ERIA Discussion Paper Series

Search-theoretic Approach to Securing New Suppliers: Impacts of Geographic Proximity for Importer and Non-importer*

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February 2010

Abstract: This paper empirically examines whether firms consider geographic proximity as they seek for a new supplier. While addressing the difference between importers and non-importers, we estimate the effects of geographic proximity on the dynamic process of procurement, using survey data gathered from manufacturing firms in Indonesia, Thailand, and Vietnam. We find that the firms procuring intermediate goods from nearby suppliers and locally owned firms are more likely to form new trade relationships with suppliers. The more sensitive they are about the geographic proximity of their suppliers, the more likely it is that locally dependent firms will seek out new sources of supply of raw materials. This relationship disappears for firms which import some of their inputs.

***Keywords*:** Search; Supplier; Agglomeration; Import; Long-term Relationship

***JEL Classification*:** D83, L25, R12

* The authors gratefully thank Kazunobu Hayakawa, Ken Imai, Fukunari Kimura, Hisaki Kono, Ikuo Kuroiwa, Kazuki Minato, Hitoshi Sato, Kazushi Takahashi, Masatsugu Tsuji, Kazunari Tsukada, and Tatsufumi Yamagata who gave us generous comments and encouragement to polish our paper at the early stage of writing. This paper is based on research conducted under the international project "Analyses of Industrial Agglomeration, Production Networks and FDI Promotion: Developing Practical Strategies for Industrial Clustering," sponsored by the Economic Research Institute for ASEAN and East Asia (ERIA) in 2007. This project could not have been carried out without cooperation from the Center for Strategic and International Studies (CSIS) of Indonesia, the Philippine Institute for Development Studies (PIDS), the Sirindhorn International Institute of Technology (SIIT) Thammasat University of Thailand, and the Institute for Industry Policy and Strategy (IPSI), Ministry of Industry and Trade of Vietnam.

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1. Introduction

This paper investigates the dynamic process of the formation of a customer-supplier relationship, through studying the impact of geographic proximity on firms. Economic geography has been known to play an important role in explaining the forward and backward production linkages between customer and supplier. However qualitatively important this may be, the effect of geography on establishing a customer - supplier relationship has not been fully examined. The dynamic process of the formation of a buyer-seller relationship may be affected by not only the search for the lowest price available, but also by the benefit of asset accumulation from a long-term relationship. Our empirical question here is to ask how important a role is played by geographic proximity in the search for a new supplier, in terms both of domestic and of international procurement. To answer this question we need to identify which types of customer-supplier relationship would benefit from agglomeration economies.

The most relevant literature is Kugler and Verhoogen (2009) which examines how plant productivities affect not only exporting (a la Melitz, 2003) but also importing intermediate inputs. The several findings of Kugler and Verhoogen (2009) suggest that importers are distinctively different from non-importers. The importer achieves higher real gross output, higher real annual earnings per worker, higher Total Factor Productivity (TFP) than the non-importer. These results suggest that importers are exceptional performers. The importer also utilizes many types of intermediate goods in production compared to the non-importer. Importers pay higher prices for imported intermediate goods than they pay for domestic inputs in the same product categories. This paper clearly shows the importance of empirical work on importer status as a way

of understanding procurement. Despite Kugler and Verhoogen (2009) and a number of recent papers on imported inputs and productivity, finding new facts on domestic and international procurement, there is a lack of understanding of the role of geographic proximity for domestic and international procurement.

The purpose of this paper is to examine the impacts of geographic proximity on the dynamic process of searching for a new supplier. This paper proposes a new mechanism linking geographic proximity and trade relationships in developing economies. It investigates the testable implications using survey data gathered from manufacturing firms in Indonesia, Thailand, and Vietnam. We collected firm-level evidence on securing new suppliers, the importance of geographic proximity for a supplier of intermediate goods and raw materials, and the respondent-firms' own characteristics using mail surveys and field interviews. The reason for our particular focus being East Asia is that East Asia is a major production site for not only local firms but also multinationals. The most striking difference between East Asian and other developing countries is in the volume of intra-industry trade. Exact information on the dynamic process of the formulation of customer - supplier relationships in East Asia brings a new way of understanding the agglomeration benefit among production networks.

This work concentrates on detecting the impact of geographic proximity on procurement, distinguishing between non-importer and importer. There have been few empirical research papers that precisely capture the dynamic process of the creation of customer - supplier relationships with a focus on economic geography. There is also a lack of quantitative evidence. Since we need to quantify the attributes of the geographic component in the operation of securing new suppliers, we collect detailed

information about production linkages and new supplier search. Field survey-based datasets provide new findings lacking in previous studies. Moreover, most of the previous studies on the effects of geographic proximity on the decision between arm's-length transactions or integration (i.e. intra-firm transaction) have been static.

The main empirical result of this paper is quite intuitive. The firms which procure intermediate goods from nearby suppliers and locally owned firms tend to have a higher propensity to secure new suppliers. The more sensitive they are about their geographic proximity to their suppliers, the more locally dependent they are, and the simpler their production processes, the higher the likelihood that firms will seek new sources of supply of raw materials. Thus local firms more than multinational enterprises or firms which mainly buy intermediate goods from foreign countries, tend to benefit from agglomeration. This result is robust for the comparison between local firms that often procure intermediate goods from domestic areas, with joint-venture firms or multinational enterprises which often achieve international procurement.

