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Abstract

This study investigates the sourcing patterns of Japanese export-platform foreign affiliates in Mexico, which mainly export to the United States and Canada. We propose a novel approach to estimate intermediate input elasticities of exports by sourcing country. We find that, on average, Japanese export-platform foreign affiliates in Mexico source intermediate inputs from third countries, including the United States and Canada, rather than from Japan and Mexico, suggesting that Japanese export-platform foreign affiliates in Mexico are mainly integrated into the vertical production networks back and forth between Mexico, the United States, and Canada. In turn, Japanese foreign affiliates selling domestically in Mexico source intermediate inputs not only within the North American Free Trade Agreement countries but also from Japan. In addition, we find that export-platform foreign affiliates in Mexico use more labor-intensive production than do foreign affiliates selling domestically in Mexico. This suggests that saving labor costs is one of the motives for export-platform foreign direct investment in Mexico.

JEL classification: F14, F21
Keywords: Input-output linkages, Export-platform foreign affiliates, Foreign direct investment

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1 Introduction

The global production network is among the key features of the modern globalized economy. Firms construct international networks by dividing their production process into several stages and locating them in separate optimal countries/regions. Goods produced with imported intermediate inputs are further exported to other countries. This vertical linkage of international trade has been growing at a tremendous rate. Using the input–output tables from 10 OECD countries and 4 emerging market countries, Hummels et al. (2001) find that this vertical international trade accounted for 21% of the exports of these countries in 1990. Hanson et al. (2005) mention that the expansion of the global vertical production network reflects the rapid growth of trade in intermediate inputs. They find that the demand for imported inputs is sensitive to trade costs, labor costs, and policies in host countries using data on the parent-to-affiliate trade of intermediates in US multinational firms.[1]

In line with the previous studies, the main concern of this study is to uncover how export-platform foreign affiliates globally source intermediate inputs. Emerging market countries, such as China and Mexico, attract foreign direct investment (FDI) of multinational firms, and their foreign affiliates globally import intermediate inputs mainly to export produced goods to third countries, and not to sell domestically in their countries of location. Relatively recent studies, such as those by Yeaple (2003), Kneller and Pisu (2004), Ekholm et al. (2007), Neary (2009), Ito (2013), and Baldwin and Okubo (2014), focus mainly on export-platform FDI.[2]

The importance of analyzing the export-platform foreign affiliates' behavior, especially their international input–output structures, has greatly increased as the production process has become fragmented globally. To reflect global value chains, for example, the OECD started to release a trade database for value added in 2013. Head and Mayer (2015) emphasize the importance of multinational production in the empirical trade literature and conduct a structural estimation of multinational production taking into account international production networks of foreign affiliates from the micro-level flow data of the car industry.

The present study focuses on the case of Japanese export-platform foreign affiliates in Mexico. As discussed by Hanson et al. (2005), there is large variation of vertical production network across countries and industries. In addition, Baldwin and Okubo (2014) document heterogeneity of

[1] Fujita and Thisse (2006) emphasize that not only decreasing trade costs of goods but also decreasing communication costs between parent firms and their foreign affiliates facilitate fragmentation of the production process.

[2] See Greenaway and Kneller (2007) for a review of this literature.

networked production structures across countries. Thus, Hanson et al. (2005) analyze the factors that determine heterogeneous production networks. By contrasts, to draw detailed implications in the North American Free Trade Agreement (NAFTA) area, the present study sheds light on the specific case of Japanese export-platform foreign affiliates in Mexico, which attracts FDI from around world.[3]

To analyze the international sourcing patterns of export-platform foreign affiliates, this study proposes a novel approach, which can be viewed as an extension of the production function estimation in the total factor productivity (TFP) literature (e.g., Olley and Pakes, 1996; Levinsohn and Petrin, 2003; Ackerberg et al., 2015). Intuitively, output is decomposed into sales by country. In addition, intermediates inputs are decomposed into purchases by sourcing country. Then, the international input–output linkages are estimated as intermediate input elasticities of exports between countries.

Estimation of the intermediate input elasticities of exports might suffer from potential sources of bias. For example, parent firms with foreign affiliates in Mexico simultaneously have other foreign affiliates in other countries, and they are integrated within the global production networks of the same parent firms. In fact, our dataset shows that more than 90% of parent firms have foreign affiliates in Mexico and the US simultaneously. Therefore, sourcing decisions of foreign affiliates in Mexico from the US are highly correlated with economic shocks of foreign affiliates in the US of the same parent firms. In other words, omitted variables to account for these unobserved economic shocks by researchers (although they are observed by foreign affiliates) lead to upward bias for intermediate input elasticities of exports, since imports of intermediate inputs from the US by foreign affiliates in Mexico are positively correlated with economic expansion in the US, which increases exports to the US.

This study proposes a proxy variable approach to address endogeneity issues arising from international sourcing decisions of intermediate inputs. As a proxy variable of economic shocks of other foreign affiliates of the same parent firms, we introduce average sales of other foreign affiliates in sourcing countries belonging to the same parent firms. These proxy variables control for economic shocks transmitted within the global production networks of the same parent firms.

Our empirical framework contributes to the debate of Baldwin and Okubo (2014), in which a networked FDI is a key concept to understand recent trends of FDI. Using data on Japanese foreign affiliates, Baldwin and Okubo (2014) propose a rough sketch concept of the networked FDI,

[3]The historical background of export-platform FDI in Mexico is discussed in Appendix B.

which is characterized by foreign affiliates being integrated both vertically and horizontally into international production networks. The authors' main idea is based on the visualization of the sales-sourcing box, which plots the share of local sales on the vertical axis and the share of local sourcing of intermediates on the horizontal axis. Baldwin and Okubo (2014) find that Japanese FDI shows mixed vertical and horizontal aspects of the sales-sourcing box for almost all sectors and countries. This study offers an empirical approach to examine the concept of Baldwin and Okubo (2014) in the regression framework.

To estimate intermediate input elasticities of exports by sourcing countries, this study exploits a unique affiliate-level panel dataset of Japan, which covers the post-NAFTA period between 1995 and 2012. An advantage of our dataset is its inclusion of information on export and import values by aggregate region, such as North America (the US and Canada), Asia, and Europe, which allows us to clarify international input–output linkages of export-platform foreign affiliates. In fact, our data show that the principal export destination of Japanese export-platform foreign affiliates in Mexico is North America (the US and Canada) and thus, this study attempts to uncover their sourcing behavior.[4]

This study finds that Japanese export-platform foreign affiliates in Mexico source inputs from third countries, including the US and Canada, rather than from Japan and Mexico. By contrast, the Japanese affiliates selling within Mexico source inputs not only within the NAFTA countries but also from Japan. This difference in sourcing patterns suggests that the export-platform foreign affiliates are integrated into more global production networks. Especially, Japanese export-platform foreign affiliates in Mexico create vertical production networks back and forth between Mexico, the US, and Canada. In addition, this study finds that the export-platform foreign affiliates in Mexico include more labor-intensive production than do foreign affiliates selling in Mexico. This suggests that saving labor costs is one of the motives for export-platform FDI in Mexico. Our findings complement those of Hanson et al. (2005).

The remainder of this paper is organized as follows. Section 2 explains the empirical framework. Section 3 describes the data. Section 3 discusses the estimation results. Finally, Section 5 concludes.

[4]Sales within the NAFTA countries occupy more than 95% of the sales share of Japanese foreign affiliates in Mexico. Only 2% of the sales share goes to Japan.

2 Empirical Framework

2.1 Estimating Intermediate Input Elasticities of Exports to the US and Canada

This study uncovers the sourcing patterns of Japanese export-platform foreign affiliates in Mexico. Our empirical approach is based on the production function estimation in the TFP literature, but our main interest is in estimating intermediate input elasticities of output. Suppose that the production function is given by a Cobb–Douglas function with constant returns to scale, $Y = AM^{\alpha}L^{\beta_L}K^{\beta_K}e^{u}$, where $\alpha + \beta_L + \beta_K = 1$, Y, A, M, L, and K represent the gross output, TFP, intermediate inputs, labor, and fixed capital, respectively, and u is an error term. In this study, we divide intermediate inputs M into four groups by sourcing countries. Taking the logarithm of the production function yields the baseline regression model as follows:

$$\log Y_{iht} = \alpha^{\mathrm{M}} \log M_{iht}^{\mathrm{M}} + \alpha^{\mathrm{J}} \log M_{iht}^{\mathrm{J}} + \alpha^{\mathrm{N}} \log M_{iht}^{\mathrm{N}} + \alpha^{\mathrm{O}} \log M_{iht}^{\mathrm{O}} + \boldsymbol{X}_{ihjt}\boldsymbol{\beta} + u_{iht}, \tag{1}$$

where Y_{iht} represents total sales of foreign affiliate i of parent firm h in year t, M_{iht}^{s} ($s = \mathrm{M}, \mathrm{J}, \mathrm{N}, \mathrm{O}$) represents intermediate inputs sourced from Mexico, Japan, the US and Canada, and other countries (superscripts M, J, N, and O, represent these countries and country groups, respectively), $\boldsymbol{X}_{ihjt}$ is a vector of foreign affiliate characteristics in industry j (including labor L and fixed capital K), and u_{iht} is an error term.

Recent papers in the TFP literature, such as Olley and Pakes (1996), Levinsohn and Petrin (2003), and Ackerberg et al. (2015), propose TFP estimation approaches, which controls for potential bias to identify input (e.g., labor and capital) elasticities of output. Unobserved productivity shocks, which are simultaneously correlated with firms' inputs choices, generate the biased estimators. To solve this bias issue, their estimation approaches basically consist of two stages using proxy variables. The final goal of Olley and Pakes (1996), Levinsohn and Petrin (2003), and Ackerberg et al. (2015) is the estimation of TFP after the parameter identification of production function.[5]

Although the value added (i.e., gross output minus intermediate inputs) production function is often estimated in the TFP literature, this study estimates a gross output production function because this study focuses on intermediate input elasticities of output to uncover international input–output linkages, rather than the TFP estimation. Therefore, this study limits the estimation

[5]Gandhi et al. (2016) criticize proxy variable approaches under the structural assumptions of Olley and Pakes (1996), Levinsohn and Petrin (2003), and Ackerberg et al. (2015).

procedure to the identification of intermediate input elasticities of output.[6]

To investigate input–output linkages of export-platform foreign affiliates, we further divide total sales Y_{iht} into two factors: exports to the US and Canada Y^{N}_{iht} and domestic sales in Mexico Y^{M}_{iht}. To estimate intermediate input elasticities of exports to the US and Canada, the regression model to be estimated is as follows:

$$\log Y^{\mathrm{N}}_{iht} = \alpha^{\mathrm{MN}} \log M^{\mathrm{M}}_{iht} + \alpha^{\mathrm{JN}} \log M^{\mathrm{J}}_{iht} + \alpha^{\mathrm{NN}} \log M^{\mathrm{N}}_{iht} + \alpha^{\mathrm{ON}} \log M^{\mathrm{O}}_{iht} + \boldsymbol{X}_{ijt}\boldsymbol{\beta}^{\mathrm{N}} + u^{\mathrm{N}}_{iht}, \tag{2}$$

where Y^{N}_{iht} represents exports of Japanese foreign affiliate i to the US and Canada in year t and the parameters α^{MN}, α^{JN}, α^{NN}, and α^{ON} measure the intermediate input elasticities of exports to the US and Canada.[7] These parameters capture input–output linkages of export-platform foreign affiliates in Mexico. For example, α^{NN} measures the extent to which a 1% increase in sourcing from the US and Canada increases exports to the US and Canada. It is expected that α^{MN}, α^{JN}, α^{NN}, and α^{ON} essentially take non-negative values.

