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Revisiting Complementarity between Japanese FDI and the Import of Intermediate Goods: Agglomeration Effects and Parent-firm Heterogeneity

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Revisiting Complementarity between Japanese FDI and the Import of Intermediate Goods: Agglomeration Effects and Parent-firm Heterogeneity♣

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Abstract

The concern regarding the hollowing out by FDI has re-emerged in Japan, with both large and small firms relocating their plants to China since the late 1990s. This study sheds lights on the effects of agglomeration and firm characteristics upon the complementary relationship between FDI and import of intermediate input from home country, which has been overlooked in the literature. Estimating the duration model of Japanese affiliates' input trade by using parent–affiliate, product-level data from 2000 to 2006, we found while firms in agglomerated regions with more foreign affiliates shorten its duration, small firms import for a longer duration. (100 words)

Keywords: FDI by SMEs, Trade duration, Intermediate goods, Agglomeration,
JEL classifications: F14, F21, F23

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1. Introduction

When China symbolically joined the world trading system by becoming a member of the World Trade Organization (WTO) in 2001, Japanese firms dramatically increased their foreign direct investment (FDI) flows to China, surpassing Japan's largest trade and investment partner, the United States (US) by 2005. Large enterprises as well as small and medium-sized enterprises (SMEs) set up their plants in China. As Table 1 shows, the share of SMEs (companies with less than 300 employees) has steadily increased over the past few decades. In particular, the share of firms with less than 1,000 employees accounts for 47.7% of the firms that began investing after 2001. The relocation of SMEs, which employ the majority of the Japanese labor force, to foreign countries, including China, has revived concerns of the hollowing out of the local economy in Japan.

[Insert Table 1 approximately here]

This study provides some stylized facts to contribute toward better debates on the hollowing out issue and, from a dynamic perspective, analyzes the duration of intermediate goods trade when it is accompanied by an increase in FDIs by using a unique parent–firm–affiliate, product-level dataset for the 2000–2006 period. More specifically, we investigate the effects of firm characteristics and agglomeration on the FDI-trade complementarity.

This study is structured as follows. Section 2 briefly review the literature and sectin3 describes the data sources and demonstrates several important stylized facts about the dynamics of intermediate goods trade. Section 4 presents the empirical specifications. Section 5 explains our estimation results. Section 6 discusses these results. The final section summarizes our concluding remarks.

2. Literature

The hollowing-out effect of FDIs has long been debated in the international trade literature, often centering on whether FDIs are substitutes or complements of exports. Brainard (1993, 1997) argued that FDIs and exports are substitutes because of the trade-off between proximity and concentration. When the production function is characterized by increasing returns to scale, a firm can benefit from lower costs by concentrating all of its production in one plant, but it incurs trade costs, such as transportation costs or import tariffs, to serve foreign markets through exports. However, by setting up a plant in each market, a firm can save on trade costs, but it loses any cost reductions gained through scale effects. Thus, this trade-off determines if a firm exports or invests to serve its foreign demand.

Complementarity may arise in a vertical production relationship. When an assembly company relocates its plant to a foreign country, the company that has supplied parts and components to the assembly firm now starts to export to the assembly firm's foreign plant. The same can be said for operations within the same firm. Specifically, when a firm "unbundles" its production stages and relocates a stage to a foreign country, the parent-firm exports inputs (typically, parts and components) to its affiliate plant abroad. The recent development of global supply chains has brought this type of FDI to the fore. Head and Ries (2001) found a complementary relationship for the case of Japanese manufacturing firms. Similar findings are obtained by Chen and Ku (2000) for Taiwan, Clausing (2000) for US, Eaton and Tamura (1994) for Japan and US, and Pfaffermayr (1996) for Austria. Hanson et al. (2005) examined trade in intermediate inputs for further processing between parent firms and their foreign affiliates using firm-level data on US multinationals and found that demand for imported inputs is higher when affiliates face lower trade costs, lower wages for low-skilled labor, and lower corporate tax rates.

There are still several concerns that the complementary relationship between FDIs and exports may not last long. First, as mentioned above, recent FDI flows to China have been mainly driven by SMEs, in which many of them are single-product firms. If it is difficult for SMEs to "unbundle" their production stages, exports from the parent SMEs to their foreign affiliates may not increase. Second, FDI flows to China tend to concentrate on the coastal areas, which mean that the multinational enterprise (MNE) affiliates in China have formed agglomerations in some coastal regions. Agglomerations of foreign firms may attract domestic suppliers to seek transactions with MNE affiliates. Therefore, once an agglomeration of suppliers develops, the MNE affiliates may reduce imports of intermediate goods from the home country. Third, as Belderbos et al. (2001) and Kiyota et al. (2008) demonstrated, MNE affiliates tend to increase local procurement as they accumulate experience in the local market.

These results imply that imports from the home country may gradually be substituted with the passage of time. In other words, the choice between imports from the home country or purchases from local suppliers may also change over time. Thus, the complementary relationship should be examined from a dynamic perspective.