The next section briefly summarizes the related literature. Section 3 provides a theoretical framework for searching for a new supplier, to describe the dynamic process. Section 4 describes the data which we originally collected for this study. The results are presented in Section 5. Section 6 concludes the paper.

2. Related Literature

Kugler and Verhoogen (2009) finds that importers are exceptional performers in terms of the level of output, wages, productivity, the varieties of intermediate goods,

and procurement prices, using a dataset derived from a census of Columbian manufacturing, at the plant level. These distinctive features also mirror exporters' performance. Behind these findings, Kugler and Verhoogen (2008) constructs a modified model of Melitz (2003) to show the distinctive features of importers. Kugler and Verhoogen (2008) emphasize the role of productivity differences for entering the import market for high quality intermediate goods, so as to generate exports of high quality products. The relationship between imported inputs and productivity is empirically examined by several recent papers. The impact of productivity on importing is shown by Kasahara and Lapham (2007), and Kugler and Verhoogen (2008, 2009). The rise of productivity due to importing is also examined by Amiti and Konings (2007), Kasahara and Rodorigue (2008), and Halpern *et al*.(2009). These literatures show the dynamic implications of importing in the sense of self-selection effects and learning effects. Despite the fact that previous literature suggests the importance of the dynamic implications of importing, there is a lack of detailed analysis. That is, the dynamic process of procurement and its geographic features have not been fully studied.

The aim of this brief literature review is to show the importance of examining the distinctive features of importers and non-importers in terms of procurement: (1) the decision to seek either a lowest price or a long-term relationship based asset accumulation; (2) the impacts of geographic proximity to the supplier on these decisions.

First, the contract theory of international trade provides a way to understand the dynamic process of procurement, for importers and non-importers. Antràs (2003) models the question of why capital-intensive goods are transacted within the boundaries

of MNCs, while labor-intensive goods are traded on the basis of arm's length market relationships. Furthermore, Antràs (2005) develops a theory to explin why the environment of incomplete contracts limits the international division of the production process. Nunn (2007) examines how a country's contracting environments would affect relation-specific investments and exports. Levchenko (2007) also aims to connect importing behavior with institutional differences, i.e. the quality of contract enforcement and property rights. The empirical result also provides evidence that institutional differences across exporting countries are an important source of trade flows. Most recently, Costinot (2009a, b) construct the simple framework that endogenous productivity differences could explain international specialization across countries. Task complexity and increasing returns to scale would create gains from specialization, while uncertainty in contractual enforcement creates transaction costs.

Secondly, related literature also provides a way to understand the impacts of geographic proximity on the dynamic process of procurement. Fujita and Thisse (1996, 2002) and Rosenthal and Strange (2004) propose several models of the Marshallian "thick market" effect. Market thickness enables local customers (or suppliers) to meet with local suppliers (or customers) without high transportation costs. Following the theoretical foundation of Marshallian externalities, input-output linkages between customers and suppliers play an important role in agglomeration economies. On the empirical side, Ellison *et al.* (2009) quantifies each contribution of the source of agglomeration economies: natural advantages, input-output linkages, labor pooling, and idea exchanges. They find a significant contribution of input-output linkages to co-agglomeration patterns, instead of the natural advantage which played a dominant role in Ellison and Glaeser (1999). Through input-output linkages, producers in denser

areas can benefit from agglomeration economies. The dynamic process of matching between customers and suppliers has not been fully investigated in empirical literature on economies of agglomeration. We will also consider how customers seek new suppliers and start new trade relationships with suppliers to avoid high transport costs, and we verify who receives benefit from agglomeration economies.

In addition to the benefits of agglomeration economies, in a model consisting of heterogeneous firms with transport costs more productive firms will export more than less productive firms, and will be more successful in importing intermediate parts. Productive firms are insensitive to transport costs while less productive firms are very sensitive to import and export transport costs, and to market penetration costs. This explanation is related to the competition-driven selection model of Syverson (2004). His explanation of the competition-driven selection process of agglomeration successfully predicts that denser markets here often mean markets with greater substitutability. It is relatively easier for inefficient producers in denser areas to lose their market share and exit the market than producers in less dense areas. The specific mechanism is the spatial substitutability in a single product market, i.e., relatively inefficient producers find it more difficult to operate profitably when it is easier for consumers to change suppliers within a local area. Consequently, the average productivity of firms in denser markets is always higher.

Finally, in the setting of East Asia, we have more concrete and detailed results. Ando and Kimura (2005), Kimura (2006, 2008, and 2009) clearly explain the simultaneous determination of geographic proximity and choice of transaction types. Fragmentation theory assumes that a more complex production schedule calls for intra-firm trade between two productions sites rather than arm's-length and spot market

transactions. Even though the complexity of a production process determines spatial architecture in each region, it is natural that the dynamics aspects of the decision between arm's-length or integrated transactions would vary according to firms' attributes: for example, intermediate goods importer or not, local or multinational firms.

In summary, previous literature concentrates on studying the relationship between imported inputs and productivity, without consideration of the geographic features of procurement. Previous literature also concentrates on static transaction choices and their patterns in space, without the dynamic implication of procurement. To understand the distinction between importers and non-importers, the next section of this paper shows the relationship between dynamic process procurement and geographic proximity to supplier.