The estimation of these parameters suffers from potential bias arising from the correlation between sourcing decisions of foreign affiliate i and other foreign affiliates of the same parent firm h in sourcing countries. For ease of explanation, consider that the error term u_{iht} includes economic shocks of other foreign affiliates of parent firm h in sourcing countries, η^{r}_{ht}, ($r = \mathrm{J, N, O}$) as follows:

$$u_{iht} = \eta^{\mathrm{J}}_{ht} + \eta^{\mathrm{N}}_{ht} + \eta^{\mathrm{O}}_{ht} + \psi_i + \tau_t + v_{iht},$$

where η^{J}_{ht} represents economic shock of the parent firm h in Japan, η^{N}_{ht} represents economic shocks of other foreign affiliates of the same parent firm h in the US and Canada, η^{O}_{ht} represents economic shocks of other foreign affiliates of the same parent firm h in other countries except Japan and NAFTA countries, ψ_i is the fixed effect of foreign affiliates i, τ_t is the year fixed-effect in year t, and v_{it} is an i.i.d. shock.[8]

[6] Note that a limitation of our data is that fixed capital K is unavailable, owing to which this study cannot estimate the capital elasticity of output.

[7] Taking the logarithm of exports to the US and Canada Y^{N}_{iht} and purchases of intermediate inputs M^{s}_{iht}, this study calculates $\log(Y^{\mathrm{N}}_{iht} + 0.1)$ and $\log(M^{s}_{iht} + 0.1)$. Exports and purchases are given in units of millions of JPY. In addition, the regression models include dummy variables that take the value of 1 if exports or purchases are 0 ($Y^{\mathrm{N}}_{iht} = 0$ and $M^{r}_{iht} = 0$), and 0 otherwise ($Y^{\mathrm{N}}_{iht} > 0$ and $M^{s}_{iht} > 0$).

[8] Olley and Pakes (1996) consider that the productivity shock ω_{iht} unobserved by researchers (but observed by firms) leads to biased estimators. To address this endogeneity issue, they propose that the investment I_{iht} can be used as a proxy variable for productivity shocks. In addition to the discussions in the present study, the elasticities α^{MN}, α^{JN}, α^{NN}, and

A potential source of bias in estimating intermediate input elasticities of exports is the correlation between sourcing decisions of intermediate inputs M^s_{iht} and economic shocks of parent firm h in sourcing countries η^r_{ht}. Suppose that parent firm h has a global production network of foreign affiliates and that these are integrated within the network. In fact, in our dataset, more than 90% of parent firms of Japan with foreign affiliates in Mexico simultaneously have foreign affiliates in the US and Canada. In such a condition, Japanese foreign affiliates of parent firm h in the US and Canada highly affect the sourcing decisions of Japanese foreign affiliates of parent firm h in Mexico. This correlation is possibly positive, since economic expansion in the US increases international trade of foreign affiliates in Mexico with the US. As such, the elasticities α^{MN}, α^{JN}, α^{NN}, and α^{ON} tend to be overestimated owing to the omitted variable η^r_{ht}, when $\mathrm{Cov}(M^s_{iht}, \eta^r_{ht}) > 0$. It is necessary to control for economic shocks arising within the network of the parent firm h to mitigate upward bias of the intermediate input elasticities.

To address simultaneity bias, this study takes a proxy variable approach. As a proxy variable of economic shocks of other foreign affiliates of the same parent firm h, we introduce three variables in the regression. The first proxy variable for η^{J}_{ht} is sales of the parent firm h in Japan, which captures time-variant economic shocks of parent firm h for the Japanese economy. The second proxy variable for η^{N}_{ht} is the average total sales of foreign affiliates in the US and Canada of the same parent firm h, which captures time-variant economic shocks of parent firm h for the US and Canadian economies. The third proxy variable for η^{O}_{ht} is the average total sales of foreign affiliates in other countries of the same parent firm h, which captures time-variant economic shocks of parent firm h for other countries.

Another estimation issue relates to the correlation between sourcing decisions of intermediate inputs M^s_{iht} and a time-invariant factor of foreign affiliate ψ_i. For example, foreign affiliates with high management quality and knowhow for global sourcing might simultaneously extend imports of intermediates. To control for this potential bias, we use within estimators, which can also solve a specific issue arising from the use of regional breakdowns of total sales and purchases in the regressions. When there are foreign affiliates that show the value 0 for some of those variables, which

α^{ON} are biased if sourcing decisions of intermediate inputs M^s_{iht} and productivity shock ω_{iht} are correlated. A solution suggested by Olley and Pakes (1996) is to include a higher-order polynomial of capital and investment as a control for the unobserved productivity in the regression, which corresponds to the first stage of the estimation process suggested by Olley and Pakes (1996). Owing to the data unavailability of fixed capital K_{iht}, this study uses the logarithm of investment. Additional estimation results are offered in the online appendix because the estimation results in this paper do not change at all.

often occurs by disaggregation, the cross-affiliate variation makes the parameter identification difficult due to 0s. To estimate intermediate input elasticities of exports, the within-affiliate variation is more suitable than the cross-affiliate variation.[9]

Tariff changes also affect global sourcing decisions, and this is a potential source of bias for the elasticities. To control for complex institutional changes in tariff and trade policy, we introduce cross-terms between industry j and year t, τ^{s}_{jt}, in the regression.

The empirical framework of this study is similar to that of Feng et al. (2016), who investigate whether imported intermediate inputs increase the export performances of Chinese manufacturing firms. However, the present study has a distinctly different empirical approach. This study emphasizes the importance of controlling for simultaneity bias to estimate international input–output linkages, whereas Feng et al. (2016) take the IV approach to estimate the causal impact of imported intermediate inputs on exports. In the present study, imported intermediate inputs are disaggregated by sourcing country, which allows us to clarify sourcing patterns of export-platform foreign affiliates. In other words, whereas Feng et al. (2016) focus on estimating the quantitative impact of imported intermediate inputs on exports, this study focuses on clarifying international sourcing patterns of intermediate inputs.[10]

2.2 Comparison with Intermediate Input Elasticities of Domestic Sales in Mexico

It is a worthwhile research topic to compare sourcing patterns between export-platform foreign affiliates and foreign affiliates selling domestically in Mexico. Regression (2) can be extended as follows:

$$\log Y^{\mathrm{M}}_{iht} = \alpha^{\mathrm{MM}} \log M^{\mathrm{M}}_{iht} + \alpha^{\mathrm{JM}} \log M^{\mathrm{J}}_{iht} + \alpha^{\mathrm{NM}} \log M^{\mathrm{N}}_{iht} + \alpha^{\mathrm{OM}} \log M^{\mathrm{O}}_{iht} + \boldsymbol{X}_{ijt}\boldsymbol{\beta}^{\mathrm{M}} + u^{\mathrm{M}}_{iht}, \tag{3}$$

where Y^{M}_{iht} represents sales of Japanese foreign affiliate i in Mexico at year t and parameters α^{MM}, α^{JM}, α^{NM}, and α^{OM} measure the intermediate input elasticities of domestic sales in Mexico. Similarly,

[9] First-difference estimators could be used instead of within estimators. The preference in this study is for fixed-effect estimations because some affiliates are dropped owing to the unbalanced panel dataset. Some Japanese affiliates do not continually appear from one year to the next.

[10] In the TFP literature, Levinsohn and Petrin (2003) discuss how to control for bias in the production function estimation and that within and IV estimators are helpful to control for simultaneity bias. On the other hand, an alternative recent approach by Olley and Pakes (1996) and Levinsohn and Petrin (2003) is to include proxy variables to solve simultaneity bias, rather than these approaches. Our identification strategy is based on the idea of the proxy variable approach, rather than the IV approach.

we control for economic shocks arising from the same parent firm h and fixed effects to mitigate potential bias for these elasticities.

This study compares differences in sourcing patterns between exports and domestic sales. In the standard empirical research, estimating Regression (1) uncovers intermediate input elasticity of output. Further extending the standard production function estimation approach, our novel approach decomposes intermediate input elasticity of output with respect to exports and domestic sales.

3 Data

This study uses the confidential micro-dataset of Japanese foreign affiliates of the Basic Survey on Overseas Business Activities (BSOBA) conducted annually by the Ministry of Economy, Trade and Industry (METI) of Japan. The BSOBA covers Japanese firms that have foreign affiliates, except for those in the insurance/finance and real estate industries. The definition of a foreign affiliate in this survey is a foreign company (1) in which the Japanese parent firm owns more than a 10% share of the investment or (2) in which a foreign company with 50% or more of a Japanese firm's investment owns more than a 50% share of its investment

This study constructs a panel dataset between 1995 and 2012 at the affiliate level based on the BSOBA questionnaires for foreign affiliates. Importantly, the BSOBA includes sales and purchases by aggregate region, such as Japan, North America (the US and Canada), Asia, and Europe, which enables us to clarify international sourcing patterns of the Japanese affiliates in Mexico. Exploiting this BSOBA data structure, this study utilizes breakdowns of intermediate inputs by sourcing countries. Note that nominal sales and purchases are deflated by the price levels of gross output and intermediate inputs in Mexico (1995=100).[11]

Another advantage of the BSOBA dataset is its inclusion of information on foreign affiliates' network of parent firms, which allows to identify the countries in which Japanese parent firms with foreign affiliates in Mexico simultaneously have other foreign affiliates. In our dataset, more than 90% of parent firms have foreign affiliates not only in Mexico but also in the US and Canada. Utilizing this information, we construct proxy variables for economic shocks of other foreign affiliates belonging to the same parent firms. The total sales of the parent firms are taken from the BSOBA questionnaires for parent firms.