Pioneering works on dynamic trade relationships can be traced to Besedes and Prusa (2006a, 2006b). Employing a survival analysis to a study of the duration of US imports, they found that the median duration of exporting a product to the US is very short—typically two to four years. They further examined the extent to which product differentiation affects the duration of the US import-trade relationship. Applying the Cox proportional hazard model to conduct empirical estimations, they estimated the hazard rate to be at least 23% higher for homogeneous goods than for differentiated products. Obashi (2010) examined whether the duration of intermediate goods trade is longer than that for the usual transactions of goods within East Asia because of the relation-specific nature of the international fragmentation of production. A series of survival analyses provided evidence that the stability of international production networks is a particularly prominent feature of East Asia. In addition, East Asian countries are more likely to engage in lasting trade relationships of intermediate goods with each other than with outsiders. Shao et al. (2012) focused on China's manufacturing exports at the six-digit harmonized system (HS) code product from 1995 to 2007 to isolate the factors affecting export duration. Their results show that export durations tend to be rather short-lived.

Crucially, the duration is longer for differentiated products and parts and components, highlighting the stability of intermediate goods trade resulting from international production fragmentation, as indicated by Obashi (2010).

Building on the previous literature about trade duration, we incorporate the FDI–trade nexus, which helps us better understand the hollowing-out effect of FDIs. More specifically, we study what kind of firms are more likely to continue to import intermediate goods from the home country and what kind of intermediate goods imported from the home country are less likely to be substituted for local procurement, which are questions that could not be addressed by the product-level trade data or firm-level data used in the previous studies. Our parent–affiliate–transaction matched panel dataset enables us to explore these issues in a dynamic perspective, and furthermore, we are able to calculate the quantitative sizes of impacts on trade duration and identify which factors contribute the most.

3. Data Sources

This study focuses on the stability of intermediate goods trade between Japanese affiliates in China and their parent companies. To do this, we construct a unique parent-affiliate-transaction panel dataset, covering 929 Japanese affiliates in China from 2000 to 2006. This section describes how the dataset was constructed.

The first data source is China's Annual Survey of Industrial Firms (CASIF), which is conducted by the National Bureau of Statistics (NBS) of China and consists of the total population of firms with sales above RMB 5 million, the so-called "scale-above" enterprises.

It covered 162,885 firms in 2000 and 301,961 firms in 2006. This dataset provides abundant information such as company name, location, type of ownership, sales, output, capital, labor and intermediate input. In the dataset, each firm reports its ownership type; viz., state-owned enterprises, private-owned enterprises, and foreign-owned enterprises (FOEs)[1] Unfortunately, nationality information for the FOEs is unavailable, preventing us from differentiating Japanese affiliates from those of other countries.

The second data source is the Toyo Keizai's Overseas Japanese Companies Data (Kaigai Shinshutsu Kigyo Soran). Toyo Keizai's survey on outward FDIs primarily covers foreign subsidiaries with a 20% or higher Japanese ownership. Crucially, the Japanese foreign affiliates in China covered in this survey have information about their Chinese names and addresses, enabling us to link them to the CASIF database and thereby access the dataset of Japanese affiliates.

We link the aforementioned compiled dataset to two more data sources. One is the China Customs data, which contains detailed information on each transaction, including the eight-digit HS code for trading products, product unit, quantity, unit value of each eight-digit HS product, total value, import origin, export destination, and type of trade. As firm identification numbers are different in the CASIF and Customs data, we use the affiliates' Chinese names to match the two datasets for information on the Japanese affiliates' imports of intermediate

[1] FOEs include Hong Kong-, Macao-, and Taiwan-owned firms (HMTs) and other foreign-owned firms.

goods. In order to focus on the imports of intermediate goods in this study, we exclude the imports of final goods, which are identified by the Broad Economic Category (BEC) classification.[2]

To consider the parent-firm characteristics, we complement Toyo Keizai's survey with the TSR database, since Toyo Keiza's survey only has limited information on parent firms (e.g., name of company and location). The Tokyo Shoko Research (TSR) Data is one of the largest databases compiled by a private company and it records both listed and non-listed companies in Japan. It gives several facts about each firm, including the year of establishment, the paid-up capital, and the current number of employees.

4. Empirical Specification and Data Overview

4.1 Empirical Specification

The semi-parametric Cox proportional hazards model has been widely used (see Besedes and Prusa, 2006a, 2006b; Brenton *et al*., 2010; and Obashi, 2010) to investigate the relationship between the duration of intermediate goods imports and its determinants. However, a recent study by Hess and Persson (2012) argued that the Cox model is inappropriate for analyzing the duration of a trade relationship. For example, given that trade

[2] We define transport equipment, except for parts and components (51 and 52), as well as durable, semi-durable, and non-durable consumer goods (61, 62, and 63) as final goods.

duration refers to the number of years such a relationship continues, we observe that many trade durations are of equal length. The many tided trade durations might cause asymptotic bias in the estimated coefficients. Hess and Persson (2012) thus proposed using a discrete-time hazard model instead of the continuous-time Cox proportional hazard model.

The estimation procedure in a discrete-time hazard model is as follows: let T_i be a continuous, non-negative random variable measuring the survival of intermediate goods imported from the parent country by the affiliates of Japanese MNEs in China. In the discrete-time framework, the probability that an affiliate terminates its imports of intermediate goods in a given time interval *k*, conditional on its survival up to the beginning of the interval and explanatory variables, or the hazard rate, is

$$h_{ik} = P(T_i < t_{k+1} \mid T_i \geq t_k, X_{ik}) = F(X'_{ik}\beta + \gamma_k) \quad (1)$$

where X_{ik} is a vector of time-varying covariates, while γ_k is a function of time that allows the hazard rate to vary across periods. As the underlying baseline hazard rate is unknown in practice, we incoporate γ_k into the model as a set of dummy variables to identify the duration (the period dummy variables). *F*(.) is an appropriate distribution function such that $0 \leq h_{ik} \leq 1$ for all *i*, *k*. The subscript *i* denotes a separate time period of intermediate goods imports. Introducing a binary variable, y_{ik}, equaling one if period *i* is observed to terminate the imports of intermediate goods during the *k*th interval, Hess and Persson (2012) derived the log-likelihood for the observed data as follows:

$$\ln L = \sum_{i=1}^{n}\sum_{k=1}^{k_i}[y_{ik}\ln(h_{ik}) + (1-y_{ik})\ln(1-h_{ik})] \quad (2)$$

