Level Uneven Terrain: Integration Strategies in East Asia

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Abstract

This paper investigates how international production networks in machinery industry have expanded in East Asia. Referring to the fragmentation theory, we first characterize intra-network trade in the form of three propositions and empirically examine which countries in East Asia participate in production networks with using gravity equations. Last, policy implication for further expanding the networks to latecomers in East Asia is discussed.

Keywords: fragmentation; agglomeration; foreign direct investment; regional integration; gravity equation
JEL Classification: F15; R12; N75

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1. Introduction

In contrast with European Union (EU), East Asia includes countries with quite different historical, cultural, and political background and at different development stages. However, in East Asia, *de facto* economic integration has dramatically advanced with forming international production/distribution networks, particularly in machinery sector, since the 1990s. In fact, the economic integration in this region has effectively taken advantage of different location advantages and diversified development stage, rather than following the text-book model of Europe as an "integrated economy." The economic integration in East Asia expands and deepens in terms of covering a large number of countries and of sophistication in the combination of intra-firm and arm's length (inter-firm) transactions (Ando and Kimura, 2005).

This paper empirically investigates how economic integration has expanded in East Asia. The number of countries participating in East Asian networks gradually increases over time. In particular, compared with Malaysia and Thailand, Indonesia and CLMV (Cambodia, Laos, Myanmar, and Vietnam) have relatively been behind in incorporating themselves in the networks. It seems extremely important for economic development to participate in international production/distribution networks. In particular, we examine inter- and intra-regional trade in intermediate goods in East Asia.

The rest of this paper is organized as follows. Section 2 characterizes some features in intra-network trade. We present three propositions drawn

from the fragmentation theory, which are utilized in determining how far each country in East Asia has been incorporated in production networks. Section 3 provides empirical methodology to examine whether the claim of three propositions holds in each East Asian country. We here employ extended gravity equation approach. Section 4 presents data sources and provides preliminary observation on machinery intermediate goods trade in East Asia. Section 5 reports regression results based on the gravity equation approach and discusses the major findings. In Section 6, policy implication for further expanding the international networks is discussed, and Section 7 concludes the paper.

2. Fragmentation Theory and Three Propositions

This section characterizes some of peculiar features of intra-network trade in the development of international production/distribution networks. The trade and investment pattern of East Asia after the 1990s obviously requires a new analytical framework. The traditional international trade theories based on industry-wise comparative advantage do not seem to capture the essence of international production/distribution networks in East Asia. The horizontal product differentiation model and the agglomeration theory, both of which have primarily been developed in the context of core EU, cannot directly be applied to East Asia, either. The starting point to investigate the mechanics of international production/distribution networks must be the fragmentation theory.[1]

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[1] See Ando (2006) and Kimura (2006).

The fragmentation theory was first proposed by Jones and Kierzkowski (1990) and has been developed in both theoretical and empirical literature.[2] Fragmentation of production processes takes place when (i) production cost *per se* in fragmented production blocks can be substantially reduced and (ii) service link cost for connecting remotely located production blocks is not prohibitively high. If a reduction in production cost by fragmentation overweighs service link cost incurred thereby, the firm breaks apart some of its production blocks to other remote locations, so as to attain a total cost reduction.

The mechanics of international fragmentation reveals that intra-network trade has the following features. First, intra-network trade in intermediate goods or parts and components drastically increases. Once fragmentation starts, countries come to be engaged in production-process-wise vertical division of labor with making use of differences in location advantages. The departure from integrated production in one country provides other countries an opportunity to produce and export intermediate goods produced by specific fragmented production blocks. As production process is split apart across several countries, international transactions among the processes dramatically increase. Consequently, as is called "magnification effect" (Yi, 2003), intra-network trade explosively increases due to possible double or triple counting of trade in intermediate goods. To summarize the above discussion, we have

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[2] As for the theoretical analysis, see Arndt and Kierzkowski (2001), Cheng and Kierzkowski (2001). As for the empirical investigation on fragmentation in East Asia, look at "18 Facts" by Kimura (2006).

Proposition 1. *In intra-network trade, international transactions of intermediate goods become more active than in other types of trade.*

Second, geographical distance to a lesser degree penalizes international transactions in the networks. Service link cost for overcoming geographical distance takes various forms such as tariffs and other trade impediments, transport cost, telecommunication cost, and various kinds of coordination cost among production blocks. In general, geographical distance between trading partners hinders any type of trade flows through raising service link cost. However, once a reduction in production cost by fragmentation overweighs service link cost incurred thereby, the countries actively get engaged in international trade in intermediate goods even if production blocks are in great distance between them. Hence, we have

Proposition 2. *Geographical distance penalizes international trade in intermediate goods in intra-network trade to a lesser extent than in other types of trade.*

Third, intra-network transactions are designed so as to effectively utilize different production conditions across countries. A new location for a production block must have some location advantages that cannot be obtained at the original position; such location advantages could be low wages, inexpensive infrastructure services, existence of supporting

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industries and industrial agglomeration, favorable policy environment, or others. Remarkable reduction in production cost *per se* in fragmented production blocks, despite a rise in service link cost, makes the break of production blocks profitable and thus makes fragmentation possible. Therefore, we have

Proposition 3. *Intra-network trade takes advantage of differences in location advantages more intensively than other types of trade.*

3. Empirical Methodology

Our empirical analysis concentrates on machinery sectors including general machinery, electric machinery, transport equipment, and precision machinery, since machinery sectors have played the most important role in production/distribution networks in East Asia. In particular, we focus on transactions of machinery parts and components accompanied with the fragmentation of vertical production processes. Our sample is restricted on international transactions of each East Asian country with all the countries of the world in order to focus on differences in the features above between inter- and intra-regional trade. Our approach to empirically investigate the development process of fragmentation in East Asia is the following.

It is well known that a gravity equation is one of the most successful tools to quantitatively analyze bilateral trade and can be supported by various kinds of theoretical models. By regressing gravity equations augmented so as to examine three features in the previous section, we try to

identify countries that participate in production networks in East Asia.

A baseline equation is given by

$$\ln Parts_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln dist_{ij} + \varepsilon_{ij} \quad ,$$

where $Parts_{ij}$, GDP_i, GDP_j, and $dist_{ij}$ denote trade values in intermediate goods from country i to country j, importer i's and exporter j's GDP, and the distance between countries i and j, respectively. We introduce various kinds of dummy variables into this equation and examine changes in the coefficients for them.

First, in order to examine Proposition 1, we introduce an intercept dummy variable of each country D_k, which is a binary variable taking unity if a trading partner of East Asian country k is also the other East Asian country and zero otherwise. That is, the baseline equation is extended to

$$\ln Parts_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln dist_{ij} + \beta_4 D_{Japan} + \beta_5 D_{Korea}$$

$$+ \beta_6 D_{China} + \beta_7 D_{Singapore} + \beta_8 D_{Hong\_Kong} + \beta_9 D_{Philippines} + \beta_{10} D_{Thailand} + \beta_{11} D_{Malaysia}$$

$$+ \beta_{12} D_{Indonesia} + \beta_{13} D_{Vietnam} + \beta_{14} D_{Cambodia} + \varepsilon_{ij} \quad .$$

By examining the coefficients for the intercept dummy variables, we investigate whether intra-regional trade in each country is significantly larger than inter-regional trade.