[11]See Appendix A for more details of the deflators.

Table 1 presents descriptive statistics of the variables used in the empirical analysis. The BSOBA has 2,968 observations of Japanese affiliates in Mexico between 1995 and 2012. This study excludes observations with missing values for the key variables and with inconsistent disaggregation (i.e., total sales do not equal the sum of sales disaggregated by region). In addition, the upper 1% of observations of the distributions for each variable is excluded from the sample, except for the operating years. Finally, our sample size becomes 1,012.

The sales shares by country are shown at the bottom of Table 1. On average, the Japanese affiliates in Mexico have a 74.3% share of local sales to total sales and a 21.4% share of exports to the US and Canada to total sales. Thus, the sum of local sales and export values to the US and Canada represents 95.7% of total sales. Therefore, this study limits the regression models to two cases (exports to the US and Canada, and sales in Mexico). On the other hand, intermediate inputs are sourced equally between Mexico, the US and Canada, and Japan.

Figure 1 shows the trend of intranational and international input–output linkages in terms of the shares of sales and purchases. Essentially, there is no big change in either sales or purchases between 1995 and 2012. However, the share of exports to the US and Canada rises slightly between 2003 and 2008, while the share of sales in Mexico declines. On the other hand, the share of exports to Japan is consistently small during the study period, whereas the share of imports from Japan is relatively large.

Figure 2 presents sales-sourcing box plots, which are suggested by Baldwin and Okubo (2014). Figure 2(a) and Figure 2(b) show that the tertiary sector tends to have a higher share of sales in Mexico, whereas the machinery industries tend to have a higher share of exports to the US and Canada. In particular, the electrical machinery industry exports outputs to the US and Canada. The service sector, which includes transportation and other services, mostly purchases its inputs in Mexico. The machinery industries source relatively more intermediate inputs from the US and Canada compared with other industries.

[Table 1 and Figures 1–2]

4 Estimation Results

4.1 Intermediate Input Elasticities of Exports to the US and Canada

Tables 2 and 3 present the ordinary least square (OLS) and fixed-effect estimation results of Regression (2), respectively. In each table, Column (1) presents a baseline result without proxy variables of economic shocks of parent firms. Columns (2)–(5) present the results of several econometric specifications, including the proxy variables. Each proxy variable is included in Columns (2)–(4), and all proxy variables are included in Column (5).

First, the intermediate input elasticities of exports estimated by OLS are mostly insignificant in Table 2, implying that OLS estimates suffer from regional disaggregation of intermediate inputs. In other words, some of the intermediate inputs, M^r_{iht}, take the value 0 and thus, cross-affiliate variation cannot correctly estimate input–output linkages. Within-affiliate variation is required to identify input–output linkages.

The fixed-effect estimation results in Table 3 offer more precise input–output linkages than the OLS estimates do. The baseline result in Column (1) shows that Japanese export-platform foreign affiliates in Mexico source intermediate inputs from third countries, including the US and Canada, and not from Japan and Mexico.

Columns (2)–(4) separately control for economic shocks in sourcing countries via global production networks of the parent firms. Whereas the statistical significance does not change fundamentally, the magnitudes of the elasticities change slightly. In Column (5), three proxy variables are introduced in the regression. Compared with the baseline result in Column (1), the inclusion of the proxy variables decreases the magnitudes of the intermediate input elasticities of exports, suggesting that economic shocks within the global network of parent firms lead to upward bias for intermediate input elasticities of exports.[12]

The main finding in Table 3 is that the Japanese export-platform foreign affiliates in Mexico create vertical production networks back and forth between Mexico, the US, and Canada. Furthermore, the Japanese export-platform foreign affiliates in Mexico do not significantly source intermediate inputs in Mexico. Indeed, Hoshino (2014), who investigates the global supply chain of Japanese automobile companies in Mexico by conducting detailed interviews, indicates that Mexican suppliers in the automobile sector have difficulty entering multinational firms' supply chains. Our estimation results could reflect this aspect.[13]

[Tables 2–3]

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[12] A finding of interest is that two proxy variables are estimated significantly in Column (5) of Table 3. The sales of parent firms in Japan and other foreign affiliates in the US and Canada of the same parent firms are positively correlated with exports of Japanese foreign affiliates in Mexico. This does not necessarily capture a causal relationship, but might offer a clue to investigate the global production networks.

[13] A recent rise in FDI in Mexico by Japanese firms, especially the entry of Japanese suppliers, might gradually increase local purchases in Mexico.

4.2 Comparison with Sourcing Patterns of Foreign Affiliates

The remaining question in Table 3 is which foreign affiliates source intermediate inputs from Mexico and Japan. To answer this question, Tables 4 and 5 present the OLS and fixed-effect estimation results of the sourcing patterns of Japanese foreign affiliates selling domestically in Mexico. In each table, Column (1) offers a baseline result without proxy variables of economic shocks of parent firms. Each proxy variable is included in Columns (2)–(4), and all proxy variables are included in Column (5).

In general, the OLS estimates of the intermediate input elasticities of total sales are quite larger than the fixed-effect estimates, suggesting that within-affiliate variation captures more precise intermediate input elasticities than cross-affiliate variation. As before, this study prefers the within estimates to the OLS estimates.

Unlike the case of export-platform foreign affiliates in Mexico, the baseline estimation results in Column (1) of Table 5 show that the Japanese foreign affiliates selling domestically in Mexico source their intermediate inputs from Japan and the NAFTA countries. On the other hand, these foreign affiliates do not source intermediate inputs from the other countries except Japan and the NAFTA countries. Controlling for economic shocks of global network of the parent firms does not change the intermediate input elasticities of domestic sales between Columns (2)–(5) of Table 5. The implication is that, unlike export-platform foreign affiliates, Japanese foreign affiliates selling domestically in Mexico are deeply integrated between Japan and the NAFTA countries.

An interesting finding from a comparison of Tables 3 and 5 is the difference in labor elasticity. Column (5) of Table 3 shows that the labor elasticity of exports is 0.385, whereas Column (5) of Table 5 shows that the labor elasticity of domestic sales is 0.296. In other words, export-platform foreign affiliates include more labor-intensive production, suggesting that saving labor costs is one of the motives for export-platform FDI in Mexico.

In summary, Japanese export-platform foreign affiliates in Mexico tend to source intermediate inputs from the third countries, including the US and Canada, to export to the US and Canada. On the other hand, Japanese foreign affiliates selling domestically in Mexico source intermediate inputs from Japan and the NAFTA countries. This difference in sourcing patterns of the two types of Japanese affiliates in Mexico suggests that export-platform foreign affiliatess do not necessarily have direct connections in the vertical production networks with their home country (in this case, Japan).

[Tables 4–5]

4.3 Intermediate Input Elasticities of Total Sales

Tables 6 and 7 present the OLS and fixed-effect estimation results of Regression (1), respectively. Note that the dependent variable is the logarithm of total sales. In both results, Column (1) offers a baseline result without proxy variables of economic shocks of parent firms. Columns (2)–(5) offer results of several econometric specifications, including the proxy variables.

Unlike the previous results in Sections 4.1 and 4.2, all OLS and within estimates of intermediate inputs are significantly positive, but the OLS estimates are larger than the fixed-effect estimates, suggesting that time-invariant factors of foreign affiliates affect their international sourcing decisions. It is often observed that within estimates become smaller than OLS estimates in the TFP literature.

An interesting feature of our empirical approach is that intermediate input elasticities of total sales can be decomposed by sales locations. For example, the elasticity of exports to the US and Canada with respect to intermediate inputs imported from the other countries (except Japan and NAFTA countries) is significant, as shown in Table 3, but the elasticity of sales in Mexico with respect to intermediate inputs imported from these countries is not significant, as shown in Table 5. Therefore, the decomposition of estimation results of Regression (1) appears in Tables 3 and 5. In general, researchers cannot directly identify the extent to which intermediate inputs are used for exports and domestic sales from the data. However, our novel approach using within-affiliate variations allows us to capture international input–output linkages.

[Tables 6–7]

4.4 Robustness Check

Our approach to international input–output linkages can be extended using the share of exports and imports as follows:

$$\begin{aligned} SalesShare^{\mathrm{N}}_{iht} &= \gamma^{\mathrm{NN}} ImportShare^{\mathrm{N}}_{iht} + \boldsymbol{X}_{ijt}\boldsymbol{\beta}^{\mathrm{N}} + u^{\mathrm{N}}_{iht}, \\ SalesShare^{\mathrm{M}}_{iht} &= \gamma^{\mathrm{NM}} ImportShare^{\mathrm{N}}_{iht} + \boldsymbol{X}_{ijt}\boldsymbol{\beta}^{\mathrm{M}} + u^{\mathrm{M}}_{iht}, \end{aligned} \tag{4}$$

where $SalesShare^{\mathrm{N}}_{iht}$ represents the sales share of exports to the US and Canada of foreign affiliate i in year t, $SalesShare^{\mathrm{M}}_{iht}$ represents the sales share of domestic sales in Mexico of foreign affiliate i in year t, and $ImportShare^{\mathrm{N}}_{iht}$ represents the purchase share of imports from the US and Canada of foreign affiliate i in year t. The parameters γ^{NN} and γ^{NM} capture the elasticities of sales share with respect to the import share.

Note that only the purchase share of imports from the US and Canada is included in Regression (4). A constraint of the shares is that by definition, their sum is 1. The change in the purchase share of imports from the US and Canada simultaneously must affect the purchase share of imports from other countries. The sales share of exports to the US and Canada reflects the same effect on sales shares in other countries.

Table 8 presents the estimation results from the within-affiliate variations in sales and import shares. This extension confirms that, in Columns (1) and (2), Japanese export-platform foreign affiliates source intermediate inputs from the US and Canada. Controlling for economic shocks of parent firms slightly reduces the magnitude of the import share elasticity. As mentioned, the increase in the sales share of exports to the US and Canada reduces the sales share of domestic sales in Mexico owing to the constraint of the definition of shares.

As presented in Table 3, within-affiliate variations in the export and import shares show that the Japanese export-platform foreign affiliates in Mexico tend to source intermediate inputs from the US and Canada to export to the US and Canada. These results suggest that the Japanese export-platform foreign affiliates in Mexico create vertical production networks between Mexico, the US, and Canada.