This is similar to a standard log-likelihood function for a binary panel regression model. Assuming the functional form for the hazard rate to be a normal, logistic, or extreme-value minimum distribution, it will lead to a probit, logit, or cloglog (complimentary log-log) model, respectively. The cloglog model with period-specific intercepts represents the exact grouped-duration analog of the Cox proportional hazard model (Hess and Persson, 2012).

4.2 Definition of variables

The vector ***X*** for the hazard function (1) consists of three dimensions: affiliate and product characteristics, regional characteristics (agglomeration), and parent-firm characteristics. For the affiliate characteristics, affiliate size (*Alabor*) is measured by the logarithm of the number of workers. A large affiliate generally needs a range of intermediate goods and some of them have to be imported, suggesting a longer duration. Thus, a negative coefficient is expected to be associated with this variable. The terms *Awage* and *KL-ratio* refer to the logarithm of the total wage bill per worker and the capital-to-labor ratio, respectively. The exporter dummy (*Export*) takes the value one if an affiliate engages in export. Most Japanese affiliates in China undertake industrial processing for exports, suggesting that they need to import intermediate goods, which translates into longer trade durations.

For product characteristics, we include five variables.[3] The first is *Im-value*, which is the logarithm of lagged import value. It is expected to be associated with a negative coefficient because import goods with larger value are more difficult to be replaced with local procurement in the short term.[4] Second, we include *Diff*, which takes the value one if the products are categorized as differentiated goods, and zero otherwise. The definition of differentiated goods is per Rauch's (1999) commodity classification.[5] Differentiated goods are expected to be more likely to survive, because differentiated goods display more complex technologies. They are thus less easily substitutable by local supplies. Third, to control for product characteristics in the global value chain, we use the upstreamness index (*Upstream*). The concept of an upstreamness index was proposed by Antràs *et al*. (2012) and it measures how far an industry is from final consumption. An industry whose output is used mainly as an intermediate input for other industries is considered to be relatively upstream.[6] Since these products are required by other relatively upstream industries, they embody a higher degree of technological content. Again, these products are less likely to be substituted for local

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[3] Since we use product-level data, one may be interested in the effect of tariff. Actually, as shown in Table 2, a majority of our observations are classified as "process trading," which is not under the effect of tariff. We believe the effect of tariff may be limited. One way to inculpate this effect is to include product-year (period) fixed effect. We confirmed the robustness of the results including product-period fixed effect.

[4] In previous studies, such as Besedes and Prusa (2006a, 2006b) and Obashi (2010) use the initial value of import, namely the import value in the first year instead of lagged import value. We confirmed our results do not change even if we replace lagged import value with the initial value of import.

[5] Rauch (1999) classifies products traded on an organized exchange as "homogeneous goods" and products that are not sold on the exchanges, but whose benchmark prices exist, as "reference priced." We treat all other products as differentiated goods.

[6] For a detailed definition of the upstreamness index, please see the supplemental appendix in Antràs *et al.* (2012).

procurement, leading to a longer trade duration. Fourth, the home dummy (*Home*) equals one if an affiliate shows a positive value for intermediate goods imported from Japan. As Japan is one of the world's leading countries in technology, it is difficult to replace its intermediate goods with local supplies, meaning that trade with the home country should have a longer duration than that with other countries. Lastly, we include "process trading" (*Process*), which takes the value one if the products are included under process trading. In the Chinese Custom data, exports can be classified into processing exports and ordinary exports. Processing exports means that the products exported are made using imported inputs to assemble the final goods. One of the features of process trading is that it enjoys zero tariffs for the imported intermediate goods.[7] The dummy variable, *Process*, takes the value one if the intermediate goods are imported under a process trading scheme, otherwise zero.

Variables capturing the regional characteristics are our key variables. We consider three regional agglomeration variables. A widely defined agglomeration is the number of local firms in the same industry in the same region (*Agg-local-r*). Under the condition of high transportation costs, the products of local firms can replace the imported ones, leading to a negative influence on the duration of trade. Two more narrowly defined agglomeration variables are *Agg-foreign-r* and *Agg-Jaffiliates-r*, denoting the number of foreign affiliates

[7] For details of process trading, see Yu (2014).

(including Japanese affiliates) in the same industry in the same region, and the number of Japanese affiliates in the same industry in the same region.

As for variables for parent-firm characteristics, we include a size dummy of the parent firm (*Plarge*) that equals one if the parent firm has 1,000 employees or more.[8] And to examine the MNEs' own production networks, we also control for the number of foreign manufacturing affiliates worldwide or in China that belong to the same parent firm (*Pnetwork* and *Pnetwork-China*) or for the years of experience in managing production for each MNE (*Exper* and *Exper-China*). Table 2 summarizes the variable definitions and basic statistics.