It is worth noting that what our methodology judges as the player of intra-network trade seems to be a little bit different from properties in players purely based on theoretical propositions above. Notice that our baseline reference for dummy variables is the average value of inter-regional

trade by East Asian countries and that our methodology is based on the comparison between intra-regional trade value in each country and the average value.   On the other hand, theoretical propositions state differences between intra-network and out-of-network trade.   We must note in the interpretation of regression results that intra-regional trade is not exactly equal to intra-network trade.

Second, Proposition 2 is examined.   We add a distance-slope dummy variable of each country into the baseline equation as follows:

$$\ln Parts_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln dist_{ij} + \beta_4 D_{Japan} \ln dist_{ij}$$

$$+ \beta_5 D_{Korea} \ln dist_{ij} + \cdots + \beta_{14} D_{Cambodia} \ln dist_{ij} + \varepsilon_{ij} \quad .$$

We here investigate whether the coefficients for the distance-slope dummy variables are estimated significantly positive or not.   A positive coefficient indicates that geographical distance less strongly discourages intra-regional trade than inter-regional trade.

Last, to examine Proposition 3, a gap variable and gap-slope dummy variables are introduced into the baseline equation.

$$\ln Parts_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln dist_{ij} + \beta_4 \ln gap_{ij} + \beta_5 D_{Japan} \ln gap_{ij}$$

$$+ \beta_6 D_{Korea} \ln gap_{ij} + \cdots + \beta_{15} D_{Cambodia} \ln gap_{ij} + \varepsilon_{ij} \quad .$$

The gap variable is the absolute value of the difference in GDP per capita between exporting and importing countries, which is used as a proxy for a part of differences in location advantages, e.g., wage rates, between importer and exporter countries.   By examining the coefficients for the gap-slope dummy variables, we investigate whether the difference in location

advantages is utilized more effectively in intra-regional back-and-forth trade than inter-regional trade.

We add some more independent variables into the equations above in order to control other elements; *imremote* , *exremote* , *contingency* , *imland* , *exland* , *language* , *colony* , and *comcol* . *imremote* and *exremote* are importer's and exporter's relative distance. *contingency* is a binary variable which takes one if the two countries share national borders and zero otherwise. *imland* (*exland*) takes unity if importer (exporter) is an island country and zero otherwise. *language* is a binary variable that takes one if the two countries share a common official language and zero otherwise. *colony* takes unity if the two countries have ever had a colonial link and zero otherwise. *comcol* is a binary variable which takes one if trading partners have had a common colonizer and zero otherwise.

4. Data issues

In this section, we list up our data sources and then provide some preliminary data description.

The data sources are the following: we use international trade data in the Standard International Trade Classification (SITC) Revision 2, which is obtained from UN comtrade. The code list of parts and components are drawn from Kimura, Takahashi, and Hayakawa (2006).[3] In order to cover as many East Asian countries as possible, we use the data in 1987, 1995, and 2003. Only in 2003, Vietnam and Cambodia are added. Since import

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[3] Kimura et al. (2006) classifies into parts and components the items that include a word such as "parts" or "accessories" in their descriptions or that are not supposed to be classified as consumption goods or investment goods.

values of China from Korea are not reported in 1987, we exclude this flow from our sample.   Data of GDP and GDP per capita are obtained from World Development Indicator.   The source of all other variables is CEPII. [4] Sample countries are listed in the Appendix.

Next, we present an overview of intra-regional trade in machinery parts and components in each East Asia country.   Table 1 shows the magnitude and the share of intra-regional trade in the whole trade in machinery parts and components.   There are three points to be noted.

==   Table 1   ==

First, in Japan, intra-regional shares in both exports and imports have been relatively low though the magnitudes in exports have been outstandingly large.   The low intra-regional shares are due to the fact that Japan has been engaged also in active out-of-network trade particularly with non-East-Asian developed countries such as the US.   Of course, however, this does not mean that Japan has not been one of the players in international production/distribution networks in East Asia.   Rather, a number of case studies reports that Japan has played the most important role in developing the networks.   Indeed, the table shows that Japan has supplied a large amount of machinery parts to East Asian countries.

Second, in ASEAN countries, the magnitudes and the shares in intra-regional exports and imports experience dramatic increases though the magnitude in imports in Indonesia is modestly changed.   Particularly in the Philippines, the magnitudes in intra-regional exports and imports increase 3,632% and 3,433%, respectively.   Almost all ASEAN countries seem to become players in the networks during a period 1987-2003.

Third, in 2003, the share in exports in China is as low as that in Japan

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[4] http://www.cepii.fr/anglaisgraph/bdd/distances.htm#

though the share in imports is quite high.[5]   The reason for this low share in

exports would be the same as in Japan.   On the other hand, the large share

in the imports may imply that China gets engaged in the networks through

importing machinery parts and exporting finished machinery goods.

Indeed, the magnitude of the imports in China is much more than that in

Japan, being the largest in East Asia.   Note that our methodology seems to

be suited particularly for testing for *developing countries* that get engaged in

international fragmentation in the form of back-and-forth international

transactions on *intermediate goods*.   In cases of Japan and China, the

asymmetric feature of exports and imports as well as their massive

inter-regional trade must be properly considered in the interpretation of our

regression results.

5. Regression Results

This section reports regression results.   Correlation among variables

is presented in Table 2.   The correlation between remoteness and GDP is

extremely high, so that we report the regression results of (1) the equation

above, (2) the equation with remoteness, and (3) without remoteness.

==   Table 2   ==

Before reporting the result of each dummy variable in each East Asian

country, we regress base equations into which each dummy variable for the

whole East Asia are added.   That is, we introduce intercept, distance slope,

and gap slope dummy variables that take unity if both trading countries are

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[5] Notice that we do not make any adjustment for Chinese imports through Hong Kong.

East Asian countries and zero otherwise, instead of those dummy variables in each East Asian country.   The result is reported in Table 3.

==   Table 3   ==

From this table, we can immediately see that the coefficients for intercept and distance slope Asian dummy variables have been significant and positive since the former half of the 1990s while the coefficient for a gap slope dummy variable has been insignificant.   The positive coefficients in the former two variables confirm that active international fragmentation begins in East Asia in the first half of the 1990s.   On the other hand, the insignificance in the latter variable may imply that active trade exists not only between developing and developed countries but also among developed countries in East Asia.

By taking a closer look at the results of dummy variables in each East Asian country, striking differences emerge among the countries.   Table 4 shows the results of an intercept dummy variable in each East Asian country. Three important results are to be noted.   First, for dummy variables of ASEAN countries, the coefficients turn out to be positive significant in Malaysia, Thailand, and the Philippines, in that order.   Machinery parts trade in Malaysia and Thailand and in the Philippines has been biased toward intra-region since the 1980s and since the middle of the 1990s, respectively.   On the other hand, in Indonesia, no significant difference is found between intra- and inter-regional trades.

==   Table 4   ==

Second, the coefficient for China is not estimated significantly positive.

This means that Chinese trade is less biased toward intra-region than the average in East Asian countries. However, as argued above, it is because China get actually engaged in the other type of fragmentation, i.e., massive imports of intermediate goods and exports of finished goods. Nevertheless, the coefficient is going to positive value; it would suggest that China comes to be engaged in active intra-regional trade in parts and components.

