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Abstract

We examine the effects of globalization on firm performance through buyer-seller networks. In particular, we focus on the impact of the start of customer firms' overseas outsourcing on supplier firms' productivity, markups, employment, average wage, and sales. Previous literature examines the direct effect of import activities on firm productivity, but there has been only limited research looking at the effect of import activities through buyer-seller networks. This paper analyzes the effects of changes in customers' import status on supplier firms' performance. We combine propensity score matching with difference-in-differences (DID) estimation, comparing the performance of manufacturing firms whose major customers begin importing with those whose customers continue to procure intermediate inputs within Japan. Our results indicate that the impact of a customer's commencement of importing on suppliers' markups, productivity, and sales is negative but with no significant effects on wage and employment. These results imply that an increase in import activities of customer firms has procompetitive effects on domestic suppliers and leads to a decrease in their markups and productivity.

Keywords: Outsourcing, Production network, Markups, Productivity, Propensity score matching with difference-in-difference
JEL Classification: F60, L25

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1. Introduction

The Japanese economy suffered from slow economic and productivity growth during the 1990s and 2000s. According to *Japan Industrial Productivity Database 2011*, Total Factor Productivity (TFP) growth rates were 2.10 and 1.52 percent per annum in the 1970s and 1980s, respectively. Those growth rates declined to 0.00 percent per annum in the 1990s before rising slightly to 0.94 percent per annum in the period from 2000 to 2008.

Cowling and Tomlinson (2000) argue that the slowdown in the productivity growth rate was caused by the "elite globalization" strategies employed by Japanese multinational enterprises. The domestic manufacturing sector has been "hollowed out" as multinationals have engaged in offshore production in lower-wage economies of Asia. This has resulted in the closure of domestic plants that were relatively productive, thus causing a further slowdown in productivity growth.

Inui et al. (2015) compare the TFP levels of large firms and small- and medium-sized enterprises (SMEs) for the period between 1982 and 2008. They find that large firms improved their productivity, whereas the TFP of SMEs stagnated during the sample period. Therefore, the TFP gap between large firms and SMEs has become wider in recent years. They consider that the failure of SMEs to adjust to globalization has led to such stagnation of TFP growth rates.

Kneller et al. (2012) examine the effects of imports, intra-industry trade, and firm R&D intensity on plant-level productivity growth. They find that import penetration has a negative impact on low-productivity plants' productivity catch-ups. Their results suggest that increased

competition with developing countries (mostly from Asia, in the case of Japan) accounts for the low rate of productivity improvement within Japanese SMEs.

In this study, we examine, through buyer and seller networks, the effects of globalization on the performance of Japanese firms. In particular, we try to examine the impact of a customer firm starting to offshore on supplier firm markups, productivity, average wage, employment, labor productivity, and sales. In the case of Japan, downstream customer firms are usually larger on average than their upstream supplier firms. The large and productive firms have a good chance to enhance their productivity by taking advantage of the increased globalization of the economy. They can export from more countries and in the process learn from their export market experiences. They can also improve their resource allocation by shutting down inefficient domestic plants and relocating them to developing countries abroad. In addition, they can rationalize their procurements of intermediate products so that they come from the most cost-effective countries.

Conversely, SMEs usually have difficulty in globalizing their activities. They have to compete with imported products from low-wage countries. In order to compete with imports, SMEs may lower their prices and their markups. When they cannot compete, they may reduce their sales to large customer firms, and this can lead to a decrease in the productivity spillover benefits from large firms (Ikeuchi et al. 2015 find that the buyer–seller network is one of the important sources of technological spillover in Japan).

Our research contributes another strand of the literature regarding the relation between market competition and productivity and markups. Tariff reductions and increased imports lead to procompetitive pressures in the liberalizing countries that result in both resource

reallocation and lower markups as indicated by Levinsohn (1993), Pavcnik (2002), and Konings and Vandenbussche (2005). We examine the procompetitive effect of customers on domestic supplier firms.

The remainder of this paper is organized as follows. Section 2 reviews previous studies. Section 3 is an introduction to the data used. Section 4 describes the analysis methods. Section 5 provides the descriptive statistics and states the estimation results. The last section discusses the main findings from the estimations as well as policy implications.