[Insert Table 2 approximately here]

4.2 Data Overview

Before starting our econometric analysis, we provide a brief overview of the sample firms and their imports of intermediate goods. Figure 1 shows the share of local procurement and imports in total procurement by Japanese MNEs affiliates in China from 1995 to 2007, as derived by Maruya (2007). The imports from Japan used to be a major source of the procurement of Japanese affiliates in China. However, while the share of imports from Japan has gradually decreased from 50% to 30%, that for local procurement has increased from 30%

[8] The legal definition of SMEs in Japan is firms with 300 or more employees or whose paid-in capital is more than 3,000 million yen. However, we define large firms as those firms with more than 1,000 employees following the definition used in some labor statistics, such as the Census of Wage Structure by the Ministry of Health, Labor, and Welfare of Japan. The other reason is that the share of firms with fewer than 300 employees is quite limited. As shown in Table 1, it is slightly more than 20%. The estimation results are qualitatively the same and quantitatively very similar, even if we use different thresholds for the parent firms' number of employees; namely, 300 or 500.

to 50%. At the same time, the share of imports from countries other than Japan has also decreased from 20% to 10%. These facts suggest that MNE affiliates in China have gradually substituted their imports for local procurement.

[Insert Figure 1 approximately here]

Table 3 shows the regional distribution of Japanese affiliates in China. Two things are noteworthy. First, almost all Japanese affiliates are located in the coastal areas—the Bohai economic zone, the Yangtze River Delta, and the Pearl River Delta. These areas represent 96% of the regional distribution of Japanese affiliates in China. Second, of these coastal areas, the Yangtze River Delta area accounts for 49% of the Japanese affiliates. Moreover, 26% of the affiliates in China are located in Shanghai. These facts suggest that the Japanese affiliates in China form a dense agglomeration in these areas.

[Insert Table 3 approximately here]

Table 4 compares product and affiliate characteristics by parent-firm size. As for product characteristics, while *Diff*, and *Im-value* are higher for large firms; *Home*, *Upstream* and *Process* are larger for SMEs, suggesting that SMEs in China import more "upstream" intermediate goods from Japan and engage more actively in process trading. Looking at affiliate characteristics, those affiliates owned by large firms are, on average, larger in terms of the number of employees, pay higher wages, and have a higher K-L ratio. In contrast, affiliates owned by SMEs tend to be more active in terms of export activities.

[Insert Table 4 approximately here]

5. Empirical Results

5.1 Baseline Model

What determines the duration of imported intermediate goods for Japanese-owned enterprises in China? Based on product-level data of the eight-digit HS code, the results of the estimations using the discrete-time hazard rate of a probit model are reported in Table 5[9]. Column (1) and column (2) show the benchmark models comprising product and affiliate characteristics. While column (1) uses whole sample, we focus on import from home country in column (2).

[Insert Table 5 approximately here]

As for the influence of product characteristics, some interesting findings are contained in the various estimations. The coefficient for the logarithm of the import value in year t-1 (*Import-value*) is statistically significant with a negative sign, suggesting that the larger the trade value in year t-1. Crucially, we find a significantly negative coefficient of the variable *Home*, indicating that, if intermediate goods are imported from Japan, the trade relationship survives longer than in the case of imports from other countries. Japan is at the forefront of technology and possesses outstanding capability in producing many key parts and components.

[9] We employ various techniques of discrete-time survival models such as the cloglog model, the random-effect model probit, and the randome effect logit model. We confirm that all estimates are very similar. Due to space limitation, we do not report these results but these tables are provided upon readers' request.

Thus, intermediate goods imported from Japan are not easily substitutable through local procurement, so the decline is slower in terms of the hazard rate.

The coefficient for *Diff* is negative and significant, meaning that the traded goods' characteristics matter to the trade duration. The differentiated products (*Diff*) dominate other product types in terms of their survival rates, which last longer for the Japanese affiliates. Moreover, as the estimated coefficient for *Upstream* is significantly negative, this suggests that, if an industry is located upstream across industries (i.e., selling a disproportionate share of its output to the relatively upstream industries), its hazard rate is lower and has a longer trade duration. The fragmentation of production across national boundaries is a distinctive feature of the Asian production network (Athukorala and Yamashita, 2006). Thus, production in developing countries entails the sourcing of inputs and components from multiple suppliers, particularly from their home countries. That an industry's output is required by other relatively upstream industries implies a higher degree of technological content embodied in their products, thereby making its replacement through local procurement difficult. The above findings are consistent with existing product-level studies such as Besedes and Prusa (2006a, 2006b) and Obashi (2010). Another interesting phenomenon is that, if imported goods are used for process trading (*Process*), they experience a lower hazard rate; that is, they survive for a longer period. This result can be attributed to the specific export-promoting measures adopted by the Chinese government that allow the firms undertaking process trade to enjoy zero tariffs on their imported inputs. This induces exporters to continue importing intermediate goods for the assembly of exports in order to remain eligible for zero import tariffs.

Turning to affiliate characteristics, which are not examined in the extant literature, while the coefficient for *Export* is negative but not significant, the variables *Alabor*, *Awage*, and *KL-ratio* show significantly positive coefficients, suggesting that larger affiliates, which pay higher wages to employees and are more capital intensive, tend to show a shorter duration of intermediate goods imports. Large and capital-intensive Japanese affiliates tend to establish local production networks and purchase inputs from local (Chinese-owned or foreign-owned) suppliers, thereby experiencing a shorter duration of intermediate goods imports.