Third, the results for East Asian developed countries are a bit puzzling. The coefficients for Singapore and Hong Kong have been positively significant while those for Japan and Korea have not. In other words, in Singapore and Hong Kong, the intra-regional trade has been remarkably large since the 1980s, while, in Japan and Korea, the intra-regional trade has not been significantly larger than inter-regional trade. The results for Japan and Korea must be due to their relatively large inter-regional trade as well as asymmetry between exports and imports of intermediate goods as argued above. This finding however does not imply that Japan and Korea have not contributed to production networks in East Asia; on the contrary, these two countries have had massive intra-regional trade in absolute quantity.

Next, Table 5 shows the result of distance-slope dummy variables. We can immediately find that the result is qualitatively similar to that in Table 4. The intra-regional trade in Malaysia, Thailand, and the Philippines has been less penalized by geographical distance since the relatively early period,

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[7] Disintegration and accompanied transaction cost have been long analyzed in the industrial organization literature of vertical integration. See, for example, Grossman and Helpman (2002, 2003, 2004, 2005) and Grossman, Helpman, and Szeidl (2004, 2005)

while, in Indonesia and China, the discouragement of the distance has been weak yet, compared with the average in East Asian countries. In addition, the intra-regional trade in Singapore and Hong Kong has been less penalized since the 1980s while that in Japan and Korea has not.

== Table 5 ==

The result of gap-slope dummy variables is reported in Table 6. Malaysia and Thailand have been engaged in intra-regional trade more intensively so as to take advantage of differences in location advantages since around 1990, the Philippines has been since the latter half of the 1990s, and China has not yet. On the other hand, the coefficients of developed countries are not estimated significantly positive.

== Table 6 ==

Here two points are to be noted. First, there seems to be differences in the timing between the time when the first and second features appear and the time when the third feature appears. The positive significance requires developing countries to actively not only import from but export to developed countries. Therefore, the differences may imply that developing countries take part in international fragmentation first by importing intermediate goods from developed countries and then gradually start to export intermediate goods to the developed countries. Second, the insignificance in coefficient signs for developed countries is due to, in addition to the intra-regional trade with developing countries, the intra-regional trade among developed countries, i.e., among pairs with small gaps, is also large. Therefore, we can conclude that the result for a gap slope dummy variable in

Table 3 is produced by trade among developed countries mixing with trade between developed and developing countries.

Last, Table 7 tabulates regression results for the sample set with Vietnam and Cambodia. The results indicate that, in Vietnam, the coefficients for intercept and distance-slope dummy variables are estimated significantly positive, but the coefficient for a gap-slope dummy is not significant. That is, intra-regional trade in Vietnam comes to be larger and is less penalized by geographical distance, but is not utilized more intensively the disparity in location advantages. Therefore Vietnam seems to just start taking part in international fragmentation. On the other hand, in Cambodia, all the coefficients are not significantly estimated. Therefore Cambodia is not yet engaged in international fragmentation in East Asia.

== Table 7 ==

Forces of fragmentation may result in uneven developments across countries and generate winners and losers due to the following reasons. First, foreign direct investment, with which physical and human capital and technology are mostly internationally mobile, is sometimes concentrated on some specific countries/regions. Second, service link is often accompanied with economies of scale so that fragmented production blocks may concentrate on a limited number of places. Third, once agglomeration of a certain production block is formed, spatial economies of scale may work so that more economic activities would be attracted.

In our empirical results in developing countries, however, we find trickle-down effects with leaving production activities in forerunners.

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Malaysia and Thailand have been engaged in international fragmentation since around 1990, and afterward the Philippines comes to take part in the fragmentation. More recently, Vietnam seems to start to get engaged in international fragmentation though Indonesia, China, and Cambodia are not yet, compared with forerunners.

6. Integration Strategies in East Asia

This section discusses policy implication of expanding international production/distribution networks in East Asia. Kimura and Ando (2005) propose the conceptual framework of two-dimensional fragmentation, i.e., fragmentation in terms of geographical distance and disintegration. The framework is illustrated in Figure 1. The horizontal axis denotes geographical distance. From the original position, a production block can be detached and be placed in geographical distance. A dotted line in the middle is a national border, which distinguishes cross-border fragmentation from domestic fragmentation. In the case of cross-border fragmentation, the reduction in production cost may be available due to different location advantages, while, in addition to cost due to geographical distance, service link cost due to crossing national border comes to be incurred.

== Figure 1 ==

On the other hand, the vertical axis represents the organization, i.e., integration or disintegration, of corporate activities. A fragmented production may be conducted by either intra-firm establishments or unrelated firms. The dotted line is a boundary of firm, distinguishing arm's-length (inter-firm) fragmentation from intra-firm fragmentation.[7] In

the case of arm's-length fragmentation, the reduction in production cost may be available due to "dis-integration" advantages, while service link cost due to weaker controllability or "transaction cost" in Oliver Williamson's sense comes to be incurred.

According to this two-dimensional concept, a list of policy measures required for the development of international production/distribution networks can be drawn as Table 8. As shown in this table, the policy measures to reduce service link cost and production cost *per se* along distance and disintegration axes become critical for the development of production networks. The assessment of those costs in each East Asian country is presented in Table 9, which is drawn from "The Global Competitiveness Report 2005-2006." Table 10 is reproduced from an annual survey of Japanese MNEs conducted by the Japan Bank for International Cooperation (JBIC), which lists up weak points in developing countries. The proposal for the development of infrastructure in each developing country is listed in Table 11, which is reproduced from Furukawa (2005).

== Table 8 ==

== Table 9 ==

== Table 10 ==

== Table 11 ==

The first task that policymakers in developing countries confront is to attract fragmented production blocks. Even if it is not indigenous but foreign firms that initially form and get engaged in international production/distribution networks, hosting network-forming MNEs is critical

for the attraction of the production blocks as the first step.   To this end, the enhancement of location advantages for production and the reduction in service link cost to overcome geographical distance, i.e., fragmentation along the distance axis, become crucially important.

Latecomers first of all are required to reduce these costs.   Indeed, in Table 9, latecomers rank at the bottom in trade barriers, financial market sophistication, and infrastructure.   In particular, Vietnam and Cambodia are placed near the lowest rank in the whole world.   Table 10 shows that the under-development of infrastructure in Vietnam is pointed out by Japanese MNEs as one of the serious problems.   In Cambodia, as indicated in Table 11, the improvement is required in any and all of infrastructures.   For latecomers, the reduction in these costs, that is, in cost along the distance axis, becomes quite important to attract production blocks.

The second task is to stabilize the location of production blocks.   To do that, it becomes important to form a seed of agglomeration by hosting as many MNEs as possible and thus to further reduce cost along the distance axis.   The concentration of MNEs not only increases international transactions in production/distribution networks but may give birth voluntarily to arm's length transactions among MNEs within a nation. Such an organic link among MNEs generates benefit from cost-linkage effect,[8] which self-reinforcingly enhances location advantages in the nation. Indeed, substantial agglomeration can be observed in forerunners such as Samut Prakan and the Eastern Seaboard in Thailand, Penang and Shah

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[8] This is sometimes called backward linkage effect.   For more details, see Baldwin, Forslid, Martin, Ottaviano, and Robert-Nicoud (2003).

Alam in Malaysia. Consequently, this mechanics stabilize not only the connection with the international networks but also the industrial structure.