2. Literature Review

Many previous studies examine the impact of globalization on domestic firms' performance. Bernard, Jensen, and Schott (2006) find that US industries that experienced a large decline in trade costs exhibited a larger productivity improvement. This improvement in productivity was mainly brought about by (1) closures of low-productivity plants, (2) increases in production at high-productivity plants, and (3) increases in plant-level productivity. They find that increased import competition leads to the improvement of plant-level productivity. Criscuolo, Haskel, and Martin (2004) employ firm-level data in the UK for the period between 1980 and 2000 and find that the productivity improvement explained by the entry and exit of firms increased substantially from 25 percent in the 1980s to 50 percent in the 1990s. They find that both increased globalization and prevailing information communication technology have enhanced the importance of such entry and exit on productivity growth. Pavcnik (2002) uses Chilean manufacturing data for the late 1970s and early 1980s and examines whether massive trade liberalization in the period contributed

to the plant-level productivity. She finds that plant-level productivity improvement occurred mainly in the import-competing sector. She also finds that aggregate productivity improvement in Chile in the sample period stems from the reshuffling of resources and production by more efficient producers coincident with the exit of less efficient ones. Kasahara and Rodrigue (2008) also use plant-level Chilean manufacturing data and find that switching from being a non-importer to being an importer of foreign intermediates can improve productivity by 3.4 to 22.5 percent. Almeida and Fernandes (2008) examine international technology transfers using firm-level data across 43 developing countries and find that exporting and importing activities are important channels for the transfer of technology. All studies in the previous literature examine the direct effect of import activities on firms' productivity, but to our knowledge, there is only limited research examining the effect of import activities through buyer-seller networks.

More recent studies examine the effects of globalization on firms' markups. De Loecker and Warzynski (2012) develop an empirical method to estimate firm-level markups and examine the effects of firms' export activities on their markups using Slovenian data. They find that markups differ dramatically between exporters and non-exporters, with significant and robust higher markups for exporting firms. De Loecker (2013) finds that export participation by Slovenian firms brought substantial productivity gains to them. Guillou and Nesta (2015) examine the procompetitive effect of establishing the euro on the markups of French manufacturing firms. They find that the introduction of the euro has led to a significant decrease in the average markups of French firms. Again, the existing literature examines the direct effect of globalization on markups but does not consider indirect effects

through networks.

Ito and Tanaka (2014), and Furusawa et al. (2015) offer a few exceptions examining the indirect effects of firms' outsourcing through buyer–seller networks using Japanese firm-level micro data. Ito and Tanaka (2014) examines the effects of globalization on suppliers' employment, and Furusawa et al. (2015) focuses on survival in the network. Nishitateno (2015) measures network effects on auto parts exports from 6 major auto producing countries using a data set covering 49 destinations and 31 products. Considering that studies on the effects of outsourcing on the total economy are still very much limited, these papers are exceptional studies on the indirect effects of firm outsourcing on the domestic economy.

Todo, Matous, and Inoue (2015) and Ikeuchi et al. (2015) examine the buyer–seller network effect on technology diffusion and productivity improvements using Japanese data. Both papers find that transaction-based spillovers have a key influence on productivity. Javorcik and Spatareanu (2009) find that suppliers in the Czech Republic learn from their relationships with multinationals and exhibit higher productivity levels. Bernard, Moxnes, and Saito (2015) suggest improvements in firm performance by the creation of new buyer–seller links exploiting the opening of a high-speed (Shinkansen) train line in Japan.

3. Data

In order to examine the effect of globalization on productivity, markups, labor productivity, sales, and employment among Japanese firms through buyer–seller networks, we combine the financial information with buyer–seller network information. In particular, we merge the financial data in the Basic Survey on Japanese Business Structure and

Activities (BSJBSA) with the Tokyo Shoko Research (TSR) data containing information on the buyer–seller network.

The first dataset used in this study is the firm-level panel data obtained from BSJBSA, collected annually by the Ministry of Economy, Trade and Industry for the period 2004–2013. The survey is compulsory and covers all firms with at least 50 employees or 30 million yen of paid-in capital in the Japanese manufacturing, mining, wholesale and retail, and several other service sectors. It covers approximately 30,000 firms per year. The survey contains financial information, such as costs, profits, investment, debt, and assets. It also contains detailed information on firm-level business activities, such as the number of employees, sales, purchases, exports, and imports (including a breakdown of the destination of sales and exports and the origin of purchases and imports).

The second dataset, TSR data, is compiled by the Tokyo Shoko Research Ltd. and contains information on interfirm relationships, such as the names of a firm's main suppliers, buyers, and shareholders in 2006 and 2011[1]. Due to data restriction, we assume the relationships between customers and suppliers were unchanged through the estimation period although that is a rather strong assumption. In order to construct the domestic production networks in Japan, we use information reported by a buyer regarding its sellers.

We merge the two datasets according to firms' names, addresses, and telephone numbers. We select only manufacturing firms in our sample.