3. Theoretical Framework

3.1. Example

We present a hypothesis to explain the dynamic process of formulation of new customer - supplier relationships based on a simple search-theoretic model of securing new suppliers. Before doing this, we would like to present an intuitive view. Consider two different assemblers in terms of quality of input parts utilization, that is, one assembler procures high quality intermediate parts while the other assembler utilizes low quality parts. We assume that utilization of high quality parts calls for frequent communications, or for a long-term relationship between customer and supplier. If this is true, the assembler which utilizes high quality intermediate parts needs to have

more communication with its supplier, or to form a longer-term trade relationship with the supplier. Long-term linkages with partners help reduce transaction costs. But this reduces the propensity of the firm to go through the costly process of finding new suppliers, if it is hypothesized that such long-term relationships are dependent on relation-specific production processes, or the use of sophisticated intermediate goods and materials to produce complex goods. This framework also supports the hypothesis that, if imported parts were more sophisticated than those available in developing economies such as Indonesia, Thailand and Vietnam, assemblers in these countries that procure intermediate parts from foreign countries will tend to have long-term relationships with foreign suppliers in economies such as Japan, Korea, or Hong Kong. Even if a new local supplier appears nearby, it is not easy for them to change the existing supply route to a new one. On the other hand, if a new local supplier appears nearby assemblers that procure parts from domestic suppliers, it is easy for them to change the existing supply route to a new one. The implication of this example is related to the finding of Asanuma (1989).

3.2. Conceptual Framework

The central proposition of this paper is that a purchaser that rates geographic proximity to their supplier highly will have an increased propensity to secure new suppliers. That is, increases in the perceived importance of geographic proximity will lead to additional suppliers being added to the waiting list of incumbent suppliers, or new suppliers will replace customer-supplier relationships which had been previously constructed. We show that this is especially true in the case of local firms, and firms that procure intermediate goods from domestic areas, while it is not true in the case of

non-local firms and firms which operate international procurement.

Consider a firm that procures a single unit of intermediate goods from domestic or foreign areas. Firms differ in terms of productivity. The productivity of any firm will affects the importance it attaches to the geographic proximity of its suppliers. That is, less productive firms prefer suppliers to be geographically close because of concerns about transport costs. In short, this framework suggests the following two implications: (1) the marginal benefit of additional searching for a low price (or low transport cost) supplier is higher for firms which ascribe higher importance to the geographic proximity to their (potential) supplier, than for firms which ascribe a lower importance to geographic proximity; (2) more productive firms have larger geographic reach of procurement than less productive firms.

If a firm decided to procure a single unit of intermediate goods from domestic areas, it would incur only transport costs. If, on the other hand a firm decided to procure internationally, it would have to pay both transport costs and the additional fixed costs of starting international procurement. As a result, the extent of its abilities in the procurement area will restrict not only the geographic boundaries within which domestic suppliers are chosen but also its degree of internationalization. If the firm were prepared to pay the fixed cost of starting international procurement, the marginal benefits of constructing long-term relationships with international suppliers would become higher than the marginal costs of additional searching for new suppliers. In addition to the above two results, we have final result (3): the impact of the perceived importance of geographic proximity on their propensity to seek new suppliers will disappear for firms with international procurement if the fixed cost of seeking a new partner abroad is high. That is, due to this fixed cost of searching abroad, firms that

procure intermediate inputs from foreign suppliers would not seek for a new supplier if they perceive that geographic proximity to their supplier is important. There is a difference between domestic and international procurement in the impact on searching for a new supplier of the perceived importance of geographic proximity. In summary, we can derive following testable hypothesis based on this framework.

Hypothesis: The impacts of the importance of geographic proximity on the propensity to seek new suppliers is larger for firms which procure intermediate inputs from domestic suppliers, than for firms which import intermediate inputs from foreign countries. This is also true for a comparison of local firms which mainly procure domestically, with joint-ventures or multinationals which operate international procurement.

This hypothesis is empirically tested in Section 4 utilizing the setting of domestic and international procurement in East Asia.

4. Data

4.1. Sampling

Our data relates to firm-level characteristics, and to supplier search behavior. We used the dataset from the Establishment Survey on Innovation and Production Networks for selected manufacturing firms in three countries in East Asia. We created this dataset in December 2007 in Indonesia, Thailand, and Vietnam. The sample population is restricted to selected manufacturing hubs in each country (Greater Jakarta area, Bandung and Surabaya for Indonesia, Greater Bangkok area for Thailand, and

Hanoi area for Vietnam). A total of over 300 firms agreed to participate in the survey, 153 firms from Thailand (41 percent of the sample), 119 firms from Indonesia (31 percent), and 101 firms from Vietnam (27 percent).