The third task is to consolidate the location of production blocks and the agglomeration. Agglomeration eventually generates congestion effects in the form of wage hikes, labor/human resource shortage, congestion in transport services, and others. While, for latecomers, this becomes a chance to enjoy trickle-down effects by utilizing forces of diversifying economic activities, forerunners come to experience the loss of some production blocks. Therefore, it becomes important not only for latecomers but also for forerunners to further enhance their location advantages by sophisticating the agglomeration.

Thus, it becomes important to host not only MNEs but also indigenous firms and to make them penetrate into production/distribution networks. A large variety of potential business partners enhance the agglomeration benefit and thus lead to a further reduction in production cost. In activating transactions with the indigenous firms, it comes to be crucial to decrease costs along the disintegration axis. That is, at this stage, it is required to reduce cost due to losing control or "transaction cost" and to promote the utilization of dis-internalization advantages.

Forerunners in developing East Asia seem to successfully reduce the cost along the disintegration axis and to nurture sophisticated agglomeration. Table 9 shows that, in Malaysia and Thailand, not only local supplier quantity and quality but also legal framework and intellectual property right have relatively high ranks even in comparison with the whole

world. The stabilization of industrial structure by the formation of the sophisticated agglomeration must enable forerunners to keep some specific production activities in spite of steady increases in their productive factor prices, e.g., wage rates.

On the other hand, under-development in legal framework and the insufficiency of intellectual property right in latecomers are particularly serious. Those are frequently pointed out by Japanese MNEs (Table 10) and become the main issues particularly in China. Therefore, once latecomers succeeded in forming agglomeration, they should sophisticate the agglomeration by intensively reducing those costs.

7. Concluding Remarks

This paper empirically investigated how international production and distribution networks had expanded in East Asia. To this end, we first characterized intra-network trade in the form of three propositions and tried to identify players in the networks by examining in which countries and when the networks were formed. As the result of regression analysis, we found trickle-down effects to latecomers with leaving production activities in forerunners.

Furthermore, we presented a required set of policies to expand international production/distribution networks in forerunners and latecomers. The policy measures to reduce service link cost and production cost *per se* along distance and disintegration axes become critical for the development.

To accomplish the reduction in those costs, it is effective to utilize the following two policy channels: the first is economic/technical cooperation by development assistance agencies and international organizations. The aid should be designed so as to reduce production cost *per se* along the distance axis, particularly through developing physical infrastructure. The rest of required measures can be implemented by the second means, Free Trade Agreements (FTAs). In general, a reduction in service link cost along the disintegration axis would be quite difficult since the reduction requires drastic reform of domestic economic system. So as to taking advantage of its encouraging effect on policy reform, measures to reduce cost along the disintegration should be included in FTAs.

Appendix. Countries in the sample

Region	Sub-region	Countries
East Asia (11)	Japan	Japan
	NIEs3	Hong Kong SAR, Rep. of Korea, Singapore
	ASEAN6	Indonesia, Malaysia, Philippines, Thailand, Vietnam, Cambodia
	China	China
Europe (18)	Northern Europe	Finland, Ireland, Norway, Sweden
	Western Europe	Austria, Belgium-Luxembourg, Denmark, France, Germany, Greece, Italy, Netherlands, Portugal, Spain, Switzerland, United Kingdom
	Eastern Europe	Czechoslovakia, Poland
NAFTA (3)		USA, Canada, Mexico
Others (26)		Algeria, Argentina, Australia, Bolivia, Brazil, Cameroon, Chile, Colombia, Costa Rica, Cote d'Ivoire, Ecuador, Egypt, India, Israel, Kenya, Morocco, New Zealand, Pakistan, Panama, Peru, Saudi Arabia, Sri Lanka, Tunisia, Turkey, Uruguay, Venezuela

Reference

[1] Ando, M. (2006), 'Fragmentation and Vertical Intra-industry Trade in East Asia', forthcoming in *North American Journal of Economics and Finance*. Available at http://www.coe-econbus.keio.ac.jp/data/DP2004-025.pdf.

[2] Ando, M. and Kimura, F. (2005), 'The Formation of International Production and Distribution Networks in East Asia', in T. Ito and A. Rose (eds), *International Trade (NBER-East Asia Seminar on Economics, Volume 14)*, Chicago: The University of Chicago Press.

[3] Arndt, S. W. and Kierzkowski, H. (2001), *Fragmentation: New Production Patterns in the World Economy*, Oxford: Oxford University Press.

[4] Baldwin, R., Forslid, R., Martin, P., Ottaviano, G., and Robert-Nicoud, F. (2003), *Economic Geography and Public Policy,* Princeton University Press.

[5] Cheng, L. K. and Kierzkowski, H. (2001), *Global Production and Trade in East Asia*, Boston: Kluwer Academic Publishers.

[6] Furukawa, S. (2005), 'Private Sector Perceptions: Infrastructure Users', In a joint study of the Asian Development Bank, the Japan Bank for International Cooperation, and the World Bank*, Infrastructure in East Asia: Providing Effective and Sustainable Infrastructure Services throughout the Region, Background Papers*.

[7] Grossman, G. M. and Helpman, E. (2002), 'Integration versus Outsourcing in Industry Equilibrium', *Quarterly Journal of Economics*, **117** (1), 85-120.

[8] Grossman, G. M. and Helpman, E. (2003), 'Outsourcing versus FDI in Industry Equilibrium', *Journal of European Economic Association*, **1** (2), 317-327.

[9] Grossman, G. M. and Helpman, E. (2004), 'Managerial Incentives and the International Organization of Production', *Journal of International Economics*, **63** (2), 237-262.

[10] Grossman, G. M. and Helpman, E. (2005), 'Outsourcing in a Global Economy', *Review of Economic Studies*, **72** (1), 135-159.

[11] Grossman, G. M., Helpman, E., and Szeidl, A. (2004), 'Optimal Integration Strategies for the Multinational Firm', *CEPR Discussion Papers 4477* (version 2004, April).

[12] Grossman, G. M., Helpman, E., and Szeidl, A. (2005), 'Complementarities between Outsourcing and Foreign Sourcing', *American Economic Review,* **95** (2), 19-24.

[13] Jones, R. W. and Kierzkowski, H. (1990), 'The Role of Services in Production and International Trade: a Theoretical Framework', in R. W. Jones and A. O. Krueger(eds), *The Political Economy of International Trade: Essays in Honor of R. E. Baldwin*, Oxford: Basil Blackwell.

[14] Kimura, F. and Ando, M. (2005), 'Two-dimensional Fragmentation in East Asia: Conceptual Framework and Empirics, International Review of Economics and Finance', (special issue on "Outsourcing and Fragmentation: Blessing or Threat" edited by Henryk Kierzkowski) **14** (3), 317-348.

[15] Kimura, F. (2006), 'International Production and Distribution Networks in East Asia: 18 Facts, Mechanics, and Policy Implication', forthcoming in *Asian Economic Policy Review (Blackwell)*.   Available at http://www.coe-econbus.keio.ac.jp/data/DP2006-008.pdf.

[16] Kimura, F., Takahashi, Y. and Hayakawa, K. (2006), 'Fragmentation and Parts and Components Trade: Comparison between East Asia and Europe'.   Available at http://www.coe-econbus.keio.ac.jp/data/DP2005-030.pdf.