4. Methodology

[1] TSR Company Information Database and TSR Company Linkage Database are used in this analysis.

Utilizing the aforementioned datasets, we can measure various characteristics of Japanese firms, such as their size, industry, productivity, markups, and buyer–seller networks. To estimate productivity, which varies by year and firm, we apply the estimation methodology developed by De Loecker and Warzynski (2012) using the translog production function by the JIP-DB industry classification. Under any form of imperfect competition, markups are identified as the ratio of an input's output elasticity and its revenue share. We obtain an expression of the markup as follows:

$$\mu_{it} = \frac{\theta_{it}^{X}}{\alpha_{it}^{X}}$$

Where α_{it}^{X} is the share of expenditures on input X_{it} in total sales (P_{it} Q_{it}). θ_{it}^{X} is obtained by estimating a production function. To obtain consistent estimates of the production function, we need to control for unobserved productivity shocks, which are potentially correlated with input choices. To deal with this simultaneity problem, first, we exploit intermediate input as a proxy for productivity following Levinsohn and Petrin (2003), Ackerberg et al. (2006), and De Loecker and Warzynski (2012), and obtain estimates of expected output. Second, we employ the GMM procedure, relying on lagged labor to identify the coefficients on labor suggested by Ackerberg et al. (2006).

We estimate production functions where output is measured by firms' value-added, and production input, including capital and labor. The real values of output and intermediate input are obtained by deflating nominal values using the price index for each industry from the JIP database, and we calculate the real value added in each firm by subtracting their real input

from their real output. The firm capital stock is estimated by the value of tangible assets deflated by the capital price index for each industry from the JIP database. Since BSBJA only provides the number of employees by firm, the labor input of each firm is obtained by multiplying the number of employees by the average number of hours worked in each industry using the JIP database. To eliminate the inappropriate influence of the few extreme values, we use TFP winsorized at the .01/.99 level.

We examine the effects of changes in customers' import status on supplier firms' productivity, markups, labor productivity, sales, and employment. To compare the performance of firms whose customers start to import with those whose customers continue to procure intermediate inputs within Japan, we employ a difference-in-difference approach. The average number of customers for Japanese suppliers is 4.84, and we examine the effect when at least one of the suppliers' customers becomes an importing firm.

Since a firm's initiation of importing is not a random sample of firms, we address the selection bias through propensity score matching combined with a difference-in-differences approach (as is done by Arnold and Javorcik (2009)). The propensity score matching method allows us to create the missing counterfactual of how the firms whose customers start to import would have performed differently from those whose customers continue to procure intermediate inputs in domestic, while the difference-in-differences approach allows us to account for unobservable firm heterogeneity.

In this exercise, we consider five outcomes: productivity, markups, labor productivity, real sales in constant units of Yen in 2000 (in log), and number of employees (in log). To obtain the propensity score for each customer firm, we first estimate a probit model, where

we estimate the probability of customers' switching to the importer, and the estimation results are reported in Appendix Table 1. The estimated propensity score satisfies the balancing property (see Appendix Table 2). We employ kernel matching, in which multiple control observations are used, and the weight given to each is determined by the distance in the propensity score from the treated (customer firms beginning to import) firm.[2]

After finding the control group through propensity score matching, we estimate the following regression:

$$\begin{aligned} \text{ATT} = \text{E}(\alpha_i \mid d_i = 1) = \ & \alpha^{DID} \\ = (\overline{\text{Outcome}}_{t+s}^{Treatment} - \ & \overline{\text{Outcome}}_{t-1}^{Treatment}) \\ - (\overline{\text{Outcome}}_{t+s}^{Control} - \ & \overline{\text{Outcome}}_{t-1}^{Control}) \end{aligned} \qquad (2)$$

where outcome denotes various outcomes of interest, particularly suppliers' TFP, markups, wage, employment, labor productivity, and sales, i denotes supplier firm and t year, and $s \in \{0,1,2\}$. *Treatment* is the firms with beginning of import by customer firm j in year t (1 if firm j switches from non-importer to importer, 0 otherwise) ,and *Control* is counterfactual among those of their customer staying non-importer. Now we replace *Treatment* with the missing value after firm j switches from a non-importer to an importer. A separate model is estimated for each value of s. In other words, we focus on the change in outcome between the year prior to customers' beginning to import and the year of beginning of import or each of

[2] In other words, kernel matching uses weighted averages of all firms in the control group (within the common support) to construct the counterfactual outcome. A higher weight is given to controls that have propensity scores closer to those of the treated observation, while a lower weight is given to more distant controls.

the two subsequent years. The coefficient γ captures the average treatment effect on the treated (ATT) firm, i.e., the effect of customers' initiation of imports. We bootstrap standard errors using 100 replications.