In columns (2), we restrict our sample to imports from Japan. Basically, our results do not change much. As indicated in Table 6, the sample size in columns (2) is 70% of that in columns (1). This may imply that our results are mainly driven by imports from Japan. Therefore, we use the sample for imports from Japan in all of our remaining estimations.[10]

As mentioned earlier, the agglomeration of suppliers may affect the procurement patterns of Japanese affiliates because they can purchase their intermediate goods locally if local suppliers, either local firms or other foreign affiliates, can supply qualified commodities. How does regional agglomeration affect the duration of the intermediate goods trade? Column from

[10] One may be interested in whether the results change or not if we include imports from all countries in the following estimations. We confirm that the results do not change. The results are provided at the reader's request.

(3) through (4) in Table 5 report the results by including the agglomeration variable and excluding the province fixed effect.[11]

Using the number of local firms within an industry and region (*Agg-local-r*) as a measure of agglomeration, the estimates in column (4) show that the agglomeration variable has a positive and significant coefficient. Recognizing the importance of innovation, China has been implementing various policies to encourage innovative activities since the late 1990s, aimed at transforming the economy into a knowledge-based one and catching up with the developed countries in technological capability.[12] With this technological upgrading in China, local firms can gradually produce qualified parts and provide them to the MNE affiliates, including Japanese affiliates, in China. Thus, in a region with more local firms in terms of numbers or sales, the Japanese affiliates exhibit a higher hazard rate to stop importing intermediate goods.

Correspondingly, the procurement of intermediate goods for Japanese affiliates can come from other foreign affiliates in China. Using the number of foreign firms to measure the degree of agglomeration (*Agg-foreign-r*), the estimates in column (4) show that within a region with more foreign affiliates, the Japanese affiliates located there tend to have a shorter duration for importing intermediate goods. Foreign affiliates overall have superior technological

[11] We construct the agglomeration variable by region (Bohai, Yangtze River Delta, Perl River Delta, Central region, West region, and North East region). However, some firms may transact with firms locating within a province. As a robustness check, we used the agglomeration variable by province and confirmed that the results do not change so much. These estimation results are provided upon readers' request..[12] China's R&D intensity (R&D expenditures-to-GDP ratio) has tripled from 0.57% in 1996 to 1.70% in 2009.

[12] China's R&D intensity (R&D expenditures-to-GDP ratio) has tripled from 0.57% in 1996 to 1.70% in 2009.

capabilities and Japanese affiliates might acquire their needed intermediate goods from other affiliates, thereby reducing imports. Similarly, for Japanese affiliates located in a region with many other Japanese-owned enterprises (*Agg-Jaffiliates-r*), their imports of intermediate goods have a shorter duration, as shown in column (5). This finding is reasonable because they may prefer acquiring intermediate inputs from other Japanese affiliates, if available.

5.2 Does the Duration in the Trade of Intermediate Goods Differ according to Parent-firm Size and Production Network?

In Table 6, we examine the impact of parent-firm characteristics. In column (1), we include the variable for parent-firm size, *Plarge*. We find that its impact is positive and significant, suggesting that SMEs tend to experience longer trade durations than those for large firms.

Turning to the variables for MNE production networks or the experience of foreign production, more striking results emerge, which are presented in columns (2)–(5) in Table 6. The MNE production network variables, both *Pnetwork* and *Pnetwork-China*, are associated with significantly positive coefficients, as shown in columns (2) and (3). Large Japanese MNEs, such as Toyota and Hitachi, have numerous foreign affiliates in China and other Southeast Asian countries that specialize in producing parts or assembly work and support the production needs of one another. Their affiliates in China thus substitute imported intermediate goods by procuring products from other affiliates belonging to the same parent firm.

Alternatively, Japanese affiliates owned by SMEs generally find it difficult to access their own production networks and continue to import needed intermediate goods from abroad, thereby showing a longer duration.

[Insert Table 6 approximately here]

Another parent-firm characteristic that potentially affects the affiliates' hazard rates of intermediate goods imports is FDI experience. The variables *Exper* and *Exper-China*, shown in columns (4) and (5), denote years of experience of foreign production and years of experience of production in China by a parent firm, respectively. We find that for parent firms with more FDI experience, their affiliates in China tend to exhibit a shorter period of importing intermediate goods; that is, there is a higher hazard rate. This is probably because MNEs learn more about local or foreign suppliers as their experience of foreign production increases. Firms that have more years of foreign production experience are more likely to substitute their imports of intermediate goods for local procurement.

In sum, we find that the duration of the imports of intermediate goods by SMEs is longer than that by large firms. Furthermore, firms with their own large production networks and greater experience of foreign production induce decreases in the imports of intermediate goods. As SMEs usually have only a few foreign affiliates and their experience of foreign production is limited, their trade duration might be shorter than that of large firms. This fact implies that trade in intermediate goods from Japan to China will continue to increase when considering the fact that recent FDI is mainly driven by SMEs.

6. Discussion

While agglomeration has a positive impact on the hazard rate of intermediate goods imports in our estimation results, FDI by SMEs has a negative impact on the probability of the termination of trade-transaction ties. One may be interested in which of the agglomeration or parent-firm characteristics are more influential in the duration of trade for intermediate goods. To measure the quantitative size of the impact of the determinants in our survival model, we calculate how much the predicted probability would change if the firm or regional characteristics changed. Figure 3 illustrates the predicted probability and the impact of changes in attributes, based on the results in column (2) in Table 6. Our baseline predicted probability of the termination of imports is calculated for those products that are differentiated (*Diff*=1), traded by large firms (*Plarge*=1), and exported by affiliates (*Export*=1). For other products and parent-firm and regional attributes, we use average values in our sample.