[17] Marugami, T., Mimura, T., Saito, K., Suzuki, M., and Kotaka, T. (2005), 'Survey Report on Overseas Business Operations by Japanese Manufacturing Companies: Results of JBIC FY2004 Survey: Outlook for Japanese Foreign Direct Investment (16th Annual Survey)', JBICI Review, **13**, 7-113.

[18] Satake, T., Sekine, E., and Suzuki, M. (2006), 'Survey Report on Overseas Business Operations by Japanese Manufacturing Companies: Results of JBIC FY2005 Survey: Outlook for Japanese Foreign Direct Investment (17th Annual Survey), Journal of Research Institute for Development and Finance, **28**, 4-82. In Japanese.

[19] Yi, K-M, (2003), 'Can Vertical Specialization Explain the Growth of World Trade?', *Journal of Political Economy,* **111** (1), 52-102.

Table 1. Intra-regional trade in machinery parts and components by East Asian countries (US $, %)

	Exports		Imports	
	1987	2003	1987	2003
China	689,201,288 (75%)	46,588,726,188 (54%)	4,309,418,974 (73%)	63,655,450,868 (72%)
Hong Kong	2,993,103,443 (63%)	9,522,570,267 (67%)	3,929,782,529 (66%)	52,944,856,796 (84%)
Indonesia	27,982,353 (28%)	4,487,085,464 (70%)	1,256,635,538 (56%)	2,983,138,304 (72%)
Japan	14,005,079,413 (27%)	83,011,155,626 (54%)	1,011,964,999 (15%)	28,438,332,922 (58%)
Korea	1,385,907,126 (30%)	29,585,129,709 (61%)	4,812,126,341 (64%)	23,003,827,689 (62%)
Malaysia	1,131,112,388 (35%)	30,011,854,492 (63%)	1,826,666,889 (46%)	22,122,139,463 (60%)
Philippines	460,254,486 (33%)	17,175,577,867 (66%)	315,136,662 (41%)	11,132,928,834 (58%)
Singapore	1,499,205,637 (25%)	20,729,389,596 (63%)	3,916,059,902 (52%)	33,498,409,821 (67%)
Thailand	718,330,579 (54%)	11,958,256,311 (68%)	1,513,793,981 (59%)	14,738,586,336 (78%)
Vietnam		661,119,097 (83%)		1,191,376,000 (75%)
Cambodia		1,407,126 (55%)		23,224,710 (66%)

Note: The upper number indicates the magnitude of intra-regional trade in machinery parts and components, and the share of intra-regional trade in the whole trade is shown in parenthesis.

Data source: UN Comtrade.

Table 2. Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ln Parts	(1)	1.00												
ln GDP_i	(2)	0.40	1.00											
ln GDP_j	(3)	0.63	-0.02	1.00										
ln dist	(4)	-0.26	-0.03	-0.03	1.00									
ln gap	(5)	-0.08	-0.06	-0.06	-0.09	1.00								
ln exremote	(6)	-0.62	0.01	-0.97	0.03	0.04	1.00							
ln imremote	(7)	-0.41	-0.97	0.01	0.03	0.04	-0.01	1.00						
imland	(8)	-0.06	0.02	-0.07	0.06	0.02	0.01	0.00	1.00					
exland	(9)	0.01	-0.07	0.02	0.06	0.02	0.00	0.01	-0.04	1.00				
contingency	(10)	0.08	-0.01	-0.01	-0.38	-0.06	0.01	0.01	-0.03	-0.03	1.00			
language	(11)	0.15	0.00	0.00	-0.15	0.00	0.02	0.02	-0.06	-0.06	0.07	1.00		
colony	(12)	0.10	0.07	0.07	-0.01	0.04	-0.08	-0.08	-0.03	-0.03	-0.02	0.13	1.00	
comcol	(13)	-0.11	-0.16	-0.16	-0.19	0.02	0.16	0.16	-0.05	-0.05	0.10	0.28	-0.03	1.00

Table 3. Base regression results

dummy	Intercept				distance slope				gap slope			
year	1987	1995	2003	2003	1987	1995	2003	2003	1987	1995	2003	2003
GDP_i	1.25** (0.10)	0.99** (0.10)	0.85** (0.07)	1.39** (0.07)	1.25** (0.10)	0.99** (0.10)	0.85** (0.07)	1.39** (0.07)	1.26** (0.10)	1.01** (0.10)	0.85** (0.07)	1.38** (0.07)
GDP_j	2.47** (0.08)	2.20** (0.10)	1.77** (0.08)	2.14** (0.07)	2.47** (0.08)	2.20** (0.10)	1.77** (0.08)	2.13** (0.07)	2.48** (0.08)	2.21** (0.10)	1.77** (0.08)	2.12** (0.07)
dist	-2.97** (0.40)	-1.63** (0.44)	-1.86** (0.29)	-1.72** (0.29)	-2.95** (0.39)	-1.67** (0.42)	-1.89** (0.28)	-1.76** (0.27)	-3.34** (0.35)	-2.03** (0.37)	-2.18** (0.26)	-2.05** (0.26)
gap									-0.05 (0.11)	-0.28* (0.11)	-0.13 (0.09)	-0.21* (0.08)
Asian dummy	0.51 (0.61)	1.62* (0.63)	1.41** (0.42)	1.02* (0.47)	0.07 (0.07)	0.20** (0.07)	0.18** (0.05)	0.12* (0.06)	-0.26 (0.23)	0.33 (0.23)	0.30 (0.17)	0.12 (0.16)
exland	2.52** (0.68)	-0.12 (0.68)	0.09 (0.65)	0.07 (0.60)	2.52** (0.68)	-0.12 (0.68)	0.10 (0.65)	0.07 (0.60)	2.50** (0.68)	-0.10 (0.66)	0.09 (0.63)	0.08 (0.59)
imland	-0.74 (1.01)	1.28* (0.49)	1.38** (0.35)	1.45** (0.49)	-0.74 (1.01)	1.28* (0.49)	1.38** (0.35)	1.45** (0.49)	-0.75 (1.01)	1.30** (0.50)	1.37** (0.35)	1.46** (0.48)
contingency	-0.72 (0.80)	-0.22 (0.69)	-1.04* (0.52)	-0.19 (0.63)	-0.67 (0.81)	-0.12 (0.72)	-0.95 (0.54)	-0.13 (0.64)	-0.79 (0.83)	-0.45 (0.77)	-1.11 (0.58)	-0.32 (0.67)
language	3.28** (0.47)	2.63** (0.50)	1.80** (0.40)	2.71** (0.36)	3.28** (0.46)	2.63** (0.50)	1.79** (0.40)	2.71** (0.36)	3.36** (0.47)	2.63** (0.50)	1.79** (0.41)	2.70** (0.37)
colony	1.40 (1.04)	0.80 (0.82)	0.79 (0.69)	0.45 (0.58)	1.41 (1.04)	0.83 (0.81)	0.81 (0.68)	0.46 (0.57)	1.35 (1.04)	0.83 (0.81)	0.84 (0.67)	0.57 (0.60)
comcol	0.76 (0.81)	-0.15 (1.01)	0.10 (0.70)	-0.37 (0.64)	0.79 (0.81)	-0.16 (1.01)	0.10 (0.70)	-0.38 (0.64)	0.50 (0.82)	-0.09 (1.04)	0.06 (0.74)	-0.49 (0.65)
constant	-56.29** (5.04)	-53.44** (6.29)	-35.67** (3.92)	-60.94** (3.93)	-56.50** (4.92)	-52.97** (6.09)	-35.37** (3.82)	-60.55** (3.81)	-53.01** (4.55)	-49.83** (5.71)	-32.52** (3.73)	-56.81** (3.86)
VC countries	no	no	no	yes	no	no	no	yes	no	no	no	yes
R-sq	0.5180	0.5104	0.5333	0.6340	0.5181	0.5103	0.5334	0.6339	0.5183	0.5109	0.5316	0.6348
Obs.	917	918	918	1144	917	918	918	1144	917	918	918	1144