We expect customers' beginning to import to have negative effects on suppliers' markups, productivity, wage, employment, labor productivity, and sales. The customers' beginning to import may reduce their procurements from the suppliers, and the suppliers have fewer chances to enjoy the productivity spillover effects from their customers. Moreover, in order to compete for the import inputs, the suppliers may decrease their price, wage, sales, and employment. In addition, increased uncertainty of suppliers' sales to their original domestic customers may lead to a decrease its investments and productivity.

5. Results

Table 1 shows summary statistics for variables used in the estimations. The suppliers' TFP is 1.06, markup is 1.61, log of wage is 15.43, and the number of employees of the supplier is 446 on average. The import/sales ratio of customer j in year (t-1) is 0.04, the average import status (1: import/sales ratio of customer j in year (t-1) is positive, 0: import/sales ratio is zero) is 0.83[3], and the average number of employees of the customer is 6,209. On average, we can confirm that the customer firms' employee strengths are much higher than those of suppliers. The total sample size falls in the range between 60,000 and 100,000 depending on the variables used in the estimation, and it is approximately 6,000–10,000 samples each year. The original BSJBSA dataset contains about 13,000 manufacturing

[3] We define the import status as 1 for a firm when the amount of import takes a positive number, 0 otherwise. We clean the data to correct for what most likely are coding errors.

firm samples per year, but the main reason for the large reduction in the number of samples in the estimations from the BSJBSA dataset is that we can match about two-thirds of the manufacturing firms in BSJBSA to those in TCR datasets. Our dependent variables are productivity (TFP), markups, labor productivity, sales, and employment.

Figure 1 and 2 display markups and TFP of supplier firm i by customers' import status and the year, respectively. They indicate that the supplier firms' markups and TFP levels are higher when their customers are importers than when they are non-importers.

Table 1. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Supplier					
Markup	66609	1.61	0.51	0.58	3.00
TFP	73861	1.06	0.52	-1.62	3.05
ln(wage)	108051	15.43	0.42	9.32	18.29
Number of employees	108154	446	1820	50	80840
Labor Productivity	107232	8.39	0.69	1.99	13.89
ln(sales)	108154	8.57	1.40	2.23	16.37
Import status (1: importer, 0: non-importer)	108154	0.32	0.47	0.00	1.00
Import ratio	108154	0.03	0.08	0.00	1.38
Number of customers	108154	6.12	10.82	0.00	434
Customer					
Import status (t-1) (1: importer, 0: non-importer)	97806	0.83	0.38	0.00	1.00
Import ratio (t-1)	97806	0.04	0.05	0.00	0.91
Import status change (1: non-importer-->importer, 0: non-importer)	93349	0.01	0.12	0.00	1.00
Number of employees (t-1)	97806	6209	7661	50	80840
Markup (t-1)	88658	1.66	0.40	0.58	3.00
TFP (t-1)	91632	1.17	0.72	-1.62	3.05

Figure 1. Supplier's markups by its customers' import status and by year

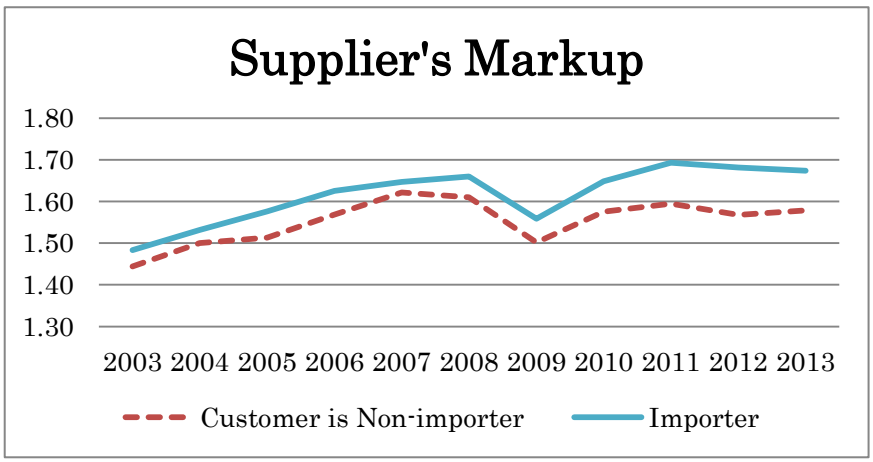
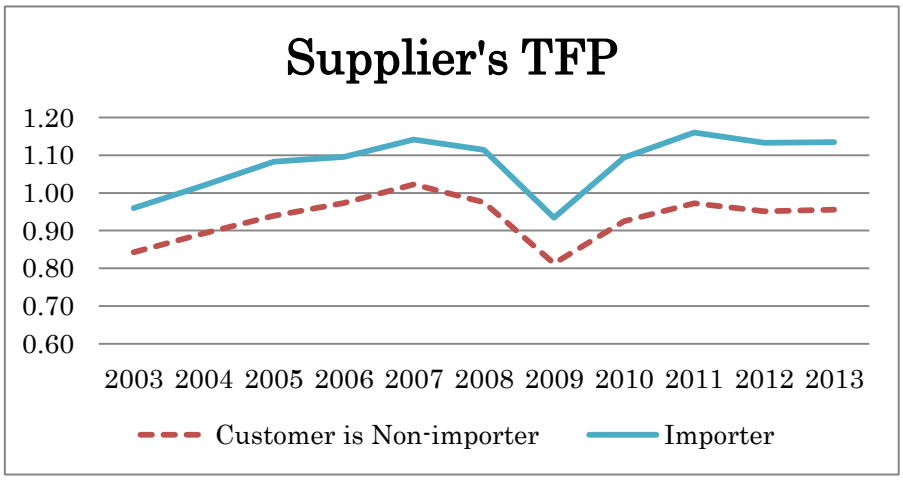