[Insert Figure 2 approximately here]

As for agglomeration, a change of one standard deviation of the agglomeration variable increases the predicted probability from 26.8% to 28.2% compared with the predicted probability of the baseline. A change of one standard deviation of the agglomeration variable is almost equivalent to the change in average value of the agglomeration variable from 2000 to 2006. Therefore, this change in predicted probability (28.2% − 26.8% = 1.4%) can be considered as the contribution of changes in agglomeration over the period. Next, looking at the contribution of SMEs (*plarge* = 0), the difference in predicted probability between large firms and the SMEs is only 0.5% (= 26.8% − 26.3%). However, recall that product and affiliate characteristics differ according to parent-firm size, as discussed in Table 5. For example, the imported goods by SMEs have a higher value for *Upstream* and engage more in process trading. Similarly, the affiliates owned by SMEs are smaller in terms of the number of workers and have lower K-L ratios. Since these characteristics lower the probability of the termination of trade-transaction ties, imported goods by the SMEs may have lower predicted probabilities. We calculate the predicted probability for the products with average SME attributes and average large firm attributes. In this case, the difference between the SME and large firms is 1.7% (= 27.4% − 25.6%). Therefore, the contribution of FDI by SMEs slightly exceeds that of agglomeration.

7. Concluding Remarks

The concern regarding the hollowing out of the domestic economy by outward FDI flows has re-emerged in Japan, with both large and small firms relocating their plants to China since the late 1990s, in line with the development of global production fragmentation. This study provides some facts to contribute toward better debates on this issue and, from a dynamic perspective, analyzes the duration of intermediate goods trade when it is accompanied by an increase in FDIs by using a unique parent–firm–affiliate, product-level dataset for the 2000–2006 period.

This study focus on the roles of products, affiliates, or parent-firm characteristics and agglomerations. Estimates obtained from the discrete-time hazard model show that intermediate goods, such as differentiated goods and products that belong to upstream industries, survive for a longer time, which is consistent with previous studies. Intermediate goods imported from Japan have a stronger impact on lowering the hazard rate, suggesting they contain sophisticated technologies and are thus less easily substitutable by local procurement. Using various measures of agglomeration indicators, we consistently find a positive relationship between agglomeration and the hazard rate of intermediate goods imports. As for parent-firm characteristics, we find that SMEs tend to engage in longer trade relationships. Moreover, the parent firms' foreign production networks and greater foreign production experience are found to reduce the duration. These findings also suggest that SMEs, which usually do not have foreign production networks, tend to continue importing intermediate goods from their home country. Finally, we calculate the quantum of the impact of the determinants of our survival model. We find that the difference in predicted probability between SMEs and large firms is slightly larger than the changes in predicted probability due to increases in agglomeration.

Although this study provides interesting insights, there remain various issues to be studied in future research. For example, how does the termination of transaction ties affect the Japanese parent firms' performances? From policymakers' viewpoint, the effect on domestic employment may be an important agenda. Another issue is to distinguish the difference between arm's-length trade and intra-firm trade. Recent studies, such as those by Ramondo et al. (2016), have shown that the MNE firms that engage in intra-firm trade are heavily concentrated within the large MNE category. Exploring the survival rate of intra-firm trade may be an interesting exercise.

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Table 1 Distribution of parent-firm size of Japanese affiliates by entry year

	Entry year			
# of employees	-1990	1991-1995	1996-2000	2001-
-299	14.1%	19.0%	18.1%	23.1%
300-499	6.7%	8.3%	8.1%	10.1%
500-999	11.3%	12.0%	12.0%	14.5%
1000-2999	23.2%	22.3%	22.0%	23.7%
3000-	44.7%	38.5%	39.7%	28.6%
Total	100%	100%	100%	100%

Source: Authors' calculations

Table 2 Variable definitions and basic statistics

Variable	N	Mean	Stan. Dev.	p25	p75	Definition
Product characteristics						
Initial-value	95437	7.88	2.56	6.138	9.657	Initital traded value in each span
Im-value	95437	7.92	2.57	6.174	9.716	Lagged import value
Home	95437	0.73	0.45	0	1	Dummy variable for imported goods from home
Diff	95437	0.68	0.47	0	1	Dummy variable for differentiated goods (Rauch's classification)
Upstream	95437	2.56	0.64	2.254	2.945	Constructed by Antras et al. (2012). For details, see the text.
Process	95437	0.59	0.49	0	1	Dummy variable for imported goods under process trading
Affiliate characteristics						
Export	95437	0.94	0.24	1	1	Exported dummy
Alabor	95437	6.58	1.30	5.649	7.527	logged numher of employees for affiliates
Awage	95437	3.09	0.55	2.741	3.413	logged average wage for affiliates
KL-ratio	95437	4.78	1.10	4.076	5.528	Capital-Labor ratio
Regional characteristics						
Agg-local-r	95437	7.49	0.74	6.957	7.92	# of local firms by industry and province
Agg-foreign-r	95437	5.86	0.77	5.472	6.409	# of foreign firms by industry and province
Agg-Jaffiliates-r	95437	7.22	1.11	6.633	8.045	# of Japanese firms by industry and province
Parent firm characteristics						
Plarge	95437	0.64	0.48	0	1	Dummy variable for parent firms with more than 1000 emp
Pnetwork	89318	18.86	22.63	4	21	# of foreign manufacturing affiliates beloinging to the same parent firm
Pnetwork-China	89265	30.18	13.01	21	40	# of manufacturing affiliates in China beloinging to the same parent firm
Exper	89318	4.92	6.09	1	5	experience year of foreign production at parent firm
Exper-China	86057	9.54	3.89	7	12	experience year of production in China at parent firm

Note: Numbers in parentheses are standard deviations. The means and standard deviations are calculated by pooling the 2000–2006 data.