Notes: The dependent variable is trade values of machinery parts & components. "Asian dummy" is a dummy variable, the value of which takes unity if both exporting and importing countries are East Asian countries and zero otherwise. This table shows results for three types of dummy variables; intercept, distance slope, and gap slope dummy variables. "VC countries" indicates whether the sample set includes Vietnam and Cambodia or not. Heteroskedasticity-consistent standard errors (White) are in parentheses. ** and * show 1% and 5% significance, respectively.

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Table 4. Regression results with intercept dummies

	Eq (1)			Eq (2)			Eq (3)		
	1987	1995	2003	1987	1995	2003	1987	1995	2003
GDP_i	1.28**	1.00**	0.85**	-0.62	-1.59**	-0.99**	1.30**	1.04**	0.89**
	(0.1)	(0.1)	(0.07)	(0.40)	(0.31)	(0.24)	(0.10)	(0.10)	(0.07)
GDP_j	2.45**	2.23**	1.80**	0.73*	0.28	0.46	2.53**	2.25**	1.81**
	(0.08)	(0.10)	(0.08)	(0.35)	(0.34)	(0.26)	(0.09)	(0.10)	(0.08)
dist	-3.11**	-1.62**	-1.81**	-2.20**	-0.78	-1.26**	-2.82**	-1.51**	-1.77**
	(0.36)	(0.42)	(0.26)	(0.41)	(0.46)	(0.29)	(0.40)	(0.45)	(0.29)
imremote				-1.90**	-2.60**	-1.86**			
				(0.38)	(0.31)	(0.23)			
exremote				-1.77**	-1.92**	-1.31**			
				(0.33)	(0.32)	(0.25)			
exland				1.81**	-0.82	-0.37	2.53**	-0.13	0.09
				(0.66)	(0.63)	(0.64)	(0.69)	(0.68)	(0.65)
imland				-1.54	0.10	0.53	-0.73	1.27*	1.38**
				(1.02)	(0.46)	(0.32)	(1.00)	(0.50)	(0.36)
contingency				-0.68	0.11	-1.00	-1.64	-1.06	-1.83**
				(0.96)	(0.65)	(0.51)	(1.00)	(0.67)	(0.54)
language				3.74**	3.16**	2.08**	3.19**	2.50**	1.61**
				(0.49)	(0.53)	(0.42)	(0.48)	(0.52)	(0.42)
colony				0.74	-0.09	0.32	1.72*	1.11	1.16*
				(0.79)	(0.61)	(0.46)	(0.87)	(0.69)	(0.51)
comcol				0.92	0.04	0.34	0.56	-0.38	0.04
				(0.89)	(1.03)	(0.76)	(0.84)	(1.04)	(0.73)
China	-1.52*	-0.91*	0.24	-1.46*	-0.64	0.56	-2.02*	-1.40**	0.01
	(0.77)	(0.40)	(0.42)	(0.70)	(0.43)	(0.42)	(0.75)	(0.42)	(0.44)
HK	1.80**	2.06**	1.30**	1.27*	1.81**	1.19**	0.91	1.38**	0.89*
	(0.53)	(0.46)	(0.33)	(0.55)	(0.43)	(0.33)	(0.57)	(0.45)	(0.35)
Indonesia	-1.13	-0.45	-0.59	0.79	1.28**	0.70*	-0.13	0.16	-0.08
	(0.64)	(0.36)	(0.33)	(0.62)	(0.40)	(0.29)	(0.63)	(0.36)	(0.30)
Japan	-2.83**	-1.38**	-1.16**	-1.17	0.52	0.04	-2.56**	-1.20**	-1.17**
	(0.57)	(0.46)	(0.42)	(0.60)	(0.52)	(0.42)	(0.63)	(0.50)	(0.44)
Korea	0.11	0.27	0.02	1.66*	2.00**	1.10**	0.52	0.54	0.07
	(0.72)	(0.39)	(0.36)	(0.70)	(0.50)	(0.39)	(0.77)	(0.49)	(0.42)
Malaysia	2.05**	2.69**	2.08**	2.00**	2.51**	2.30**	2.14**	2.70**	2.43**
	(0.67)	(0.53)	(0.44)	(0.75)	(0.50)	(0.41)	(0.74)	(0.50)	(0.41)
Philippines	0.22	1.51**	1.81**	1.11	2.43**	2.41**	0.16	1.30*	1.62**
	(0.59)	(0.50)	(0.38)	(0.67)	(0.61)	(0.45)	(0.66)	(0.58)	(0.45)
Singapore	3.46**	3.70**	2.35**	2.72**	3.14**	2.02**	2.63**	3.05**	1.96**
	(0.65)	(0.52)	(0.41)	(0.65)	(0.52)	(0.40)	(0.67)	(0.51)	(0.42)
Thailand	0.82	1.21**	1.02**	2.39**	2.43**	1.94**	1.89**	1.84*	1.54**
	(0.53)	(0.42)	(0.31)	(0.56)	(0.48)	(0.32)	(0.56)	(0.46)	(0.32)
constant	-54.79**	-54.08**	-36.55**	64.42**	98.26**	71.02**	-60.34**	-56.80**	-38.46**
	(4.83)	(6.24)	(3.69)	(19.95)	(17.19)	(13.45)	(5.30)	(6.59)	(4.15)
R-sq	0.4996	0.502	0.5253	0.544	0.5581	0.5684	0.5259	0.519	0.5401
Obs.	917	918	918	917	918	918	917	918	918

Notes: The dependent variable is trade values of machinery parts & components. Heteroskedasticity-consistent standard errors (White) are in parentheses. ** and * show 1% and 5% significance, respectively.