4.2. Firm Characteristics

Table 1 presents the summary statistics of the main variables. The sample industries consist of 48 percent manufacturing and 52 percent other supporting services. Of the total number surveyed, approximately 65 percent are local firms; 20 percent, joint-venture firms; and 15 percent, multinational enterprises. A firm is classified as either exporter or non-exporter here according to its main market. Twenty-four percent of the firms export their production goods while 76 percent of the firms sell their goods mainly to domestic customers. Thirty-two percent of the firms import intermediate goods (components, parts, and raw materials) from suppliers located in foreign countries while 68 percent of the firms procure intermediate inputs from domestic suppliers. The firms are 17 years old on average, with a standard deviation of 20 years. Firm size is also much dispersed. Average size is 370 employees, with a standard deviation of 548. Since our sampling strategy covers the whole of manufacturing and services in each country, some firms have more than 2,000 employees while there are also extremely small firms, with less than 20 employees.

Specifically, we collected information relating to the search for suppliers and geographic proximity, in order to study the dynamic process of the formation of customer-supplier relationships. Table 1 suggests that 49 percent of the firms have found a new source of supply of intermediate inputs. The importance of geographic proximity in the operation of the firm is graded into five categories from least important

(1) to most important (5). Average rating is 3.9 with a standard deviation of 1. Many firms rate geographic proximity as one of the key factors in making their business decisions. We also collected information on the importance of local synergies in the operation of the firms. This is defined as the importance of the fact that other companies from the same country are located nearby. The importance of local synergy is also classified into five categories from least important (1) to most important (5). Average rating is 3.1 with standard deviation of 1.1. On average, some firms consider local synergy as very important, while others respond that local synergy is not important for their operations.

Table 1. Summary Statistic

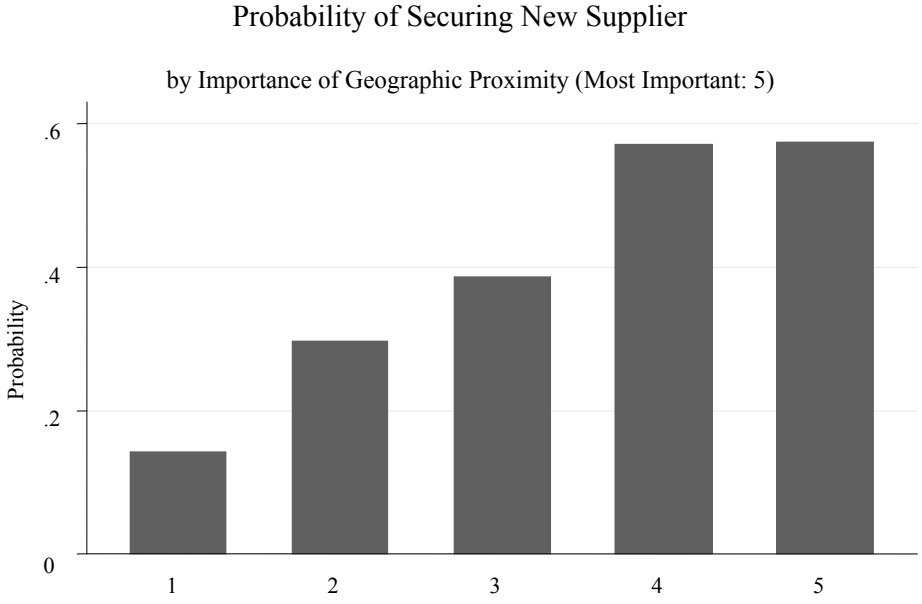
	No. Obs	Mean	Std. Dev.
Manufacturing	373	0.477	0.500
Multinationals	373	0.153	0.360
Joint-Venture firms	373	0.196	0.397
Local firms	373	0.651	0.477
Goods Exporters	373	0.241	0.428
Material Importers	373	0.316	0.466
Firm Age	373	16.751	20.056
Full-time Employees	372	370.43	548.085
Thailand firm dummy	373	0.41	0.493
Indonesia firm dummy	373	0.319	0.467
Vietnam firm dummy	373	0.271	0.445
Acquisition of a new source of supply of raw materials	362	0.492	0.501
Proximity (Min: 1, Max:5)	356	3.865	1.048
Synergy (Min: 1, Max: 5)	359	3.181	1.157

4.3. Preliminary Evidence

What are the mechanisms underlying the dynamic process of formation of a new customer-supplier relationship? First we discuss the distribution of the propensity to secure new suppliers by types of customer. The distribution of the probability of securing new suppliers according to the importance of geographic proximity is

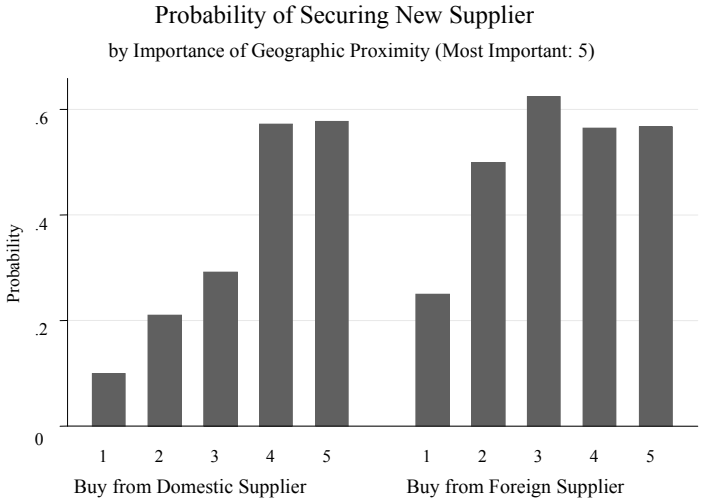
presented in Figure 1. This figure shows that the probability of securing a new supplier increases as the importance of geographic proximity increases. Figure 2 contrasts two different types of procurement: buying from domestic suppliers and buying from foreign suppliers, and shows different relationships between the probability of securing new suppliers and the importance of geographic proximity, between the two groups. The left hand half of Figure 2 shows that there is a regular relationship between searching for new suppliers and the importance of geographic proximity for customers buying intermediate inputs from domestic suppliers, while the right hand half of Figure 2 shows no such regular relationship. Figure 3 compares the same relationship between local and non-local firms (joint-venture firms and multinationals). The group of local firms shows the clear regular relationship.