Figure 2. Supplier's TFP by its customers' import status and by year



We examine two cases of the effects of customers' importing on suppliers' performance. The first examines the case in which at least one of the customers of the supplier becomes an importer from a non-importer (estimation results in Table 2) using kernel matching. Table 2 results indicate that customers' beginning to import leads to decrease both suppliers' markups and TFP in the treatment group relative to the control group. The suppliers' markups in the treatment group is 0.039 log points lower and 0.044 log points lower after one year and two years, respectively, from the year preceding the one in which the customer starts to import. The suppliers' TFP in the treatment group is 0.024 log points lower and 0.032 log points lower in the next year in which the customer starts to import and two years after that year, respectively. The suppliers' labor productivity in the treatment group is 0.041 points lower after two years from the year preceding the one in which the customer starts to import. The suppliers' sales decreased by 0.019 log points in one year after the year in which the customer starts to import and 0.026 log points in two years. However, we do not find any

significant effects on the supplier's employment, and wage. Table 3 repeats the same analysis keeping the same samples from the previous year to two years after the customer starts to import. Our key results, negative and statistically significant difference of markups and TFP between the treatment and control groups, changes little even if we use balanced panel data. Figure 3 and 4 show markups and TFP of both treatment group and control group in year (t-1), t, (t+1), and (t+2) using balanced panel data. As shown in Figure 3, levels and the growth rate of markups in treatment group are always lower than those of control group. The same is equally true of TFP. Table 4 provides another evidence on the robustness of the estimation---which changes little when we use k-Nearest neighbors matching. Next, we loose our assumption---the relationships between customers and suppliers were unchanged from 2003 to 2013. Table 5 displays the results using samples holding relationships between customers and suppliers both 2006 and 2011. Reassuringly, our key result---the negative effects of customers beginning to import on markups and TFP---changes little.

We also examine the effects of the customers' importing by employing a different sample from the above. Table 6 shows the estimation results from the case in which at least 10 per cent of the total customers of the suppliers become importers from being non-importers. The obtained results are essentially the same as the previous results. The change in customers' import status has a negative effect on suppliers' markups, TFP, and sales, and the magnitude of the effects is larger than that depicted in the results in Table 2. Simultaneously, the effects on suppliers' wage, employment, and labor productivity are limited as in the previous results.

Table 2. Estimated ATT (at least one customer among the total number of customers becomes an importer)

		Observed	Std. Err.		No. of chage from non-importer to importer
ln(Markup)					
	t	-0.025	0.015	*	583
	t+1	-0.039	0.014	***	534
	t+2	-0.044	0.020	**	435
ln(TFP)					
	t	-0.013	0.005	**	657
	t+1	-0.024	0.007	***	594
	t+2	-0.032	0.008	***	484
ln(Wage)					
	t	-0.002	0.007		1073
	t+1	0.012	0.010		965
	t+2	-0.003	0.011		823
ln(employment)					
	t	0.000	0.003		1073
	t+1	-0.007	0.006		965
	t+2	-0.015	0.008	**	825
ln(Labor Productivity)					
	t	-0.021	0.011	*	1055
	t+1	-0.012	0.012		951
	t+2	-0.041	0.025	*	809
ln(Sales)					
	t	-0.015	0.007	**	1073
	t+1	-0.019	0.007	***	965
	t+2	-0.026	0.013	**	825