[Table 8]

5 Conclusion

According to a recent FDI trend, foreign affiliates are integrating with the global production networks and their sourcing patterns for intermediate inputs have become complex. In particular, export-platform foreign affiliates exhibit a distinct feature of current international trade. Focusing on Japanese foreign affiliates in Mexico, this study has uncovered how the export-platform foreign affiliates globally source intermediate inputs. To investigate international sourcing patterns of intermediate inputs, we have proposed a novel approach by extending the approach to the production function estimation.

The estimation results show that Japanese export-platform foreign affiliates in Mexico source intermediate inputs from third countries, including the US and Canada, rather than from Japan and Mexico, suggesting that they create vertical production networks back and forth between Mexico, the US, and Canada. In turn, the Japanese foreign affiliates selling domestically in Mexico source intermediate inputs not only within the NAFTA countries but also from Japan. In addition, we have found that the export-platform foreign affiliates in Mexico include more labor-intensive production than foreign affiliates selling domestically in Mexico, suggesting that saving labor cost is one of the motives for export-platform FDI into Mexico.

These empirical findings have important implications for trade policies. Policymakers tend to consider bilateral trade relationships between their home countries and partner countries. However, it is necessary to consider multilateral trade policies to enjoy the gains from global production networks. For example, Conconi et al. (2016) discuss that rules of origin stipulated in FTAs distort trade in intermediate inputs. Therefore, multilateral FTAs, rather than bilateral FTAs, will play a central role in a modern globalized economy.

We note some limitations of this study. It has focused on the sourcing patterns of Japanese export-platform foreign affiliates only in Mexico. However, the analysis should be extended to broader cases, including East Asia and Southeast Asia. In addition, the locations of export-platform FDI and their international sourcing patterns will change dynamically with trade policies. It is important to study how trade policies affect firms' export-platform FDI and international sourcing decisions. Related to this issue, Conconi et al. (2016) find that rules of origin of the NAFTA distort trade in intermediate inputs. The connection between intermediate trade and rules of origin is an important future research topic. Another limitation of this study is that it does not focus on the heterogeneity across industries owing to small sample size. For example, Fujita and Gokan (2005) and Hanson et al. (2005) emphasize differences in trade costs between industries, which are highly related with global production networks. Further research needs to address these issues.

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Appendix A Deflator for Sales and Purchases by Industry

The deflators of gross output and intermediate inputs in Mexico are obtained from the World Input–Output Database (WIOD) (see Timmer et al., 2015). The socio-economic accounts of the WIOD have the deflators of gross output and intermediate inputs by industry between 1995 and 2009 (1995=100). To complement deflators until 2012, the deflators of the National Institute of Statistics and Geography (INEGI) are used. The INEGI offers monthly producer price indices by industry for final and intermediate goods from 2007. First, annual average producer price indices by industry are calculated. Second, industry classification between the WIOD and INEGI is matched. Then, the deflators of the WIOD are extended until 2012 by percentage changes calculated from the INEGI's deflators.

The industrial classification of the WIOD differs from that of the BSOBA. First, the industrial classification is organized to keep their consistency across years. Then, the industrial classification of the WIOD is matched with that of the BSOBA. Finally, the real sales and purchases (1995=100) are calculated as nominal sales and purchases deflated by price levels of gross output and intermediate goods by industry, respectively.

Appendix B Export-Platform FDI in Mexico and NAFTA

In Mexico, FDI from around world was attracted by the *Maquiladora* programs, which permitted duty-free imports of inputs and materials under the condition that the outputs produced from these imports be exported outside Mexico.[14] After the NAFTA was launched in 1994, non-NAFTA countries' export-platform affiliates in Mexico faced two challenges. First, Article 303 of NAFTA, which was enacted in January 2001 after a transition period of 7 years, stipulated the elimination of duty drawback. Second, NAFTA's rules of origin affect the cost competitiveness of export-platform affiliates in Mexico within NAFTA in terms of whether NAFTA preferential tariffs are applicable when these affiliates export their products from Mexico to the US. However, export-platform FDI into Mexico does not decrease after the NAFTA. To keep attracting FDI from around the world, the Mexican Government started the Sectoral Promotion Programs in January 2001 to strengthen industrial competitiveness and source intermediate inputs from outside the NAFTA in response to the elimination of duty drawback. In addition, the free trade agreement (FTA) between the EU and Mexico started in October 2000, and the FTA between Japan and Mexico was launched in April 2005.

To enjoy the benefits of NAFTA preferential tariffs, non-NAFTA member countries' export-platform foreign affiliates in Mexico might have incentives to source high value-added intermediate inputs from within NAFTA instead of from non-NAFTA member countries. Krishna and Krueger (1995) and Krishna (2005) mention that although an FTA is intended to promote trade liberalization, the rules of origin of the FTA bring about hidden protection to countries outside the FTA. In other words, non-FTA foreign affiliates that are strongly connected with their home countries' production networks tend to lose their cost competitiveness to the FTA member countries. Recent studies have indicated that FTA networks significantly impact the patterns of trade in intermediate goods. For example, Conconi et al. (2016) find that the rules of origin of the NAFTA distorted trade in intermediate goods. However, the relationship with these new findings is beyond the scope of this study.

[14] The *maquiladora* program originally started in 1965 to promote industrialization in the northern border area of Mexico. It was reformed in 2006 and is currently known as the Manufacturing, Maquila and Export Services Industry (IMMEX) program. See Bergin et al. (2009) for additional information on the *maquiladora* industry.

Appendix C FDI into NAFTA and Japanese Firms' Characteristics

C.1 Data

For the FDI and TFP analysis, this study uses a firm-level confidential micro-dataset from the Basic Survey of Japanese Business Structure and Activities (BSJBSA), which has been conducted annually by the Ministry of Economy, Trade and Industry (METI) of Japan since 1994 after the first survey in 1991. The BSJBSA covers firms with 50 employees or more and capital of 30 million JPY or more in the mining, manufacturing, electricity and gas, wholesale and retail trades, and some service sectors. Firm-level TFP is estimated by the data of the BSJBSA.

The comparison group comprises domestic firms that do not export and have no affiliates in foreign firms. The BSJBSA asks the number of affiliates that firms have in foreign countries and the export values of firms.[15] Therefore, this study focuses on the comparison between FDI firms and domestic ones.

C.2 Empirical Framework

This study examines what type of firms make FDI into NAFTA and Mexico. As shown in Helpman et al. (2004), more productive firm can make FDI. To clarify the relationship between FDI and total factor productivity (TFP), two empirical approaches are adopted. First, this study compares TFP distributions between domestic firms and FDI firms into NAFTA countries/Mexico. This analysis illustrates the differences between the two distributional patterns. The TFP distribution for FDI firms is expected to be located on the right-hand side of that for domestic firms.

Second, this study explores what characteristics the FDI firms show by estimating the probit model:

$$\Pr(\mathrm{FDI}_{ik} = 1|\mathbf{Z}_i) = \Phi(\mathbf{Z}_i\gamma_k), \tag{5}$$

where FDI_{ik} takes a value of 1 if firm i has any affiliates in area/country k (k = NAFTA, Mexico) and 0 if firm i has neither affiliates nor export in foreign countries; $\mathbf{Z}_i$ is a vector of explanatory variables including the firm average TFP, employment size, ratio of foreign capital, and firm age; and Φ denotes the cumulative distribution function of the standard normal distribution. Note that FDI_{ik} is constructed if firm i undertook FDI into area/country k at least once during the study period. Similarly, the explanatory variables are constructed as the firm average value during the period.

[15] There are firms with missing values on affiliates in foreign countries and export values. For simplicity, it is assumed that these firms are domestic.

C.3 TFP Estimation

This study estimates the firm level TFP using the method proposed by Levinsohn and Petrin (2003). The value-added case of the Cobb-Douglas production technology is considered as follows:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + v_{it}$$

where y_{it} is the logarithm of value-added, l_{it} is the logarithm of labor, and k_{it} is the fixed capital. The error term is assumed to consist of two components: the temporally transmitted productivity shock ω_{it} that affects firm's investment decision and the i.i.d. idiosyncratic shock v_{it}, which has no impact on the firm's investment decision.

An estimation issue is that the OLS estimator of β_k is inconsistent owing to the omitted variable bias because k_{it} is correlated with productivity shock ω_{it}. Therefore, Levinsohn and Petrin (2003) proposed a method to estimate the consistent estimator of β_k, which is a modified version originally proposed by Olley and Pakes (1996). After obtaining consistent estimates $\hat{\beta}_l$ and $\hat{\beta}_k$ by the method of Levinsohn and Petrin (2003), the logarithm of TFP is available as follows:

$$\log(\widehat{\text{TFP}}_{it}) = y_t - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it}.$$

As a proxy variable of productivity shock, purchases of inputs are used.[16] To consider heterogeneity in production technology across industries, firm-level TFP by industry is estimated. To make TFP comparable across industries, industry-year effects are removed.

In the analysis of FDI into NAFTA and Mexico, it is assumed that firms made FDI ($\text{FDI}_{ik} = 1$) if firms appear in the BSOBA at least once between 1995 and 2011. To keep consistency between two datasets, average TFP across years is calculated as follows:

$$\log(\widehat{\text{TFP}}_i) = \frac{1}{T_i} \sum_{t}^{T_i} \log(\widehat{\text{TFP}}_{it}),$$

where T_i denotes the number of years for firm i, and $\log(\widehat{\text{TFP}}_i)$ is the geometric mean of TFP for firm i.

In the TFP estimation, the BSJBSA is used to calculate the value-added y_{it}, labor l_{it}, and capital k_{it}. The net value-added is calculated as the sum of operating profit, wage bill, and taxes and dues. Labor l_{it} is calculated as total hours worked of regular and part-time workers. The average hours

[16] The firm TFP is estimated by the Stata command `levpet` (Petrin et al., 2004).

worked by industry is obtained from the JIP 2014. The average hours worked for part-time workers are calculated by the average hours worked of JIP 2014 and the ratio of hours worked between regular and part-time workers. The ratio of hours worked is taken from the Monthly Labor Survey of the Ministry of Health, Labour and Welfare. The capital k_{it} is book value of tangible assets deflated by the price level of investment goods (2000=100) calculated from the JIP 2014.[17]

C.4 Estimation Results

Table A.1 presents descriptive statistics of variables for FDI and TFP analysis. Each 0.25% upper and lower observations for value-added, labor, capital, and purchases of intermediate inputs are excluded as outliers. In addition, firms that appear only once in the BSJBSA are excluded. The final sample size is 30,936. In our sample, the numbers of firms undertaking FDI into the NAFTA and Mexico are 1,620 and 115, respectively, and the number of domestic firms is 29,316.