Figure 1. Probability of Securing New Supplier by Importance of Geographic Proximity



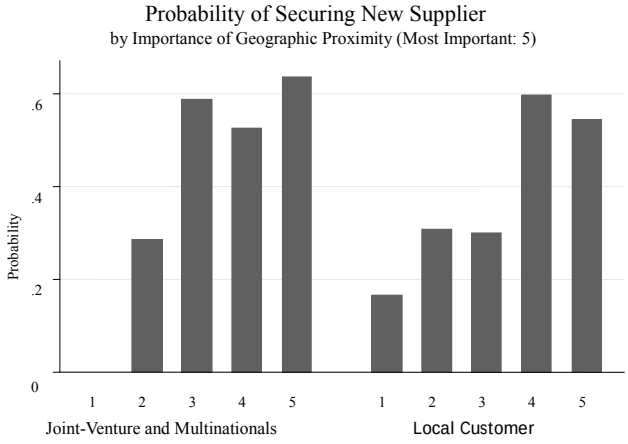
Source: ERIA Establishment Survey 2007.
Notes: Importance of geographic proximity is classified into five categories: Not important at all (1); Not very important (2); Not sure (3); Somewhat important (4); Very important (5).

Figure 2. Probability of Securing New Supplier by Importance of Geographic Proximity between Customer which Imports Intermediate Goods from Foreign Countries and Customer which Procures from Domestic Suppliers



Source: ERIA Establishment Survey 2007.
Notes: Importance of geographic proximity is classified into five categories: Not important at all (1); Not very important (2); Not sure (3); Somewhat important (4); Very important (5).

Figure 3. Probability of Securing New Supplier by Importance of Geographic Proximity between Local Customer and Non-Local Customer (Joint-Venture and Multinationals)



Source: ERIA Establishment Survey 2007.
Notes: Importance of geographic proximity is classified into five categories: Not important at all (1); Not very important (2); Not sure (3); Somewhat important (4); Very important (5).

4.4. Results

4.4.1. Baseline Estimates: The Effect of Geographic Proximity on Securing New Suppliers

The dependent variable is the binomial choice of finding a new supplier for each firm. The explanatory variable is the importance of geographic proximity for each firm. The firm's basic characteristics are used as controls. The dummy variable of whether each respondent seeks a new supplier is regressed on the variable which signifies the importance of the firms geographic proximity to its suppliers.

Table 2 shows the marginal effect of Probit estimates: the effect of geographic proximity on the probability of acquiring a new source of supply of raw materials and intermediate goods. The coefficient for geographic proximity is .110 with a robust standard error of .026 in column 1 of Table 2. This result suggests that a firm that ascribes importance to geographic proximity in production and other operations, on average, searches and succeeds in securing new suppliers with a higher probability than firms which do not consider geographic proximity to be important. This probability is higher by about 11 percentage points. This result is robust even after controlling for additional explanatory variables. Column 2 of Table 2 shows the effect of geographic proximity, with the additional of synergy as control variable. The coefficient for geographic proximity is .115 with a standard error of .027. This result suggests that if firms ascribe importance to synergy in production operations, then those firms that already have production linkages with suppliers will not pay for the cost of seeking a new supplier. Even after controlling this synergy effect, the effect of geographic proximity is still 11.5 percentage points larger compared with firms which do not

ascribe importance to geographic proximity. The empirical results still hold if we control for other important variables. Columns 3 to 9 show the effect of geographic proximity after controlling for other firm and country characteristics. In summary, firms which treat geographic proximity as an important operational consideration would be more likely to secure new suppliers than firms which do not recognize geographic proximity as an important condition.

Table 2. The Effect of Proximity on Acquisition of a New Source of Supply of Raw Material

Probit (Marginal Effects)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variables: Acquisition of a new source of supply of raw materials last 3 years =1, otherwise 0									
Proximity	0.11	0.115	0.105	0.106	0.106	0.106	0.106	0.104	0.106
	[0.026]	[0.027]	[0.028]	[0.028]	[0.028]	[0.028]	[0.028]	[0.028]	[0.028]
Synergy		-0.033	-0.025	-0.022	-0.022	-0.021	-0.021	-0.019	-0.014
		[0.024]	[0.025]	[0.025]	[0.025]	[0.025]	[0.025]	[0.025]	[0.026]
Manufacturing			0.248	0.243	0.243	0.241	0.242	0.24	0.236
			[0.053]	[0.054]	[0.054]	[0.055]	[0.055]	[0.055]	[0.056]
Multinationals				0.106	0.105	0.102	0.102	0.088	0.043
				[0.078]	[0.078]	[0.079]	[0.079]	[0.082]	[0.083]
Goods Exporter					0.004	0.001	0.001	0.001	-0.004
					[0.068]	[0.068]	[0.068]	[0.068]	[0.068]
Material Importer						0.016	0.016	0.017	-0.018
						[0.063]	[0.063]	[0.063]	[0.064]
Firm Age							0	-0.001	0
							[0.001]	[0.001]	[0.001]
Full-time Employees								0	0
								[0.000]	[0.000]
Thailand firm dummy									0.007
									[0.072]
Indonesia firm dummy									-0.206
									[0.077]
Observation	348	344	344	344	344	344	344	343	343