Table 3. Estimated ATT (at least one customer among total number of customers becomes an importer—balanced panel data)

		Observed	Std. Err.		No. of chage from non-importer to importer
ln(Markup)					
	t	-0.027	0.015	*	372
	t+1	-0.045	0.015	***	372
	t+2	-0.047	0.015	***	372
ln(TFP)					
	t	-0.018	0.006	***	372
	t+1	-0.020	0.009	**	372
	t+2	-0.032	0.008	***	372
ln(Wage)					
	t	-0.007	0.007		372
	t+1	-0.004	0.009		372
	t+2	-0.012	0.011		372
ln(employment)					
	t	0.001	0.006		372
	t+1	-0.005	0.007		372
	t+2	-0.009	0.008		372
ln(Labor Productivity)					
	t	-0.023	0.010	**	372
	t+1	-0.029	0.014	**	372
	t+2	-0.032	0.017	*	372
ln(Sales)					
	t	-0.015	0.007	**	372
	t+1	-0.018	0.008	**	372
	t+2	-0.017	0.012		372

Figure 3. Markups of both treatment group and control group between year (t-1) and (t+2)

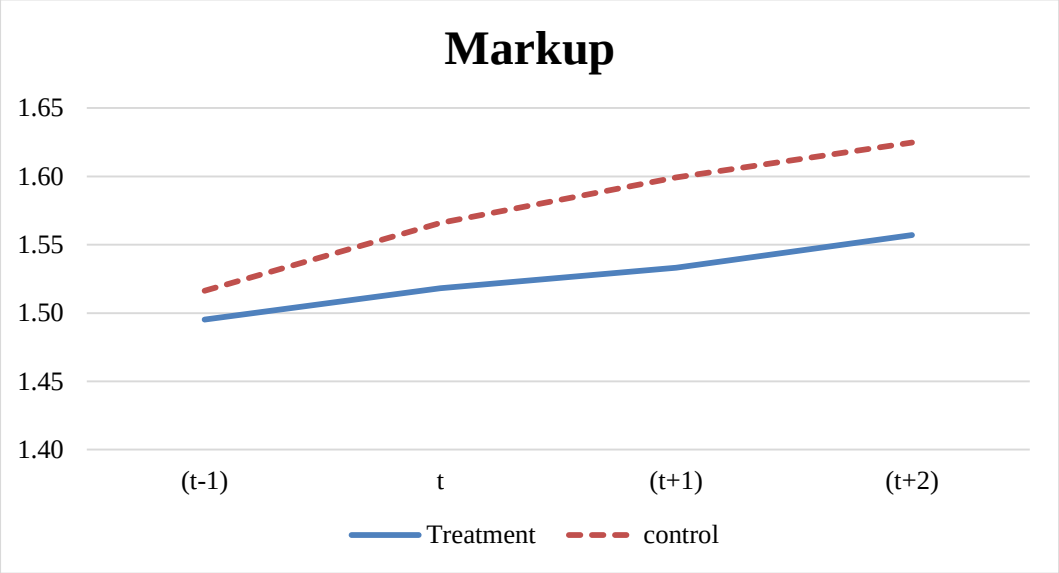


Figure 4. TFP of both treatment group and control group between year (t-1) and (t+2)