Table 5. Regression results with distance slope dummies

| | Eq (1) | | | Eq (2) | | | Eq (3) | | |
	1987	1995	2003	1987	1995	2003	1987	1995	2003
GDP_i	1.28**	0.99**	0.85**	-0.63	-1.58**	-0.99**	1.30**	1.04**	0.89**
	(0.10)	(0.10)	(0.07)	(0.40)	(0.31)	(0.24)	(0.10)	(0.10)	(0.07)
GDP_j	2.45**	2.23**	1.80**	0.72*	0.29	0.46	2.53**	2.25**	1.81**
	(0.08)	(0.10)	(0.08)	(0.35)	(0.33)	(0.26)	(0.09)	(0.10)	(0.08)
dist	-3.09**	-1.66**	-1.83**	-2.20**	-0.85*	-1.30**	-2.79**	-1.54**	-1.78**
	(0.34)	(0.39)	(0.24)	(0.39)	(0.43)	(0.28)	(0.39)	(0.43)	(0.28)
imremote				-1.91**	-2.58**	-1.85**			
				(0.38)	(0.30)	(0.22)			
exremote				-1.78**	-1.91**	-1.31**			
				(0.33)	(0.31)	(0.24)			
exland				1.82**	-0.81	-0.37	2.54**	-0.13	0.10
				(0.66)	(0.62)	(0.64)	(0.69)	(0.68)	(0.65)
imland				-1.53	0.11	0.54	-0.72	1.28*	1.38**
				(1.02)	(0.46)	(0.32)	(1.00)	(0.50)	(0.36)
contingency				-0.48	0.38	-0.77	-1.45	-0.79	-1.59**
				(0.92)	(0.65)	(0.50)	(0.96)	(0.68)	(0.53)
language				3.72**	3.15**	2.07**	3.17**	2.50**	161**
				(0.49)	(0.53)	(0.42)	(0.48)	(0.52)	(0.42)
colony				0.78	-0.01	0.36	1.71	1.12	1.16*
				(0.78)	(0.59)	(0.46)	(0.87)	(0.69)	(0.52)
comcol				0.95	0.03	0.34	0.61	-0.36	0.07
				(0.88)	(1.02)	(0.75)	(0.84)	(1.03)	(0.72)
China	-0.20*	-0.13**	0.02	-0.19*	-0.10	0.06	-0.26*	-0.20**	-0.01
	(0.09)	(0.05)	(0.05)	(0.09)	(0.05)	(0.05)	(0.09)	(0.05)	(0.05)
HK	0.23**	0.26**	0.16**	0.16*	0.23**	0.15**	0.11	0.17**	0.11*
	(0.07)	(0.06)	(0.04)	(0.07)	(0.05)	(0.04)	(0.07)	(0.06)	(0.04)
Indonesia	-0.11	-0.04	-0.06	0.11	0.16**	0.08*	0.00	0.03	0.00
	(0.08)	(0.05)	(0.04)	(0.08)	(0.05)	(0.04)	(0.08)	(0.04)	(0.04)
Japan	-0.36**	-0.19**	-0.15**	-0.15*	0.05	-0.01	-0.32**	-0.16**	-0.15**
	(0.07)	(0.06)	(0.05)	(0.07)	(0.06)	(0.05)	(0.07)	(0.06)	(0.05)
Korea	0.01	0.02	0.00	0.20*	0.23**	0.13**	0.06	0.06	0.01
	(0.08)	(0.04)	(0.04)	(0.08)	(0.06)	(0.05)	(0.09)	(0.06)	(0.05)
Malaysia	0.31**	0.37**	0.29**	0.28**	0.33**	0.30**	0.31**	0.36**	0.32**
	(0.08)	(0.06)	(0.05)	(0.09)	(0.06)	(0.05)	(0.09)	(0.06)	(0.05)
Philippines	0.02	0.19**	0.23**	0.14	0.31**	0.31**	0.02	0.17*	0.21**
	(0.07)	(0.06)	(0.05)	(0.08)	(0.08)	(0.06)	(0.08)	(0.07)	(0.06)
Singapore	0.49**	0.50**	0.33**	0.38**	0.41**	0.28**	0.38**	0.41**	0.27**
	(0.07)	(0.06)	(0.05)	(0.08)	(0.06)	(0.05)	(0.08)	(0.06)	(0.05)
Thailand	0.12	0.16**	0.14**	0.31**	0.31**	0.25**	0.25**	0.24**	0.20**
	(0.07)	(0.05)	(0.04)	(0.07)	(0.06)	(0.04)	(0.07)	(0.06)	(0.04)
constant	-55.01**	-53.58**	-36.36**	64.84**	98.23**	71.42**	-60.68**	-56.50**	-38.35**
	(4.69)	(6.01)	(3.58)	(19.95)	(17.12)	(13.43)	(5.20)	(6.41)	(4.06)
R-sq	0.5001	0.5023	0.5260	0.5446	0.5582	0.5688	0.5263	0.5192	0.5405
Obs.	917	918	918	917	918	918	917	918	918

Notes: The dependent variable is trade values of machinery parts & components. Heteroskedasticity-consistent standard errors (White) are in parentheses. ** and * show 1% and 5% significance, respectively.

Table 6. Regression results with gap slope dummies

	Eq (1)			Eq (2)			Eq (3)		
	1987	1995	2003	1987	1995	2003	1987	1995	2003
GDP_i	1.27**	0.99**	0.84**	-0.55	-1.45**	-0.88**	1.29**	1.04**	0.88**
	(0.10)	(0.10)	(0.07)	(0.39)	(0.30)	(0.23)	(0.10)	(0.10)	(0.07)
GDP_j	2.43**	2.22**	1.79**	0.80*	0.42	0.57*	2.52**	2.25**	1.80**
	(0.08)	(0.10)	(0.08)	(0.34)	(0.32)	(0.25)	(0.09)	(0.10)	(0.08)
dist	-3.31**	-1.92**	-2.04**	-2.59**	-1.26**	-1.66**	-3.05**	-1.77**	-1.98**
	(0.31)	(0.37)	(0.23)	(0.36)	(0.40)	(0.26)	(0.36)	(0.40)	(0.27)
gap	-0.01	-0.23*	-0.08	-0.03	-0.21	-0.08	-0.03	-0.26*	-0.11
	(0.12)	(0.11)	(0.09)	(0.11)	(0.11)	(0.09)	(0.12)	(0.11)	(0.09)
imremote				-1.82**	-2.45**	-1.74**			
				(0.37)	(0.29)	(0.22)			
exremote				-1.69**	-1.78**	-1.2**			
				(0.32)	(0.30)	(0.24)			
exland				1.82**	-0.76	-0.34	2.52**	-0.09	0.1
				(0.66)	(0.62)	(0.63)	(0.69)	(0.67)	(0.64)
imland				-1.53	0.16	0.56	-0.73	1.31**	1.39**
				(1.03)	(0.48)	(0.33)	(1.01)	(0.50)	(0.35)
contingency				-0.24	0.31	-0.93	-1.00	-0.60	-1.52*
				(0.92)	(0.78)	(0.59)	(0.93)	(0.81)	(0.62)
language				3.72**	3.09**	2.03**	3.23**	2.50**	1.63**
				(0.50)	(0.54)	(0.43)	(0.50)	(0.53)	(0.44)
colony				0.69	0.00	0.44	1.55	0.97	1.11*
				(0.82)	(0.63)	(0.47)	(0.92)	(0.74)	(0.54)
comcol				0.85	0.16	0.3	0.62	-0.01	0.21
				(0.90)	(1.07)	(0.80)	(0.86)	(1.08)	(0.78)
China	-0.73*	-0.38	0.21	-0.66*	-0.42	0.29	-0.74*	-0.47	0.26
	(0.29)	(0.20)	(0.23)	(0.31)	(0.26)	(0.25)	(0.32)	(0.26)	(0.26)
HK	0.80**	0.77**	0.14	0.45	0.57*	0.02	0.36	0.43	-0.10
	(0.30)	(0.24)	(0.22)	(0.31)	(0.25)	(0.23)	(0.32)	(0.25)	(0.23)
Indonesia	-0.56	-0.23	0.02	0.18	0.34	0.43*	-0.08	0.09	0.32
	(0.35)	(0.24)	(0.25)	(0.31)	(0.23)	(0.22)	(0.30)	(0.24)	(0.24)
Japan	-0.64*	-0.29	-0.56*	-0.37	0.16	-0.32	-0.67*	-0.27	-0.65**
	(0.28)	(0.24)	(0.24)	(0.29)	(0.26)	(0.24)	(0.31)	(0.27)	(0.25)
Korea	-0.22	0.09	-0.28	0.54	0.95**	0.16	-0.12	0.21	-0.33
	(0.63)	(0.34)	(0.29)	(0.60)	(0.36)	(0.29)	(0.63)	(0.37)	(0.30)
Malaysia	1.00**	1.49**	1.34**	0.79	1.36**	1.45**	0.74	1.28**	1.41**
	(0.38)	(0.37)	(0.34)	(0.45)	(0.40)	(0.31)	(0.43)	(0.38)	(0.30)
Philippines	-0.09	0.47	0.87**	0.21	0.63	0.99**	-0.09	0.42	0.89**
	(0.35)	(0.28)	(0.24)	(0.39)	(0.35)	(0.28)	(0.41)	(0.34)	(0.28)
Singapore	1.26**	1.28**	0.46	0.84*	0.99**	0.24	0.79*	0.93**	0.17
	(0.34)	(0.26)	(0.25)	(0.35)	(0.29)	(0.25)	(0.35)	(0.28)	(0.24)
Thailand	0.30	0.59*	0.76**	1.09**	1.29**	1.24**	0.85*	0.95**	1.06**
	(0.31)	(0.28)	(0.23)	(0.33)	(0.35)	(0.26)	(0.34)	(0.33)	(0.26)
constant	-52.20**	-50.55**	-33.85**	63.02**	92.95**	67.19**	-57.67**	-54.05**	-35.99**
	(4.39)	(5.82)	(3.53)	(19.56)	(16.42)	(13.18)	(4.93)	(6.21)	(4.00)
R-sq	0.4971	0.4994	0.5221	0.5406	0.5524	0.5626	0.5236	0.5167	0.5371
Obs.	917	918	918	917	918	918	917	918	918