Notes: Robust standard errors in brackets. "Proximity" variable means importance of geographic proximity to suppliers/subcontractors. "Synergy" variable means importance that other companies from the same country are located.

4.4.2. Testing Heterogeneity: Domestic Procurement vs. Importing Firms

We turn to heterogeneity in the effect of geographic proximity across firm characteristics. Our goal in this estimation is to compare estimates for firms that procure intermediate inputs from domestic suppliers with those that procure from foreign suppliers. In this subsection, we verify the impacts of quality differences in intermediate goods, to compare firms procuring intermediate goods and materials in the domestic economy with firms importing them from foreign countries. If foreign firms could supply high quality, and relationship-specific, intermediate goods than domestic firms in East Asia, their customer firm importing intermediate goods and materials from the foreign suppliers would keep their existing transactional relationships. Keeping long-term relationships with existing suppliers is efficient for accumulating relationship-specific assets between customer and supplier. This type of goods differentiation needs long-term investment in consolidating customer-supplier relationships. These relationship-specific assets could create competitiveness and differentiation. We expect that customers importing intermediate goods would keep long-term relationships, and that they would not seek new suppliers. We also expect that customers procuring intermediate goods from domestic suppliers would face more a competitive environment. Then they would seek new suppliers offering lower prices.

Table 3 examines this idea, showing the marginal effects of Probit estimates for firms procuring intermediate goods from domestic suppliers. The effect of geographic proximity on the acquisition of a new source of supply of raw materials and intermediate goods is significantly positive. The coefficient for geographic proximity is .148 with a standard error of .034, in column 1 of Table 3. This result suggests that if firms procuring intermediate goods and materials from domestic suppliers ascribe

importance to geographic proximity in their production operations, then the probability that they will search for and succeed in securing a new supplier is about 14.8 percentage points higher than for firms which maintain relationships with domestic suppliers but do not ascribe importance to geographic proximity. This result is robust against additional explanatory variables relating to supplier search. Column 2 of Table 3 shows the effect of geographic proximity in addition to synergy as a control variable. The coefficient for geographic proximity is .145 with a standard error of .034. Columns 3 to 9 present the geographic proximity effects on securing new suppliers, after controlling for additional firm characteristics.

However, the case of firms importing inputs is quite different. Table 4 presents the effect of geographic proximity on securing new suppliers for firms having customer-supplier relationships with foreign suppliers. No column shows any significant impact of geographic proximity for firms importing intermediate goods. Column 8 of Table 4 shows that the coefficient of geographic proximity in securing new suppliers is .047 with a standard error of .053, when controlling for firm characteristics and country differences. This result means that geographic proximity has an insignificant effect on firms importing intermediate goods.

Table 3. The Effect of Proximity on Acquisition of a New Source of Supply of Raw Materials (Source: Domestic)

Probit (Marginal Effects)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables: Acquistion of a new source of supply of raw materials last 3 years =1, otherwise 0								
Proximity	0.148	0.145	0.134	0.134	0.135	0.134	0.132	0.133
	[0.034]	[0.034]	[0.034]	[0.035]	[0.035]	[0.035]	[0.036]	[0.036]
Synergy		0.002	-0.002	0.003	0.004	0.004	0.006	0.008
		[0.030]	[0.030]	[0.031]	[0.031]	[0.031]	[0.032]	[0.032]
Manufacturing			0.259	0.255	0.254	0.256	0.264	0.251
			[0.066]	[0.067]	[0.067]	[0.067]	[0.067]	[0.068]
Multinationals				0.201	0.187	0.191	0.177	0.137
				[0.109]	[0.111]	[0.111]	[0.116]	[0.120]
Goods Exporter					0.087	0.085	0.084	0.075
					[0.089]	[0.089]	[0.089]	[0.092]
Firm Age						-0.001	-0.001	-0.001
						[0.002]	[0.002]	[0.002]
Full-time Employees							0	0
							[0.000]	[0.000]
Thailand firm dummy								0.032
								[0.099]
Indonesia firm dummy								-0.092
								[0.100]
Observation	237	233	233	233	233	233	232	232

Notes: Robust standard errors in brackets. "Proximity" variable means importance of geographic proximity to suppliers/subcontractors. "Synergy" variable means importance that other companies from the same country are located

Table 4. The Effect of Proximity on Acquisition of a New Source of Supply of Raw Materials (Source: Domestic)

