01	-0.01	-0.02	0.004	0.004	0.036	0.064	1				
[20]	D. log (Output price)	0.027	0.005	0.004	0.138	0.029	0.035	0.026	0.01	0.148	0.027	0.043	0.011	0.011	0.051	-0	-0	-0.03	0.003	-0.37	1			
[21]	D. log (Import price)	0.008	-0.02	0.006	0.067	0.025	0.016	0.017	-0.01	0.067	0.017	0.022	0.007	0.006	0.018	-0	-0	-0.04	-0.05	-0.25	0.459	1		
[22]	* Import Penetration	-0.02	-0.05	-0.01	-0.05	-0.01	0.004	-0.01	0.001	-0.01	-0	0.003	-0.02	-0.01	0.004	-0.04	0.102	-0.27	-0.29	-0.01	-0.01	0.031	1	
[23]	D. log (Wage)	0.017	-0.02	0.004	0.074	0.017	0.017	0.016	-0	0.067	0.012	0.016	0.006	0.005	0.02	-0	-0	0.077	0.017	-0.09	0.334	0.67	0.001	1

Source: Authors' computation

Table A6. Robustness Check for Probit Model (Marginal Effects)

	(1)	(2)	(3)	(4)
	Before GEJE		Different definition of final goods producers	
Supplier characteristics				
log (Employee)	-0.001	-0.001	-0.002*	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
log (# of plants)	-0.010***	-0.010***	-0.010***	-0.010***
	(0.003)	(0.003)	(0.003)	(0.003)
log (# of customers)	0.009***	0.013***	0.022***	0.026***
	(0.003)	(0.003)	(0.004)	(0.004)
Agglomeration	0.003***	0.003***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Customer characteristics				
log (Employee)	0.010***	0.011***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
log (# of plants)	0.003	0.002	0.005**	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)
log (# of customers)	-0.006**	-0.005**	-0.008***	-0.008***
	(0.003)	(0.003)	(0.003)	(0.003)
Emp-growth				
Incumbent MNEs	-0.092***	-0.070***	-0.088***	-0.067***
	(0.003)	(0.003)	(0.003)	(0.003)
New MNEs	-0.117***	-0.099***	-0.110***	-0.086***
	(0.017)	(0.014)	(0.017)	(0.014)
DS to incumbent MNEs	-0.061***	-0.060***	-0.059***	-0.059***
	(0.003)	(0.003)	(0.003)	(0.003)
DS to new MNEs	-0.003	0.018	-0.014	0.012
	(0.022)	(0.018)	(0.022)	(0.018)
Bilateral characteristics				
log (Distance)	0.012***	0.012***	0.013***	0.013***
	(0.001)	(0.001)	(0.001)	(0.001)
Definition of Suppliers	I	II	I	II
Number of Observations	185,668	185,668	156,516	156,516

Notes: A dependent variable is the dummy variable that takes the value one if transaction tie is broken off between 2006 and 2011. Figures in parentheses are robust standard errors. *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. Industry and Prefecture fixed effects are included.