Table 3 Regional distribution of Japanese affiliates in China

	# of firms	Share
1 Bohai economic zone		
11 Beijing	39	4%
12 Tenjing	65	7%
13 Hebei	16	2%
21 Liaoning	69	7%
37 Shandong	58	6%
Subtotal	247	27%
2 Yangtze River Delta		
31 Shang Hai	238	26%
32 Jiangsu	159	17%
33 Zhejiang	56	6%
Subtotal	453	49%
3 Perl River Delta		
35 Fujian	25	3%
44 Guangdong	161	17%
Subtotal	186	20%
4 Central region	10	1%
5 West region	22	2%
6 North East region	11	1%
Total	929	100%

Source: Authors' calculations

Table 4 Product and affiliate characteristics by parent-firm size

	Total	N=95437	SME	N=34377	Large firms	N=61060
	Mean	SD	Mean	SD	Mean	SD
Diff	0.68	0.47	0.67	0.47	0.68	0.47
Home	0.73	0.45	0.75	0.43	0.71	0.45
Im-value	7.92	2.57	7.73	2.52	8.03	2.60
Upstream	2.56	0.64	2.57	0.63	2.55	0.65
Process	0.59	0.49	0.67	0.47	0.55	0.50

	Total	N=929	SME	N=457	Large firms	N=472
	Mean	SD	Mean	SD	Mean	SD
Export	0.87	0.34	0.78	0.41	0.83	0.38
Export-home	0.76	0.43	0.63	0.48	0.69	0.46
Alabor	5.16	1.12	5.72	1.25	5.45	1.22
Awage	3.00	0.56	3.27	0.56	3.14	0.58
Aoutput	6.26	1.19	7.42	1.49	6.85	1.47
KL-ratio	4.75	1.13	5.36	1.10	5.06	1.16

Source: Authors' calculations

Table 5 Survival of intermediate goods imports for Japanese affiliates in China

Estimation method	(1)	(2)	(3)	(4)	(5)
Import origin	all country		Japan		
Im_value	-0.0402***	-0.0411***	-0.0405***	-0.0404***	-0.0404***
	(0.0006)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Home	-0.0625***				
	(0.0036)				
Diff	-0.0178***	-0.0164***	-0.0169***	-0.0168***	-0.0169***
	(0.0034)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
Upstream	-0.0698***	-0.0781***	-0.0779***	-0.0778***	-0.0778***
	(0.0025)	(0.0029)	(0.0029)	(0.0029)	(0.0029)
Process	-0.0596***	-0.0479***	-0.0463***	-0.0453***	-0.0456***
	(0.0033)	(0.0038)	(0.0037)	(0.0037)	(0.0037)
Export	-0.0008	0.0009	-0.0067	-0.0084	-0.0070
	(0.0069)	(0.0076)	(0.0075)	(0.0075)	(0.0075)
Alabor	0.0093***	0.0093***	0.0082***	0.0076***	0.0070***
	(0.0015)	(0.0018)	(0.0017)	(0.0017)	(0.0017)
Awage	0.0125***	0.0075**	0.0111***	0.0120***	0.0139***
	(0.0032)	(0.0038)	(0.0037)	(0.0037)	(0.0036)
KL-ratio	0.0264***	0.0265***	0.0248***	0.0240***	0.0238***
	(0.0018)	(0.0021)	(0.0020)	(0.0020)	(0.0020)
Agg-local-r			0.0268***		
			(0.0034)		
Agg-foreign-r				0.0234***	
				(0.0034)	
Agg-Jaffiliates-r					0.0166***
					(0.0030)
Observations	95,437	69,198	69,202	69,202	69,202
Period FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	No	No	No
log LL	-57830	-41886	-42010	-42017	-42026
Pseudo R2	0.109	0.113	0.110	0.110	0.110

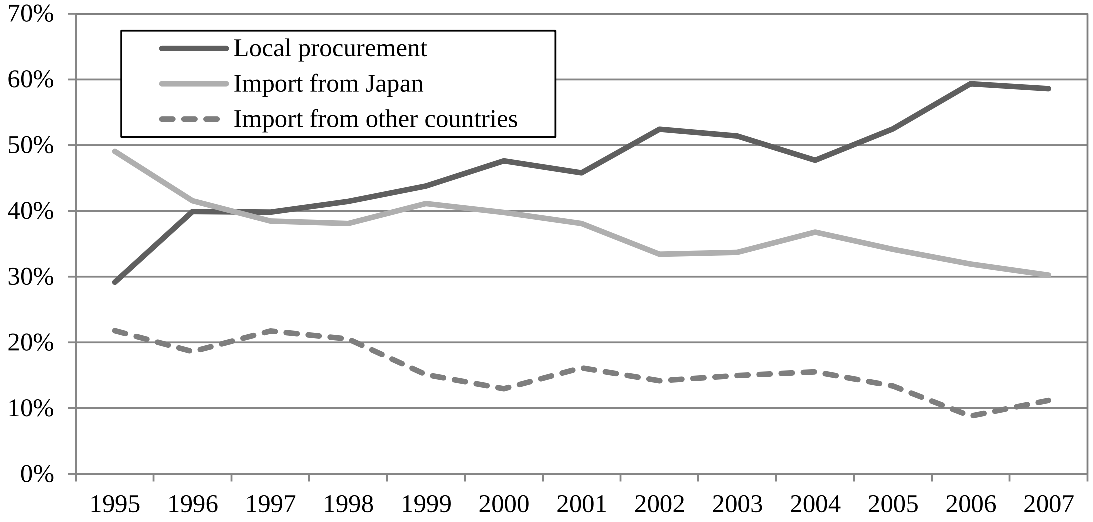
Note: Marginal effects at mean-level are presented in this table. Figures in parentheses are standard errors. *** represents statistical significance at the 1% level.