Probit (Marginal Effects)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables: Acquistion of a new source of supply of raw materials last 3 years =1, otherwise 0								
Proximity	0.032	0.063	0.056	0.056	0.057	0.056	0.052	0.047
	[0.045]	[0.049]	[0.049]	[0.049]	[0.049]	[0.049]	[0.049]	[0.053]
Synergy		-0.095	-0.073	-0.073	-0.07	-0.071	-0.074	-0.075
		[0.044]	[0.046]	[0.046]	[0.046]	[0.046]	[0.046]	[0.049]
Manufacturing			0.164	0.164	0.187	0.182	0.138	0.15
			[0.101]	[0.101]	[0.105]	[0.105]	[0.113]	[0.113]
Multinationals				0.002	0.013	0.012	-0.011	-0.079
				[0.111]	[0.112]	[0.112]	[0.116]	[0.121]
Goods Exporter					-0.084	-0.085	-0.072	-0.013
					[0.108]	[0.108]	[0.108]	[0.116]
Firm Age						0.001	0	0.003
						[0.002]	[0.002]	[0.003]
Full-time Employees							0	0
							[0.000]	[0.000]
Thailand firm dummy								-0.071
								[0.127]
Indonesia firm dummy								-0.539
								[0.092]
Observation	111	111	111	111	111	111	111	111

Notes: Robust standard errors in brackets. "Proximity" variable means importance of geographic proximity to suppliers/subcontractors. "Synergy" variable means importance that other companies from the same country are located.

4.4.3. Robustness Check: Local vs. Foreign-owned Firms

We move to heterogeneity in the effect of geographic proximity on the propensity to secure new suppliers across firms with different technological capabilities. Now we examine the impacts of technology differences across firms to compare the local firms with joint-venture companies and multinationals. If locals are not superior in terms of production efficiency, they have to charge higher prices in order to recoup higher production costs than foreign owned firms. It is not cost-effective for such local firms to invest in long-term relationships with suppliers, especially with foreign suppliers incurring higher transportation costs. If local firms in our sample from Indonesia,

Thailand, and Vietnam, on average, have less advanced production technologies than joint-venture firms or multinationals located in these countries, then such local firms must to seek for lowest prices for intermediate goods instead of charging costs of creating new relationship with supplier. In addition to our main results, the differential impacts of geographic proximity on securing new suppliers between local firms and foreign-owned firms are worth examination. We expect that the relationship between the probability of securing new suppliers and the importance of geographic proximity is higher for local firms than for foreign-owned firms. Table 5 shows that the effect of geographic proximity on securing new suppliers is positive and significant for local firms. Column 1 of Table 5 shows that the coefficient for geographic proximity is .111 with a standard error of .033. The results in columns 2 to 8 of Table 5 show that the coefficient for geographic proximity is positively significant for securing new suppliers. These results hold if we control using a synergy variable, which indicates the importance of co-location of other companies, from the same country, nearby. After controlling for firm characteristics and country differences, Column 8 of Table 5 shows that the coefficient for geographic proximity is .119 with a standard error of .034. This result suggests that, if local firms ascribe importance to geographic proximity in their production operations, then the probability that the firms will search for and secure new suppliers is about 11.9 percentage points higher than firms which do not ascribe importance to geographic proximity. If firms did ascribe importance to geographic proximity, such firms, especially local firms, would seek for new suppliers. In stationary equilibrium, this result is interpreted as meaning that local firms secure new suppliers again and again, seeking for lowest prices for their intermediate goods.

Table 5. The Effect of Proximity on Acquisition of a New Source of Supply of Raw Materials (Local firms)

Probit (Marginal Effects)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables: Acquisition of a new source of supply of raw materials last 3 years =1, otherwise 0								
Proximity	0.111	0.12	0.12	0.12	0.116	0.116	0.116	0.119
	[0.033]	[0.034]	[0.033]	[0.033]	[0.034]	[0.034]	[0.034]	[0.034]
Synergy		-0.043	-0.039	-0.04	-0.033	-0.033	-0.034	-0.028
		[0.031]	[0.030]	[0.030]	[0.031]	[0.031]	[0.031]	[0.032]
Manufacturing			0.252	0.251	0.243	0.244	0.255	0.25
			[0.067]	[0.067]	[0.068]	[0.068]	[0.070]	[0.070]
Goods Exporter				0.011	0.006	0.005	0.008	-0.011
				[0.090]	[0.091]	[0.091]	[0.092]	[0.094]
Material Importer					0.143	0.143	0.148	0.114
					[0.083]	[0.083]	[0.083]	[0.083]
Firm Age						0	0	0.001
						[0.002]	[0.002]	[0.002]
Full-time Employees							0	0
							[0.000]	[0.000]
Thailand firm dummy								-0.05
								[0.091]
Indonesia firm dummy								-0.123
								[0.096]
Observation	225	221	221	221	221	221	220	220

Notes: Robust standard errors in brackets. "Proximity" variable means importance of geographic proximity to suppliers/subcontractors. "Synergy" variable means importance that other companies from the same country are located

This is not true for joint-venture firms or multinationals. Column 1 of Table 6 shows that the coefficient for geographic proximity for joint-ventures is .134 with a standard error of .058. The impact of geographic proximity for joint-ventures is also positively significant. But this result for joint-ventures does not hold if we control for firm and country characteristics. After controlling for firm characteristics and country differences, column 8 of Table 5 shows that the coefficient for geographic proximity is .065 with a standard error of .066. The significance of the coefficients for multinationals is opposite to those for local firms. The coefficients for geographic proximity in columns 1 to 7 of Table 7 are not significant. The magnitude of the

coefficient for geographic proximity in column 8 of Table 6 is sharply reduced after controlling for country characteristics.