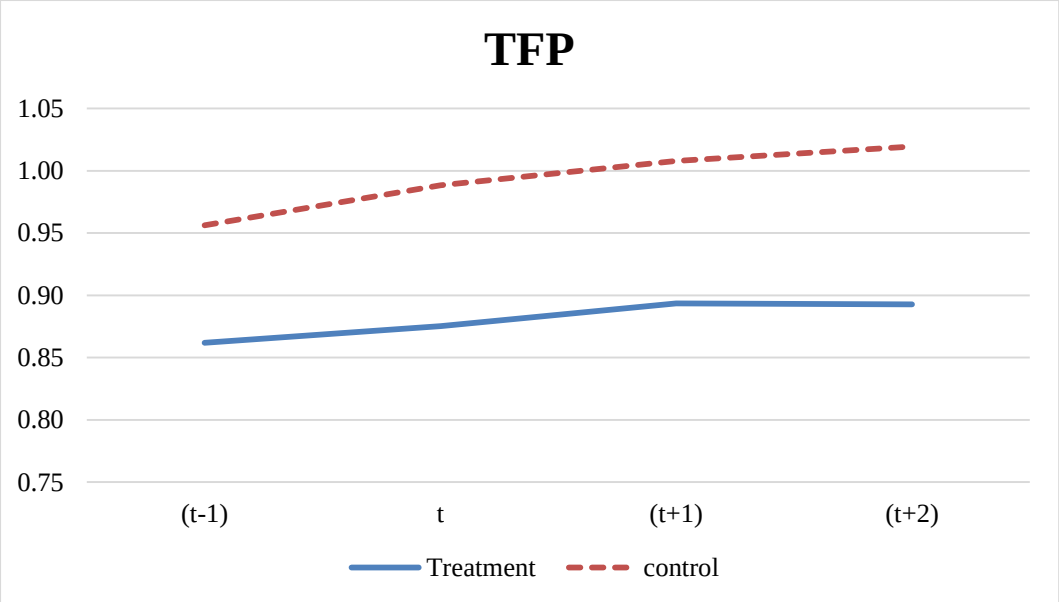


Table 4. Estimated ATT (at least one customer among the total number of customers becomes an importer: k-Nearest neighbors matching)

ln(Markup)				
	t	-0.010	0.014	583
	t+1	-0.029	0.018	534
	t+2	-0.029	0.016 *	435
ln(TFP)				
	t	-0.008	0.007	657
	t+1	-0.029	0.010 ***	594
	t+2	-0.023	0.013 *	484
ln(Wage)				
	t	-0.007	0.011	1073
	t+1	0.006	0.013	965
	t+2	-0.008	0.016	823
ln(employment)				
	t	0.003	0.005	1073
	t+1	-0.003	0.006	965
	t+2	-0.006	0.009	825
ln(Labor Productivity)				
	t	-0.025	0.014 *	1055
	t+1	-0.014	0.017	951
	t+2	-0.049	0.025 **	809
ln(Sales)				
	t	-0.015	0.008 *	1073
	t+1	-0.015	0.013	965
	t+2	-0.027	0.013 **	825

Table 5. Estimated ATT (at least one customer among total number of customers becomes an importer— holding relationships between customers and suppliers both 2006 and 2011)

		Observed	Std. Err.		No. of chage from non-importer to importer
ln(Markup)					
	t	-0.008	0.012		614
	t+1	-0.018	0.013		541
	t+2	-0.037	0.017	**	462
ln(TFP)					
	t	-0.005	0.005		698
	t+1	-0.012	0.007	*	608
	t+2	-0.034	0.012	***	517
ln(Wage)					
	t	-0.011	0.008		1099
	t+1	-0.004	0.011		986
	t+2	-0.005	0.010		855
ln(employment)					
	t	-0.005	0.004		1099
	t+1	-0.011	0.005	**	986
	t+2	-0.012	0.006	**	856
ln(Labor Productivity)					
	t	-0.022	0.011	**	1088
	t+1	-0.004	0.013		979
	t+2	-0.009	0.015		848
ln(Sales)					
	t	-0.017	0.007	**	1099
	t+1	-0.018	0.009	**	986
	t+2	-0.008	0.010		856

Table 6. Estimated ATT (at least 10 per cent of the total number of customers become importers)

		Observed	Std. Err.		No. of chage from non-importer to importer
ln(Markup)					
	t	-0.027	0.015	*	608
	t+1	-0.038	0.014	***	554
	t+2	-0.049	0.020	**	449
ln(TFP)					
	t	-0.015	0.005	***	687
	t+1	-0.028	0.008	***	620
	t+2	-0.038	0.008	***	502
ln(Wage)					
	t	-0.003	0.008		1110
	t+1	0.010	0.010		996
	t+2	-0.003	0.011		847
ln(employment)					
	t	0.000	0.003		1110
	t+1	-0.005	0.006		996
	t+2	-0.012	0.007	*	849
ln(Labor Productivity)					
	t	-0.022	0.011	**	1092
	t+1	-0.013	0.011		982
	t+2	-0.043	0.024	*	833
ln(Sales)					
	t	-0.017	0.007	**	1110
	t+1	-0.021	0.008	***	996
	t+2	-0.029	0.013	**	849

It is plausible that the effects of beginning to import differ by the sourcing country or region. We focus on the effect of import from Asia. The main imported goods from the region are parts and intermediate products, and raw material import does not play an important role. Table 7 shows the effects of customers' beginning to import from Asia on suppliers' markups, TFP, average wage, employment, labor productivity, and sales. The effect of customers' beginning to import from Asia on suppliers' markups, TFP, and sales are overall negative, and most of those coefficients are statistically significant. The suppliers' markups in the treatment group is 0.033 log points lower and 0.036 log points lower one year and two years from the

year preceding the one in which the customer starts to import. The suppliers' TFP in the treatment group is 0.021 log points lower and 0.026 log points lower after one year in which the customers start to import and two years from the year preceding the year in which the customer starts to import. The suppliers' sales decreased by 0.018 log points in one year after the year in which the customer starts to import from asia and 0.031 log points in two years. The effect of customers' importing from Asia on suppliers' employment, and labor productivity are generally negative although most of those coefficients are not statistically significant. The results obtained using Asian samples have essentially the same implications as those of the results using worldwide samples.