Figure A.1 presents the TFP distributions for FDI firms into NAFTA/Mexico and domestic firms. Panel (a) shows that the TFP distribution for FDI firms into NAFTA is right-shifted, and thus, the FDI firms have higher TFP than the domestic firms. In Panel (b), the TFP distribution for FDI firms into Mexico is slightly right-shifted, but the right-shift is not as big as the case of FDI into NAFTA. Therefore, the right-shift in Panel (a) is because more productive firms undertake FDI into the US and Canada within the NAFTA, rather than into Mexico. On the whole, these results are consistent to Helpman et al. (2004).

Table A.2 presents the results of probit estimations that investigate what type of firms undertake FDI into NAFTA/Mexico. As discussed in Figure A.1, Column (1) confirms that firms with higher TFP undertake FDI into the NAFTA. Column (2) shows that this result holds even after controlling for employment size, foreign capital ratio, and firm age. Column (3) shows firms with higher TFP undertake FDI into Mexico. However, this is not true after controlling for other factors in Column (4). Although it is true that productive firms undertake FDI into Mexico, higher TFP of these firms is explained by larger employment size, higher ratio of foreign capital, and older firms.

[Figure A.1 and Tables A.1–A.2]

[17] The JIP 2014 offers deflators for gross output, intermediate inputs, and investment goods by industry (2000=100), respectively. The deflators are available until 2011. This study ends up with 1995–2011 datasets of BSJBSA for the FDI analysis.

Table 1: Descriptive Statistics for Input–Output Linkage Analysis

Variable	Obs.	Mean	S.D.	Median
Total Sales	1012	1785.647	2895.298	727.550
Sales in Mexico	1012	1381.434	2677.201	408.819
Export to Japan	1012	18.514	123.399	0.000
Export to Third Countries	1012	385.699	1000.575	2.529
Export to the US and Canada	1012	335.292	961.344	0.000
Export to the Other Countries	1012	50.407	197.848	0.000
Total Purchases	1012	1254.982	2134.646	488.663
Purchases in Mexico	1012	559.165	1325.160	53.791
Import from Japan	1012	375.739	807.447	60.529
Import from Third Countries	1012	320.078	846.108	39.608
Import from the US and Canada	1012	229.995	727.739	2.148
Import from the Other Countries	1012	90.083	358.106	0.000
Employment	1012	348.826	719.156	94.500
Operating Years	1012	13.070	11.115	10.000
Sales of Japanese Parent Firm in Japan	898	864684.618	2029096.553	155907.000
Average Sales of Japanese Foreign Affiliates in US	898	23543.710	41063.003	11943.250
Average Sales of Japanese Foreign Affiliates in Other Countries	898	8088.840	10866.366	4606.262
Ratio of Sales in Mexico to Total Sales	1012	0.744	0.376	0.990
Ratio of Export to Japan to Total Sales	1012	0.017	0.091	0.000
Ratio of Export to Third Countries to Total Sales	1012	0.239	0.368	0.004
Ratio of Export to the US and Canada to Total Sales	1012	0.211	0.355	0.000
Ratio of Purchases in Mexico to Total Purchases	1012	0.378	0.396	0.205
Ratio of Import from Japan to Total Purchases	1012	0.318	0.353	0.175
Ratio of Import from Third Countries to Total Purchases	1012	0.304	0.378	0.100
Ratio of Import from the US and Canada to Total Purchases	1012	0.232	0.357	0.009

Notes: Real values for sales, exports, purchases, and imports are in units of million JPY. The values of sales and exports are deflated by the price indices of gross output obtained from the World Input–Output Database. In addition, the values of purchases and imports are deflated by the price indices of intermediate inputs obtained from the World Input–Output Database (1995=100). The upper 1% of distributions of each variable, except operating years, is excluded from the sample. Inconsistent observations, in which the sum of domestic sales in Mexico and total exports does not equal total sales, are dropped from the sample. Sales of Japanese parent firms and averages sales of Japanese foreign affiliates are in units of million JPY. The logarithms of these nominal values are used in the regressions.

Table 2: OLS Estimation Results of Intermediate Input Elasticities of Exports to the US and Canada by Sourcing Countries

	Dependent Variable: log(Exports to the US and Canada)				
	OLS	OLS	OLS	OLS	OLS
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	0.001	−0.003	−0.000	−0.002	−0.000
	(0.046)	(0.051)	(0.051)	(0.051)	(0.051)
log(Import from Japan)	0.022	−0.008	−0.000	−0.009	−0.006
	(0.053)	(0.058)	(0.060)	(0.062)	(0.061)
log(Import from the US and Canada)	0.070	0.073	0.077	0.073	0.077
	(0.062)	(0.064)	(0.063)	(0.063)	(0.062)
log(Import from the Other Countries)	0.162**	0.121	0.122	0.121	0.117
	(0.075)	(0.078)	(0.078)	(0.079)	(0.079)
log(Employment)	0.280***	0.279***	0.284***	0.279***	0.280***
	(0.063)	(0.067)	(0.068)	(0.067)	(0.068)
Operating Years	0.014	0.017	0.016	0.017	0.016
	(0.018)	(0.019)	(0.019)	(0.019)	(0.020)
Operating Years (/100)	−0.072*	−0.073	−0.069	−0.072	−0.071
	(0.042)	(0.047)	(0.045)	(0.045)	(0.046)
log(Total Sales of Parent Firm in Japan)		0.014			0.030
		(0.064)			(0.096)
log(Total Sales of Foreign Affiliates in the US and Canada)			−0.021		−0.072
			(0.080)		(0.101)
log(Total Sales of Foreign Affiliates in the Other Countries)				0.016	0.038
				(0.084)	(0.121)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	No	No	No	No	No
Number of Observations	1012	898	898	898	898
Number of Affiliates	209	184	184	184	184
Adjusted R^2	0.906	0.902	0.902	0.902	0.902

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 3: Fixed-Effect Estimation Results of Intermediate Input Elasticities of Exports to the US and Canada by Sourcing Countries

	Dependent Variable: log(Exports to the US and Canada)				
	FE	FE	FE	FE	FE
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	−0.078	−0.093	−0.083	−0.084	−0.087
	(0.059)	(0.061)	(0.060)	(0.059)	(0.059)
log(Import from Japan)	−0.021	−0.021	−0.019	−0.025	−0.021
	(0.074)	(0.078)	(0.077)	(0.076)	(0.077)
log(Import from the US and Canada)	0.167***	0.171***	0.168***	0.156***	0.150***
	(0.049)	(0.048)	(0.048)	(0.045)	(0.044)
log(Import from the Other Countries)	0.150***	0.123**	0.115**	0.108**	0.113**
	(0.051)	(0.049)	(0.049)	(0.050)	(0.050)
log(Employment)	0.442***	0.383***	0.414***	0.402***	0.385***
	(0.111)	(0.118)	(0.123)	(0.116)	(0.121)
log(Total Sales of Parent Firm in Japan)		0.384***			0.280**
		(0.146)			(0.129)
log(Total Sales of Foreign Affiliates in the US and Canada)			0.227**		0.160*
			(0.097)		(0.088)
log(Total Sales of Foreign Affiliates in the Other Countries)				0.330*	0.266
				(0.172)	(0.162)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	1012	898	898	898	898
Number of Affiliates	209	184	184	184	184
Within R^2	0.866	0.859	0.858	0.859	0.861

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 4: OLS Estimation Results of Intermediate Input Elasticities of Sales in Mexico by Sourcing Countries

	Dependent Variable: log(Sales in Mexico)				
	OLS	OLS	OLS	OLS	OLS
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	0.329***	0.282***	0.276***	0.285***	0.277***
	(0.057)	(0.059)	(0.058)	(0.058)	(0.060)
log(Import from Japan)	0.398***	0.404***	0.389***	0.395***	0.388***
	(0.058)	(0.058)	(0.058)	(0.060)	(0.059)
log(Import from the US and Canada)	0.170***	0.167***	0.153***	0.161***	0.152***
	(0.052)	(0.056)	(0.054)	(0.056)	(0.053)
log(Import from the Other Countries)	0.082	0.096*	0.103**	0.094*	0.102**
	(0.051)	(0.050)	(0.050)	(0.052)	(0.051)
log(Employment)	0.155**	0.217***	0.210***	0.209***	0.208***
	(0.066)	(0.058)	(0.058)	(0.058)	(0.058)
Operating Years	0.009	−0.001	0.003	−0.001	0.003
	(0.018)	(0.017)	(0.017)	(0.018)	(0.017)
Operating Years (/100)	0.002	0.007	0.005	0.013	0.006
	(0.034)	(0.032)	(0.031)	(0.034)	(0.030)
log(Total Sales of Parent Firm in Japan)		0.087			−0.009
		(0.073)			(0.108)
log(Total Sales of Foreign Affiliates in the US and Canada)			0.176**		0.169**
			(0.075)		(0.076)
log(Total Sales of Foreign Affiliates in the Other Countries)				0.134*	0.023
				(0.074)	(0.121)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	No	No	No	No	No
Number of Observations	1012	898	898	898	898
Number of Affiliates	209	184	184	184	184
Adjusted R^2	0.893	0.898	0.900	0.898	0.900

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 5: Fixed-Effect Estimation Results of Intermediate Input Elasticities of Sales in Mexico by Sourcing Countries

	Dependent Variable: log(Sales in Mexico)				
	FE	FE	FE	FE	FE
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	0.197***	0.198***	0.198***	0.194***	0.198***
	(0.040)	(0.042)	(0.043)	(0.042)	(0.043)
log(Import from Japan)	0.207***	0.246***	0.248***	0.247***	0.249***
	(0.046)	(0.050)	(0.048)	(0.050)	(0.049)
log(Import from the US and Canada)	0.111***	0.104***	0.098***	0.113***	0.109***
	(0.034)	(0.035)	(0.035)	(0.034)	(0.035)
log(Import from the Other Countries)	0.010	0.011	0.011	0.016	0.014
	(0.035)	(0.038)	(0.038)	(0.037)	(0.038)
log(Employment)	0.376***	0.288**	0.282**	0.291***	0.296***
	(0.111)	(0.111)	(0.111)	(0.111)	(0.109)
log(Total Sales of Parent Firm in Japan)		−0.084			−0.079
		(0.104)			(0.107)
log(Total Sales of Foreign Affiliates in the US and Canada)			0.108		0.137
			(0.084)		(0.084)
log(Total Sales of Foreign Affiliates in the Other Countries)				−0.161**	−0.167**
				(0.074)	(0.073)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	1012	898	898	898	898
Number of Affiliates	209	184	184	184	184
Within R^2	0.891	0.897	0.898	0.898	0.899