Table 6. The Effect of Proximity on Acquisition of a New Source of Supply of Raw Materials (Joint Venture)

Probit (Marginal Effects)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables: Acquisition of a new source of supply of raw materials last 3 years =1, otherwise 0								
Proximity	0.134	0.131	0.109	0.113	0.135	0.115	0.11	0.065
	[0.058]	[0.058]	[0.062]	[0.063]	[0.065]	[0.065]	[0.068]	[0.066]
Synergy		0.023	0.045	0.044	0.038	0.035	0.068	0.075
		[0.057]	[0.061]	[0.061]	[0.061]	[0.062]	[0.064]	[0.067]
Manufacturing			0.3	0.301	0.324	0.42	0.485	0.445
			[0.121]	[0.122]	[0.123]	[0.125]	[0.132]	[0.136]
Goods Exporter				0.076	0.183	0.184	0.2	0.219
				[0.146]	[0.163]	[0.168]	[0.179]	[0.174]
Material Importer					-0.225	-0.23	-0.213	-0.117
					[0.146]	[0.145]	[0.149]	[0.159]
Firm Age						-0.014	-0.018	-0.013
						[0.006]	[0.007]	[0.007]
Full-time Employees							0	0
							[0.000]	[0.000]
Thailand firm dummy								0.256
								[0.214]
Indonesia firm dummy								-0.168
								[0.241]
Observation	69	69	69	69	69	69	69	69

Notes: Robust standard errors in brackets. "Proximity" variable means importance of geographic proximity to suppliers/subcontractors. ”Synergy" variable means importance that other companies from the same country are located

Table 7. The Effect of Proximity on Acquisition of a New Source of Supply of Raw Materials

Probit (Marginal Effects)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables: Acquisition of a new source of supply of raw materials last 3 years =1, otherwise 0								
Proximity	0.077	0.079	0.052	0.056	0.046	0.045	0.009	-0.01
	[0.074]	[0.074]	[0.080]	[0.080]	[0.080]	[0.082]	[0.083]	[0.087]
Synergy		-0.036	-0.024	-0.027	-0.023	-0.024	0.017	-0.025
		[0.065]	[0.066]	[0.065]	[0.066]	[0.067]	[0.067]	[0.079]
Manufacturing			0.189	0.199	0.221	0.249	0.252	0.297
			[0.141]	[0.146]	[0.146]	[0.149]	[0.157]	[0.166]
Goods Exporter				-0.043	-0.029	-0.039	-0.056	0.05
				[0.143]	[0.141]	[0.145]	[0.150]	[0.143]
Material Importer					-0.124	-0.122	-0.117	-0.055
					[0.137]	[0.137]	[0.137]	[0.141]
Firm Age						0.003	0.002	0.001
						[0.002]	[0.002]	[0.002]
Full-time Employees							0	0
							[0.000]	[0.000]
Thailand firm dummy								0.175
								[0.193]
Observation	69	69	69	69	69	69	69	69

Notes: Robust standard errors in brackets. "Proximity" variable means importance of geographic proximity to suppliers/subcontractors. "Synergy" variable means importance that other companies from the same country are located

5. Conclusion

Geographic proximity affects firm-level operational efficiency through input-output linkages, transportation costs and technology transfer. Firms utilizing low-quality intermediate inputs could save transport costs if they procure inputs from nearby domestic suppliers. These firms are sensitive to transport costs and geographic proximity to suppliers. On the other hand, firms utilizing high-quality intermediate inputs tend to incur high transport costs when they import their inputs. This import activity is cost-effective if the customers for imported inputs produce high-quality or

highly differentiated goods and services through long-term relationships with foreign suppliers. As well as imported intermediate goods, more productive firms, such as multinationals or joint-venture firms, tend to be less sensitive to transport costs than less productive firms such as local enterprises. Less productive firms have to charge higher prices if they procure intermediate inputs from suppliers located far away. As a result, such less productive customers switch supplier if a new supplier appears near their sites. This suggests that the importance of geographic proximity positively affects the decision to secure a new supplier, especially for less productive firms. These findings are basically consistent with the search-theoretic model of agglomeration.

The policy implication of this result is related to small and medium sized enterprise development through accumulating collective reputation. Empirical results suggest that local firms and firms procuring domestic inputs would realize greater benefit from agglomeration economies in terms of seeking new suppliers. This implication is plausible for almost all small and medium enterprises (SMEs hereafter) in East Asia. As shown in Tirole (1996) and Banerjee and Duflo (2000, 2005) in the context of Indian software clusters, a town's reputation is formed by the nexus of customer-supplier linkages between local enterprises or between locals and foreign-owned firms. If local suppliers have a good reputation for quality and timeliness, local and global buyers will flock to the town. This is the key point of industry upgrading and diversification for local SMEs in developing economies. A good group reputation enables local SMEs to engage with global buyers.

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