We found robust negative effects of customers' importing on suppliers' markups, TFP, and sales. Conversely, the results show the negative effects on suppliers' wage, employment, and labor productivity, but they are not statistically significant. These results imply that pro-competitive pressures toward domestic suppliers lead to a decrease in markups and TFP. The decline in TFP is partly due to the decrease in sales.

Table 7. Estimated ATT (at least one customer among the total number of customers becomes an importer from Asian countries)

		Observed	Std. Err.		No. of chage from non-importer to importer
ln(Markup)					
	t	-0.014	0.009		994
	t+1	-0.033	0.010	***	894
	t+2	-0.036	0.015	**	727
ln(TFP)					
	t	-0.011	0.004	***	1124
	t+1	-0.021	0.006	***	997
	t+2	-0.026	0.007	***	819
ln(Wage)					
	t	0.000	0.007		1812
	t+1	0.008	0.008		1619
	t+2	0.001	0.010		1400
ln(employment)					
	t	0.000	0.003		1813
	t+1	-0.003	0.004		1620
	t+2	-0.008	0.007		1401
ln(Labor Productivity)					
	t	-0.019	0.011	*	1785
	t+1	-0.016	0.012		1599
	t+2	-0.027	0.019		1375
ln(Sales)					
	t	-0.011	0.005	*	1813
	t+1	-0.018	0.007	**	1620
	t+2	-0.031	0.009	***	1401

6. Conclusions and Policy Implication

Changes in production networks due to enhanced globalization can lead to changes in industry-level or economy-wide productivity, but no previous literature has attempted to examine this effect of globalization through changes in the network structure. A section of the previous literature finds the importing activity of customer firms contributes to firms' own productivity improvement. We examine the indirect effects of importing through the buyer–

supplier network by estimating the effects of customers' import status on their suppliers' markups, productivity, wage, employment, labor productivity, and sales. Our results, which are based on a combination of difference-in-differences estimation and propensity score matching suggest that the impact of customers starting to import on their suppliers' markups and productivity are negative, but there are no strong effects on wage, employment, labor productivity, and sales.

This paper provides an important policy implication. Our knowledge regarding the effect of globalization on the country's production networks and their productivity is still very limited even though promoting the country's globalization and productivity improvement has been an important policy issue in many countries. The results of our research suggest that an increase in the globalization of firms' activities have a negative impact on their supplier firms' markups and productivity.

Some supplier firms are small- and medium-sized firms, and they are located in remote areas. They may have difficulties in offshoring their production process and increasing overseas procurement or selling their products overseas because of several economic barriers, such as the lack of overseas information and financial constraints. The government should provide some support to small firms that are isolated from the global market in approaching the overseas market. Otherwise, they may suffer from the negative effects of globalization as indicated in this research. In order to help these firms enjoy the merits of globalization, the policy should be aimed at reducing the obstacles for their offshoring. For example, the government can provide those small firms with information on potential business partners in foreign countries and advice on recruiting employees, advertising, tax systems, and

administrative issues such as accounting systems, laws, and regulations.

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Appendix

Appendix Table 1. Predicting the change from non-importer to importer for customers

	Coef.	Std. Err.	z	P>|z|
Customer's TFP_lag * Custmer's number of empolyees_lag	-0.03	0.00	-20.36	0.00
Customer's markup_lag	0.05	0.03	1.70	0.09
_cons	-2.01	0.05	-38.22	0.00
Number of obs	78402			
Pseudo R2	0.04			

Appendix Table 2. Balancing Tests

		Mean			%reduct	t-test	
Variable	Sample	Treated	Control	%bias	|bias|	t	p>|t|
Customer's TFP_lag * Custmer's number of empolyees_lag							
	Unmatched	5.67	10.04	-63.30		-20.87	0.00
	Matched	5.67	5.67	-0.10	99.80	-0.02	0.98
Customer's markup_lag							
	Unmatched	1.66	1.66	-0.40		-0.14	0.89
	Matched	1.66	1.66	-1.30	-201.20	-0.29	0.77