Table A7. Estimation Results for Heckman Model

Definition of Suppliers	(1) I		(2) II	
Dependent variable	ΔL	selection	ΔL	selection
Incumbent MNEs	0.031***	1.224***	0.033***	1.224***
	(0.011)	(0.254)	(0.011)	(0.254)
New MNEs	0.146***	5.732***	0.148***	5.733***
	(0.033)	(0.082)	(0.033)	(0.082)
DS	0.019***	0.031**	0.018***	0.033***
	(0.004)	(0.013)	(0.004)	(0.012)
IDS	0.025***	0.089***	0.026***	0.089***
	(0.004)	(0.014)	(0.004)	(0.014)
log (# of plants)	-0.043***	0.097***	-0.043***	0.097***
	(0.005)	(0.018)	(0.005)	(0.018)
log (# of customers)	-0.025***	0.137***	-0.026***	0.137***
	(0.004)	(0.015)	(0.004)	(0.015)
log (Average distance to customers)	0.011**	-0.046***	0.011**	-0.046***
	(0.005)	(0.015)	(0.005)	(0.015)
Agglomeration	-0.005***	-0.001	-0.005***	-0.001
	(0.001)	(0.004)	(0.001)	(0.004)
Agglomeration of MNEs	0.000***	-0.001***	0.000***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
D. log (Outputs)	0.022***	-0.068***	0.022***	-0.068***
	(0.004)	(0.015)	(0.004)	(0.016)
D. log (Output price)	0.089***	0.325***	0.086***	0.324***
	(0.021)	(0.071)	(0.021)	(0.071)
D. log (Import price)	-0.042***	-0.065	-0.042***	-0.065
	(0.015)	(0.049)	(0.015)	(0.049)
* Import Penetration	0.130***	0.236*	0.130***	0.235*
	(0.046)	(0.133)	(0.046)	(0.133)
D. log (Wage)	-0.356***	0.564**	-0.352***	0.564**
	(0.086)	(0.266)	(0.086)	(0.266)
Score		0.035***		0.035***
		(0.001)		(0.001)
athrho		-0.782***		-0.782***
		(0.024)		(0.024)
lnsigma		-0.756***		-0.756***
		(0.008)		(0.008)
Observations	100,004	100,004	100,004	100,004

Notes: A dependent variable in outcome equations is a log-difference of firm's employment from 2006 to 2011. Figures in parentheses are robust standard errors. *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. "D.X" indicates the difference in X from 2005 to 2010.

Table A8. Robustness Check for Labor Demand Function

	(1)	(2)	(3)	(4)
	Before GEJE		Different definition of finalg goods producers	
Firm-specific variables				
Incumbent MNEs	0.066***	0.069***	0.062***	0.064***
	(0.011)	(0.011)	(0.011)	(0.011)
New MNEs	0.193***	0.195***	0.189***	0.190***
	(0.033)	(0.033)	(0.033)	(0.033)
DS	0.026***	0.025***	0.026***	0.026***
	(0.004)	(0.003)	(0.004)	(0.004)
IDS	0.031***	0.031***	0.023***	0.021***
	(0.004)	(0.004)	(0.004)	(0.004)
log (# of plants)	-0.024***	-0.024***	-0.023***	-0.023***
	(0.005)	(0.005)	(0.005)	(0.005)
log (# of customers)	0.004	0.003	0.007*	0.006
	(0.004)	(0.004)	(0.004)	(0.004)
log (Average distance to customers)	0.009*	0.008*	0.009**	0.009**
	(0.005)	(0.005)	(0.005)	(0.005)
Sector-specific variables				
Agglomeration	-0.006***	-0.006***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Agglomeration of MNEs	0.000***	0.000***	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
D. log (Outputs)	0.017***	0.017***	0.014***	0.014***
	(0.004)	(0.004)	(0.004)	(0.004)
D. log (Output price)	0.123***	0.120***	0.140***	0.140***
	(0.020)	(0.020)	(0.020)	(0.020)
D. log (Import price)	-0.044***	-0.044***	-0.032**	-0.032**
	(0.015)	(0.015)	(0.015)	(0.015)
* Import Penetration	0.159***	0.158***	0.158***	0.158***
	(0.045)	(0.045)	(0.045)	(0.045)
D. log (Wage)	-0.335***	-0.330***	-0.342***	-0.338***
	(0.083)	(0.083)	(0.083)	(0.083)
Definition of suppliers	I	II	I	II
Observations	87,407	87,407	87,565	87,565
R-squared	0.004	0.004	0.004	0.004

Notes: A dependent variable is a log-difference of firm's employment from 2006 to 2011. Figures in parentheses are robust standard errors. *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. A specification used in this table is the same as in column (1) in Table 7.