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 6: OLS Estimation Results of Intermediate Input Elasticities of Total Sales by Sourcing Countries

	Dependent Variable: log(Total Sales)				
	OLS	OLS	OLS	OLS	OLS
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	0.294***	0.244***	0.240***	0.252***	0.239***
	(0.049)	(0.040)	(0.038)	(0.040)	(0.039)
log(Import from Japan)	0.328***	0.292***	0.278***	0.281***	0.272***
	(0.047)	(0.047)	(0.046)	(0.045)	(0.044)
log(Import from the US and Canada)	0.180***	0.162***	0.145***	0.154***	0.145***
	(0.035)	(0.036)	(0.033)	(0.034)	(0.033)
log(Import from the Other Countries)	0.127***	0.132***	0.143***	0.131***	0.139***
	(0.033)	(0.032)	(0.032)	(0.034)	(0.033)
log(Employment)	0.317***	0.373***	0.366***	0.362***	0.362***
	(0.065)	(0.044)	(0.041)	(0.043)	(0.041)
Operating Years	0.014	0.014	0.018	0.013	0.018
	(0.013)	(0.013)	(0.012)	(0.013)	(0.012)
Operating Years (/100)	−0.005	−0.021	−0.019	−0.009	−0.022
	(0.026)	(0.026)	(0.023)	(0.028)	(0.024)
log(Total Sales of Parent Firm in Japan)		0.141***			0.028
		(0.036)			(0.054)
log(Total Sales of Foreign Affiliates in the US and Canada)			0.239***		0.190***
			(0.045)		(0.065)
log(Total Sales of Foreign Affiliates in the Other Countries)				0.200***	0.037
				(0.044)	(0.077)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	No	No	No	No	No
Number of Observations	1012	898	898	898	898
Number of Affiliates	209	184	184	184	184
Adjusted R^2	0.792	0.826	0.835	0.826	0.835

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 7: Fixed-Effect Estimation Results of Intermediate Input Elasticities of Total Sales by Sourcing Countries

	Dependent Variable: log(Total Sales)				
	FE	FE	FE	FE	FE
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	0.148***	0.156***	0.160***	0.158***	0.159***
	(0.035)	(0.037)	(0.038)	(0.037)	(0.037)
log(Import from Japan)	0.201***	0.229***	0.231***	0.229***	0.231***
	(0.042)	(0.046)	(0.045)	(0.046)	(0.045)
log(Import from the US and Canada)	0.121***	0.114***	0.109***	0.113***	0.109***
	(0.027)	(0.027)	(0.028)	(0.029)	(0.029)
log(Import from the Other Countries)	0.091***	0.093***	0.091**	0.091***	0.091**
	(0.033)	(0.035)	(0.035)	(0.035)	(0.035)
log(Employment)	0.408***	0.332***	0.339***	0.336***	0.337***
	(0.125)	(0.124)	(0.121)	(0.123)	(0.122)
log(Total Sales of Parent Firm in Japan)		0.060			0.023
		(0.065)			(0.061)
log(Total Sales of Foreign Affiliates in the US and Canada)			0.154**		0.151**
			(0.072)		(0.074)
log(Total Sales of Foreign Affiliates in the Other Countries)				0.025	0.001
				(0.065)	(0.063)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	1012	898	898	898	898
Number of Affiliates	209	184	184	184	184
Within R^2	0.559	0.556	0.563	0.555	0.561

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table 8: Fixed-Effect Estimation Results of Intermediate Input Share Elasticity by Sourcing Countries

	Dependent Variable: Sales Share to Country			
	US and Canada		Mexico	
Explanatory Variables	FE (1)	FE (2)	FE (3)	FE (4)
Import Share from the US and Canada	0.101*	0.094**	−0.101*	−0.090*
	(0.054)	(0.046)	(0.055)	(0.049)
log(Employment)	−0.011	−0.007	0.046	0.042
	(0.013)	(0.014)	(0.040)	(0.045)
log(Total Sales of Parent Firm in Japan)		−0.031		0.058**
		(0.022)		(0.029)
log(Total Sales of Foreign Affiliates in the US and Canada)		0.053***		−0.029
		(0.017)		(0.019)
log(Total Sales of Foreign Affiliates in the Other Countries)		0.048*		−0.064**
		(0.029)		(0.032)
Industry × Year Dummy	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	1012	898	1012	898
Number of Affiliates	209	184	209	184
Within R^2	0.282	0.318	0.297	0.337

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table A.1: Descriptive Statistics for FDI and TFP Analysis

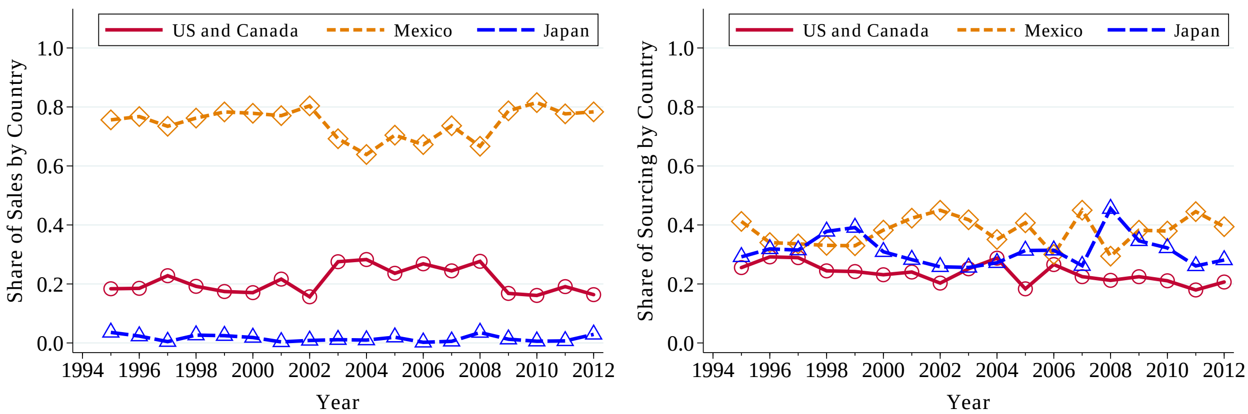
Variable	Obs.	Mean	S.D.	Median
Dummy for FDI into NAFTA	30936	0.052	0.223	0.000
Dummy for FDI into Mexico	29431	0.004	0.062	0.000
Average Logarithm of TFP	30936	1.301	0.475	1.301
Average Logarithm of Employment	30936	5.098	0.935	4.864
Average Ratio of Foreign Capital	30936	1.006	7.636	0.000
Average Firm Age	30936	34.203	16.701	34.400

Notes: Variables are averaged across years observed. The FDI dummy takes a value of 1 if a firm has at least one affiliate in the corresponding country during the study period 1995–2011 and 0 otherwise. Each 0.25% upper and lower observations for value-added, labor, capital and purchases of intermediate inputs are excluded as outliers. In addition, firms that appear only once in the BSJBSA are excluded.

Table A.2: Probit Estimation Results for FDI and TFP

	Dependent Variable: Dummy (1=FDI Firms; 0=Domestic Firms)			
	FDI into NAFTA		FDI into Mexico	
Explanatory Variables	(1)	(2)	(3)	(4)
$\widehat{\text{TFP}}$	0.592***	0.433***	0.274***	0.034
	(0.026)	(0.033)	(0.061)	(0.082)
log(Employment)		0.492***		0.464***
		(0.012)		(0.032)
Ratio of Foreign Capital		0.011***		0.012***
		(0.001)		(0.002)
Firm Age		0.023***		0.022***
		(0.001)		(0.002)
Constant	−2.456***	−5.872***	−3.035***	−6.300***
	(0.041)	(0.090)	(0.092)	(0.250)
Number of Observations	30936	30936	29431	29431
Pseudo R^2	0.043	0.265	0.011	0.263
AIC	12166.993	9350.280	1492.164	1118.443

Notes: Heteroskedasticity-consistent standard errors are in parentheses. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

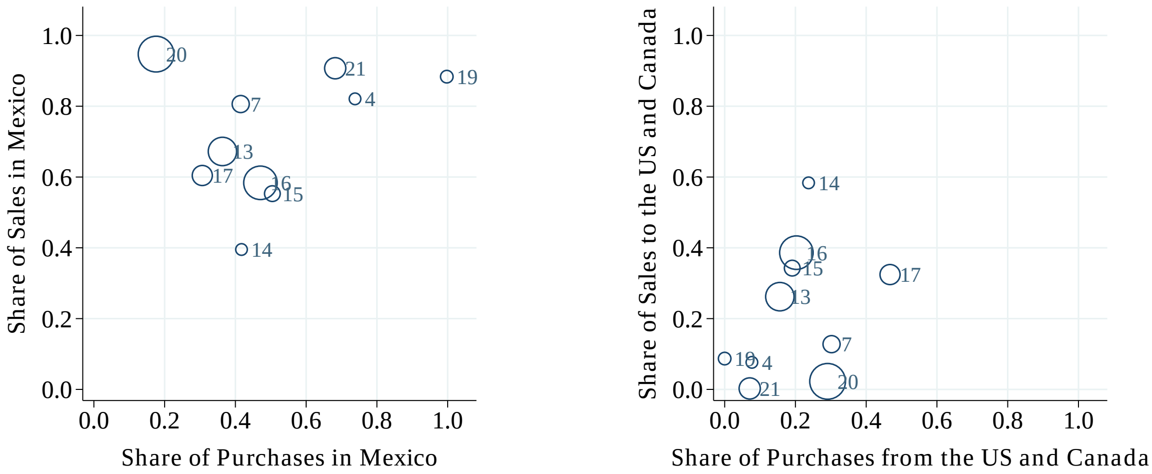


(a) Export Share by Country

(b) Import Share by Country

Figure 1: Regional Share of Sales between 1995 and 2012

Notes: The sample is the same as in Table 1. The average shares across Japanese affiliates in Mexico are shown by year.