Table 6 Impact of the parent-firm characteristics

	(1)	(2)	(3)	(4)	(5)
Im-value	-0.0406***	-0.0404***	-0.0402***	-0.0403***	-0.0404***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Diff	-0.0170***	-0.0170***	-0.0171***	-0.0170***	-0.0164***
	(0.0040)	(0.0042)	(0.0042)	(0.0042)	(0.0043)
Upstream	-0.0779***	-0.0772***	-0.0768***	-0.0771***	-0.0767***
	(0.0029)	(0.0030)	(0.0030)	(0.0030)	(0.0031)
Process	-0.0458***	-0.0452***	-0.0451***	-0.0452***	-0.0450***
	(0.0037)	(0.0039)	(0.0039)	(0.0039)	(0.0040)
Export	-0.0050	-0.0066	-0.0046	-0.0061	-0.0008
	(0.0075)	(0.0078)	(0.0078)	(0.0078)	(0.0081)
Alabor	0.0065***	0.0086***	0.0077***	0.0090***	0.0058***
	(0.0018)	(0.0019)	(0.0020)	(0.0019)	(0.0020)
Awage	0.0086**	0.0054	0.0064	0.0059	0.0037
	(0.0038)	(0.0039)	(0.0039)	(0.0039)	(0.0040)
KL-ratio	0.0233***	0.0245***	0.0248***	0.0250***	0.0253***
	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0022)
Agg-local-r	0.0276***	0.0286***	0.0281***	0.0279***	0.0278***
	(0.0034)	(0.0035)	(0.0035)	(0.0035)	(0.0037)
Plarge	0.0132***	0.0046	0.0067	0.0090*	0.0178***
	(0.0042)	(0.0049)	(0.0051)	(0.0047)	(0.0046)
Pnetwork		0.0005***			
		(0.0001)			
Pnetwork-China			0.0006***		
			(0.0002)		
Exper				0.0014***	
				(0.0004)	
Exper-China					0.0019***
					(0.0005)
Observations	69,202	64,205	64,160	64,205	61,909
Period FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes
log LL	-42005	-38980	-38957	-38985	-37639
Pseudo R2	0.111	0.111	0.111	0.111	0.111

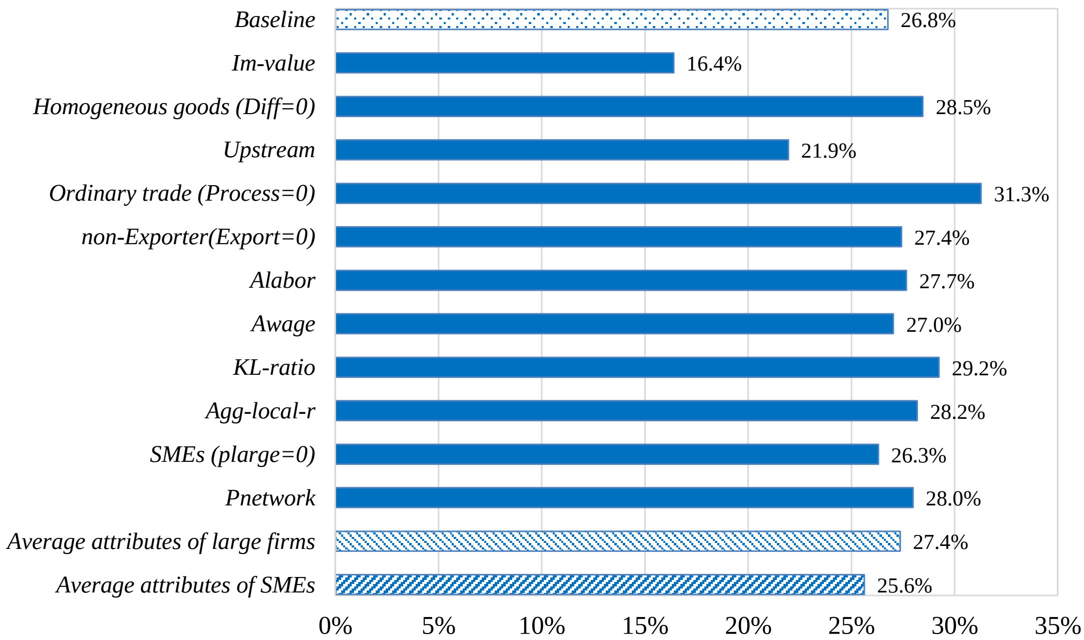
Note: Marginal effects at the mean level are presented in this table. Figures in parentheses are standard errors. *** and ** represent statistical significance at the 1% and 5% levels, respectively.

Figure 1 The share of local procurement and imports by Japanese MNE affiliates in China



Source: Maruya (2007).

Figure 2 Predicted probability that the transaction tie by an average firm is terminated.



Source: Authors' calculations