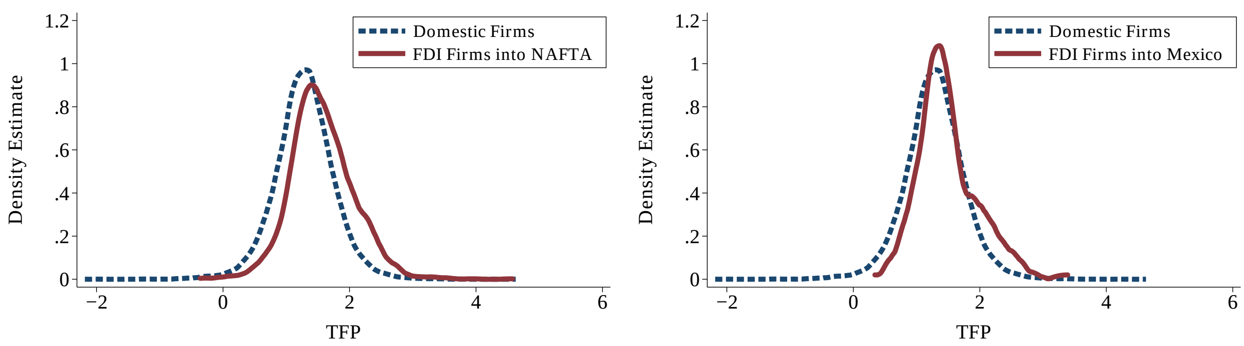


(a) Sales and Purchases in Mexico

(b) Export to and Import from the US and Canada

Figure 2: Sales-Purchases Relationships by Industry

Notes: The sample is the same as in Table 1. The shares by industry are averaged across 1995–2012. The numbers denote industrial classification: 4 is Food; 7 is Chemistry; 13 is General Machinery; 14 is Electrical Machinery; 15 is Information and Communications Machinery; 16 is Transportation Machinery; 17 is Other Manufacturing; 19 is Transportation; 20 is Wholesale and Retail; 21 is Other Services. To maintain confidentiality, some industries are not shown if there are less than five Japanese affiliates in each industry. The circle size indicates the sample size.



(a) FDI Firms into NAFTA vs. Domestic Firms

(b) FDI Firms into Mexico vs. Domestic Firms

Figure A.1: Comparison of TFP Distributions

Notes: The null hypothesis of equal distribution functions by the Kolomogorov-Smirnov test is rejected at the 1% level in both Panes (a) and (b). TFP is the firm average value between 1995 and 2011. See Appendix C for more details of TFP estimation. Domestic firms are those that do not export and had no establishment in foreign countries between 1995 and 2011, and number 29,316. FDI firms denote firms with affiliates in NAFTA countries or Mexico.

Online Appendix for

Input–Output Linkages of Japanese Affiliates in Mexico within NAFTA

Keisuke Kondo*

This online appendix provides additional estimation results, in which productivity shock ω_{it} unobserved by researchers (but observed by foreign affiliates) is controlled for, as discussed by Olley and Pakes (1996). Our gross output production function with disaggregated intermediate inputs is as follow:

$$\log Y_{iht} = \alpha^{\mathrm{M}} \log M_{iht}^{\mathrm{M}} + \alpha^{\mathrm{J}} \log M_{iht}^{\mathrm{J}} + \alpha^{\mathrm{N}} \log M_{iht}^{\mathrm{N}} + \alpha^{\mathrm{O}} \log M_{iht}^{\mathrm{O}} + \beta_0 + \beta_L \log(L_{iht}) + \beta_K \log(K_{iht}) + \omega_{iht} + v_{iht},$$

where ω_{iht} is the productivity shock of foreign affiliate i belonging to parent firm h in year t, and v_{iht} is an i.i.d. shock. The productivity shock ω_{iht} potentially affect foreign affiliates' factor input decisions, which leads to biased estimators of the input elasticities of output.

Olley and Pakes (1996) suggest that the investment can be used as a proxy variable of unobserved productivity shocks. Under the model setting of Olley and Pakes (1996), the investment function consists of fixed capital K_{iht} and productivity shock ω_{iht} as follows:

$$\log(I_{it}) = f_t\Big(\log(K_{it}), \omega_{it}\Big),$$

which is assumed to be strictly increasing in ω_{iht}. Under these assumptions, the investment function can be inverted, and the productivity shock ω_{iht} can be expressed as a function of fixed capital and investment as follows:

$$\omega_{it} = f_t^{-1}\Big(\log(K_{it}), \log(I_{it})\Big).$$

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Substituting it into the production function yields the following equation:

$$\log Y_{iht} = \alpha^{\mathrm{M}} \log M^{\mathrm{M}}_{iht} + \alpha^{\mathrm{J}} \log M^{\mathrm{J}}_{iht} + \alpha^{\mathrm{N}} \log M^{\mathrm{N}}_{iht} + \alpha^{\mathrm{O}} \log M^{\mathrm{O}}_{iht} + \beta_L \log(L_{it}) + \phi_t\Big(\log(K_{it}), \log(I_{it})\Big) + v_{iht},$$

where $\phi_t\Big(\log(K_{it}), \log(I_{it})\Big) = \beta_0 + \beta_K \log(K_{iht}) + f_t^{-1}\Big(\log(K_{it}), \log(I_{it})\Big)$. This production function corresponds to the first stage estimation suggested by Olley and Pakes (1996), which intends to identify α^{M}, α^{J}, α^{N}, α^{O}, and β_L.[1] The parameter β_K is estimated in the second stage. In the regression, $\phi_t\Big(\log(K_{it}), \log(I_{it})\Big)$ can be approximated as higher order polynomials.

This study focuses on intermediate input elasticities of output to uncover international input–output linkages, rather than the TFP estimation. Therefore, this study limits the estimation procedure to the identification of intermediate input elasticities of output in the first stage. Owing to the data unavailability of fixed capital K_{it}, this study uses the logarithm of investment (the first order polynomial) as a proxy variable of productivity shocks. Taking the logarithm of investment I_{it}, this study calculates $\log(I_{it} + 0.1)$. In addition, the regression models include dummy variables that take the value of 1 if investment is 0 ($I_{it} = 0$), and 0 otherwise ($I_{it} > 0$). Estimation results are presented in Tables OA.1–OA.8. The table numbers in the online appendix correspond to those in the paper.

[1] Olley and Pakes (1996) originally consider a value added production function and thus, the first stage estimation intends to identify the parameter β_L.

Table OA.1: Descriptive Statistics for Input–Output Linkage Analysis

Variable	Obs.	Mean	S.D.	Median
Total Sales	921	1877.903	2962.372	764.428
Sales in Mexico	921	1460.391	2765.737	433.111
Export to Japan	921	18.984	127.160	0.000
Export to Third Countries	921	398.527	949.504	5.348
Export to the US and Canada	921	345.225	904.452	0.000
Export to the Other Countries	921	53.303	205.651	0.000
Total Purchases	921	1311.905	2167.135	524.122
Purchases in Mexico	921	596.494	1378.818	59.206
Import from Japan	921	388.512	811.426	77.667
Import from Third Countries	921	326.899	845.760	46.050
Import from the US and Canada	921	238.807	730.877	3.867
Import from the Other Countries	921	88.093	340.143	0.000
Employment	921	373.391	747.500	111.000
Operating Years	921	13.202	11.098	10.000
Investment	921	207.754	603.610	20.000
Sales of Japanese Parent Firm in Japan	898	864684.618	2029096.553	155907.000
Average Sales of Japanese Foreign Affiliates in US	898	23543.710	41063.003	11943.250
Average Sales of Japanese Foreign Affiliates in Other Countries	898	8088.840	10866.366	4606.262
Ratio of Sales in Mexico to Total Sales	921	0.738	0.377	0.985
Ratio of Export to Japan to Total Sales	921	0.016	0.088	0.000
Ratio of Export to Third Countries to Total Sales	921	0.246	0.370	0.007
Ratio of Export to the US and Canada to Total Sales	921	0.219	0.357	0.000
Ratio of Purchases in Mexico to Total Purchases	921	0.383	0.395	0.219
Ratio of Import from Japan to Total Purchases	921	0.322	0.352	0.189
Ratio of Import from Third Countries to Total Purchases	921	0.295	0.372	0.096
Ratio of Import from the US and Canada to Total Purchases	921	0.228	0.352	0.009

Notes: Real values for sales, exports, purchases, and imports are in units of million JPY. The values of sales and exports are deflated by the price indices of gross output obtained from the World Input–Output Database. In addition, the values of purchases and imports are deflated by the price indices of intermediate inputs obtained from the World Input–Output Database (1995=100). The upper 1% of distributions of each variable, except operating years, is excluded from the sample. Inconsistent observations, in which the sum of domestic sales in Mexico and total exports does not equal total sales, are dropped from the sample. Investment, sales of Japanese parent firms, and averages sales of Japanese foreign affiliates are in units of million JPY. The logarithms of these nominal values are used in the regressions.

Table OA.2: OLS Estimation Results of Intermediate Input Elasticities of Exports to the US and Canada by Sourcing Countries

	Dependent Variable: log(Exports to the US and Canada)				
Explanatory Variables	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)
log(Purchase in Mexico)	0.003	−0.011	−0.008	−0.012	−0.007
	(0.048)	(0.053)	(0.053)	(0.052)	(0.052)
log(Import from Japan)	0.029	−0.006	0.002	−0.015	−0.009
	(0.056)	(0.061)	(0.064)	(0.066)	(0.065)
log(Import from the US and Canada)	0.073	0.078	0.081	0.073	0.079
	(0.063)	(0.065)	(0.064)	(0.064)	(0.061)
log(Import from the Other Countries)	0.163**	0.136*	0.137*	0.135*	0.130
	(0.077)	(0.081)	(0.080)	(0.081)	(0.080)
log(Employment)	0.330***	0.371***	0.375***	0.365***	0.371***
	(0.077)	(0.085)	(0.087)	(0.085)	(0.086)
Operating Years	0.008	0.010	0.009	0.011	0.008
	(0.019)	(0.021)	(0.022)	(0.021)	(0.021)
Operating Years (/100)	−0.062	−0.064	−0.060	−0.065	−0.058
	(0.047)	(0.053)	(0.052)	(0.052)	(0.052)
log(Investiment)	−0.052	−0.069	−0.068	−0.068	−0.071
	(0.049)	(0.058)	(0.059)	(0.058)	(0.060)
log(Total Sales of Parent Firm in Japan)		0.015			−0.006
		(0.068)			(0.103)
log(Total Sales of Foreign Affiliates in the US and Canada)			−0.021		−0.117
			(0.084)		(0.108)
log(Total Sales of Foreign Affiliates in the Other Countries)				0.061	0.150
				(0.085)	(0.122)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	No	No	No	No	No
Number of Observations	921	817	817	817	817
Number of Affiliates	204	181	181	181	181
Adjusted R^2	0.906	0.903	0.903	0.903	0.903

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table OA.3: Fixed-Effect Estimation Results of Intermediate Input Elasticities of Exports to the US and Canada by Sourcing Countries

	Dependent Variable: log(Exports to the US and Canada)				
	FE	FE	FE	FE	FE
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	−0.075	−0.097	−0.085	−0.088	−0.088
	(0.060)	(0.064)	(0.063)	(0.061)	(0.060)
log(Import from Japan)	−0.030	−0.049	−0.047	−0.048	−0.044
	(0.078)	(0.084)	(0.083)	(0.080)	(0.082)
log(Import from the US and Canada)	0.172***	0.179***	0.177***	0.159***	0.155***
	(0.051)	(0.049)	(0.050)	(0.045)	(0.044)
log(Import from the Other Countries)	0.157***	0.137***	0.126**	0.120**	0.125**
	(0.051)	(0.050)	(0.050)	(0.050)	(0.050)
log(Employment)	0.482***	0.471***	0.499***	0.492***	0.481***
	(0.116)	(0.129)	(0.132)	(0.127)	(0.133)
log(Investiment)	−0.052	−0.080	−0.084	−0.079	−0.085
	(0.058)	(0.067)	(0.067)	(0.068)	(0.068)
log(Total Sales of Parent Firm in Japan)		0.390***			0.293**
		(0.149)			(0.131)
log(Total Sales of Foreign Affiliates in the US and Canada)			0.227**		0.153
			(0.103)		(0.098)
log(Total Sales of Foreign Affiliates in the Other Countries)				0.379**	0.318*
				(0.188)	(0.179)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	921	817	817	817	817
Number of Affiliates	204	181	181	181	181
Within R^2	0.867	0.859	0.858	0.860	0.861

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table OA.4: OLS Estimation Results of Intermediate Input Elasticities of Sales in Mexico by Sourcing Countries

	Dependent Variable: log(Sales in Mexico)				
	OLS	OLS	OLS	OLS	OLS
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	0.328***	0.301***	0.293***	0.303***	0.293***
	(0.055)	(0.061)	(0.061)	(0.060)	(0.061)
log(Import from Japan)	0.407***	0.418***	0.404***	0.418***	0.407***
	(0.059)	(0.059)	(0.059)	(0.062)	(0.060)
log(Import from the US and Canada)	0.157***	0.150***	0.133**	0.144**	0.134**
	(0.051)	(0.056)	(0.054)	(0.056)	(0.053)
log(Import from the Other Countries)	0.080	0.101**	0.109**	0.102*	0.110**
	(0.050)	(0.051)	(0.051)	(0.052)	(0.051)
log(Employment)	0.119*	0.197***	0.183***	0.192***	0.185***
	(0.072)	(0.066)	(0.066)	(0.065)	(0.065)
Operating Years	0.007	−0.003	0.001	−0.004	0.002
	(0.018)	(0.017)	(0.017)	(0.018)	(0.017)
Operating Years (/100)	0.008	0.015	0.010	0.021	0.009
	(0.036)	(0.032)	(0.031)	(0.035)	(0.030)
log(Investiment)	0.046	0.007	0.015	0.013	0.015
	(0.050)	(0.049)	(0.050)	(0.051)	(0.048)
log(Total Sales of Parent Firm in Japan)		0.086			0.010
		(0.077)			(0.115)
log(Total Sales of Foreign Affiliates in the US and Canada)			0.182**		0.208***
			(0.077)		(0.074)
log(Total Sales of Foreign Affiliates in the Other Countries)				0.106	−0.052
				(0.076)	(0.127)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	No	No	No	No	No
Number of Observations	921	817	817	817	817
Number of Affiliates	0.895	0.900	0.902	0.900	0.902
Adjusted R^2	204	181	181	181	181

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table OA.5: Fixed-Effect Estimation Results of Intermediate Input Elasticities of Sales in Mexico by Sourcing Countries

	Dependent Variable: log(Sales in Mexico)				
	FE	FE	FE	FE	FE
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	0.196***	0.196***	0.197***	0.191***	0.196***
	(0.043)	(0.045)	(0.046)	(0.045)	(0.046)
log(Import from Japan)	0.227***	0.286***	0.288***	0.286***	0.287***
	(0.044)	(0.043)	(0.042)	(0.042)	(0.042)
log(Import from the US and Canada)	0.095***	0.092***	0.089***	0.104***	0.102***
	(0.031)	(0.032)	(0.032)	(0.031)	(0.031)
log(Import from the Other Countries)	0.005	0.012	0.013	0.019	0.015
	(0.037)	(0.038)	(0.039)	(0.038)	(0.038)
log(Employment)	0.396***	0.277***	0.274***	0.277***	0.283***
	(0.112)	(0.103)	(0.105)	(0.102)	(0.101)
log(Investiment)	−0.079**	−0.069*	−0.072**	−0.068*	−0.071**
	(0.034)	(0.036)	(0.036)	(0.035)	(0.035)
log(Total Sales of Parent Firm in Japan)		−0.114			−0.102
		(0.099)			(0.103)
log(Total Sales of Foreign Affiliates in the US and Canada)			0.074		0.108
			(0.076)		(0.077)
log(Total Sales of Foreign Affiliates in the Other Countries)				−0.185**	−0.187**
				(0.072)	(0.073)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	921	817	817	817	817
Number of Affiliates	204	181	181	181	181
Within R^2	0.899	0.907	0.907	0.908	0.909

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table OA.6: OLS Estimation Results of Intermediate Input Elasticities of Total Sales by Sourcing Countries

	Dependent Variable: log(Total Sales)				
	OLS	OLS	OLS	OLS	OLS
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	0.283***	0.249***	0.243***	0.251***	0.243***
	(0.044)	(0.040)	(0.039)	(0.039)	(0.040)
log(Import from Japan)	0.319***	0.292***	0.284***	0.287***	0.278***
	(0.048)	(0.048)	(0.048)	(0.047)	(0.047)
log(Import from the US and Canada)	0.171***	0.159***	0.141***	0.148***	0.141***
	(0.034)	(0.036)	(0.033)	(0.035)	(0.034)
log(Import from the Other Countries)	0.121***	0.128***	0.139***	0.128***	0.135***
	(0.034)	(0.033)	(0.034)	(0.035)	(0.034)
log(Employment)	0.282***	0.362***	0.347***	0.352***	0.347***
	(0.072)	(0.048)	(0.047)	(0.046)	(0.046)
Operating Years	0.015	0.011	0.015	0.010	0.015
	(0.014)	(0.013)	(0.012)	(0.013)	(0.012)
Operating Years (/100)	−0.002	−0.010	−0.011	−0.001	−0.012
	(0.029)	(0.027)	(0.025)	(0.029)	(0.025)
log(Investiment)	0.054	0.006	0.020	0.016	0.017
	(0.038)	(0.035)	(0.035)	(0.035)	(0.034)
log(Total Sales of Parent Firm in Japan)		0.130***			0.026
		(0.035)			(0.050)
log(Total Sales of Foreign Affiliates in the US and Canada)			0.214***		0.158***
			(0.044)		(0.058)
log(Total Sales of Foreign Affiliates in the Other Countries)				0.187***	0.048
				(0.043)	(0.060)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	No	No	No	No	No
Number of Observations	921	817	817	817	817
Number of Affiliates	204	181	181	181	181
Adjusted R^2	0.798	0.826	0.832	0.827	0.833

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table OA.7: Fixed-Effect Estimation Results of Intermediate Input Elasticities of Total Sales by Sourcing Countries

	Dependent Variable: log(Total Sales)				
	FE	FE	FE	FE	FE
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
log(Purchase in Mexico)	0.143***	0.154***	0.159***	0.155***	0.158***
	(0.036)	(0.037)	(0.038)	(0.037)	(0.038)
log(Import from Japan)	0.217***	0.265***	0.267***	0.265***	0.267***
	(0.041)	(0.044)	(0.044)	(0.044)	(0.044)
log(Import from the US and Canada)	0.111***	0.106***	0.103***	0.105***	0.102***
	(0.025)	(0.025)	(0.025)	(0.026)	(0.026)
log(Import from the Other Countries)	0.094***	0.100***	0.097***	0.098***	0.098***
	(0.034)	(0.036)	(0.036)	(0.036)	(0.037)
log(Employment)	0.443***	0.343**	0.350***	0.345***	0.348***
	(0.140)	(0.132)	(0.130)	(0.130)	(0.131)
log(Investiment)	−0.051*	−0.055*	−0.059**	−0.055*	−0.059**
	(0.027)	(0.028)	(0.029)	(0.029)	(0.029)
log(Total Sales of Parent Firm in Japan)		0.058			0.028
		(0.066)			(0.060)
log(Total Sales of Foreign Affiliates in the US and Canada)			0.134*		0.129*
			(0.069)		(0.072)
log(Total Sales of Foreign Affiliates in the Other Countries)				0.032	0.010
				(0.069)	(0.067)
Industry × Year Dummy	Yes	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	921	817	817	817	817
Number of Affiliates	204	181	181	181	181
Within R^2	0.661	0.675	0.679	0.675	0.679

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Table OA.8: Fixed-Effect Estimation Results of Intermediate Input Share Elasticity by Sourcing Countries

	Dependent Variable: Sales Share to Country			
	US and Canada		Mexico	
Explanatory Variables	FE (1)	FE (2)	FE (3)	FE (4)
Import Share from the US and Canada	0.105*	0.101*	−0.104	−0.096*
	(0.063)	(0.053)	(0.064)	(0.056)
log(Employment)	−0.001	0.010	0.036	0.024
	(0.016)	(0.014)	(0.046)	(0.051)
log(Investment)	−0.010	−0.017*	0.007	0.012
	(0.010)	(0.010)	(0.011)	(0.012)
log(Total Sales of Parent Firm in Japan)		−0.027		0.049*
		(0.021)		(0.030)
log(Total Sales of Foreign Affiliates in the US and Canada)		0.058***		−0.042**
		(0.017)		(0.018)
log(Total Sales of Foreign Affiliates in the Other Countries)		0.055*		−0.071**
		(0.030)		(0.033)
Industry × Year Dummy	Yes	Yes	Yes	Yes
Control of Affiliate Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	921	817	921	817
Number of Affiliates	204	181	204	181
Within R^2	0.291	0.346	0.296	0.345

Notes: Heteroskedasticity-consistent standard errors clustered at the affiliate level are in parentheses. The constant term is not reported. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.