Notes: The dependent variable is trade values of machinery parts & components. Heteroskedasticity-consistent standard errors (White) are in parentheses. ** and * show 1% and 5% significance, respectively.

Table 7. Regression results with Cambodia and Vietnam in 2003

	intercept			distance slope			gap slope		
	Eq (1)	Eq (2)	Eq (3)	Eq (1)	Eq (2)	Eq (3)	Eq (1)	Eq (2)	Eq (3)
GDP_i	1.40**	-0.02	1.41**	1.40**	-0.01	1.40**	1.38**	-0.03	1.39**
	(0.07)	(0.26)	(0.07)	(0.07)	(0.26)	(0.07)	(0.07)	(0.25)	(0.07)
GDP_j	2.16**	1.27**	2.15**	2.16**	1.27**	2.15**	2.14**.	1.26**	2.13**
	(0.07)	(0.26)	(0.07)	(0.07)	(0.26)	(0.07)	(0.07)	(0.25)	(0.07)
dist	-1.63**	-1.24**	-1.56**	-1.65**	-1.28**	-1.58**	-1.82**	-1.55**	-1.77**
	(0.27)	(0.30)	(0.30)	(0.26)	(0.28)	(0.28)	(0.25)	(0.28)	(0.28)
gap							-0.18*	-0.23**	-0.18*
							(0.08)	(0.08)	(0.08)
imremote		-1.41**			-1.41**			-1.41**	
		(0.24)			(0.24)			(0.24)	
exremote		-0.87**			-0.86**			-0.86**	
		(0.25)			(0.24)			(0.24)	
exland		-0.22	0.06		-0.22	0.06		-0.21	0.08
		(0.61)	(0.61)		(0.61)	(0.61)		(0.60)	(0.60)
imland		0.77	1.44**		0.77	1.44**		0.79	1.46**
		(0.50)	(0.49)		(0.50)	(0.49)		(0.49)	(0.48)
contingency		-0.26	-0.64		-0.07	-0.47		0.12	-0.19
		(0.61)	(0.63)		(0.60)	(0.62)		(0.69)	(0.70)
language		2.84**	2.45**		2.84**	2.45**		2.88**	2.54**
		(0.38)	(0.38)		(0.38)	(0.38)		(0.39)	(0.39)
colony		0.12	0.80		0.13	0.79		0.09	0.66
		(0.37)	(0.42)		(0.37)	(0.43)		(0.47)	(0.55)
comcol		-0.35	-0.38		-0.35	-0.37		-0.39	-0.4
		(0.67)	(0.65)		(0.67)	(0.65)		(0.70)	(0.68)
China	-0.32	-0.37	-0.69	-0.05	-0.06	-0.10*	-0.35	-0.41	-0.53*
	(0.39)	(0.40)	(0.40)	(0.05)	(0.05)	(0.05)	(0.27)	(0.26)	(0.27)
HK	1.27*	0.95	0.66	0.16*	0.12	0.09	0.44	0.25	0.18
	(0.57)	(0.55)	(0.56)	(0.07)	(0.07)	(0.07)	(0.34)	(0.33)	(0.34)
Indonesia	-0.58	0.34	-0.21	-0.06	0.04	-0.02	-0.36	0.07	-0.13
	(0.44)	(0.47)	(0.47)	(0.06)	(0.06)	(0.06)	(0.30)	(0.29)	(0.31)
Japan	-1.98**	-1.02*	-1.78**	-0.25**	-0.13**	-0.22**	-0.19	-0.06	-0.21
	(0.40)	(0.41)	(0.41)	(0.05)	(0.05)	(0.05)	(0.28)	(0.27)	(0.28)
Korea	0.08	0.93*	0.30	0.00	0.11*	0.03	0.30	0.49	0.29
	(0.35)	(0.38)	(0.40)	(0.04)	(0.05)	(0.05)	(0.28)	(0.27)	(0.28)
Malaysia	2.91**	2.76**	2.71**	0.39**	0.36**	0.36**	1.55**	1.41**	1.35**
	(0.43)	(0.45)	(0.44)	(0.05)	(0.05)	(0.05)	(0.29)	(0.27)	(0.27)
Philippines	1.74**	2.03**	1.51*	0.22**	0.26**	0.20*	0.58	0.63	0.45
	(0.66)	(0.69)	(0.68)	(0.08)	(0.09)	(0.09)	(0.38)	(0.38)	(0.39)
Singapore	3.01**	2.49**	2.40**	0.41**	0.34**	0.33**	1.05*	0.80**	0.79**
	(0.41)	(0.42)	(0.42)	(0.05)	(0.05)	(0.05)	(0.25)	(0.26)	(0.26)
Thailand	1.50**	2.27**	1.97**	0.20**	0.29**	0.26**	0.68**	1.05**	0.88**
	(0.35)	(0.37)	(0.36)	(0.04)	(0.05)	(0.04)	(0.25)	(0.27)	(0.26)
Vietnam	1.78**	2.63**	2.29**	0.23**	0.33**	0.29**	0.15	0.46	0.37
	(0.54)	(0.54)	(0.54)	(0.07)	(0.07)	(0.07)	(0.24)	(0.24)	(0.25)
Cambodia	-2.32*	-1.54	-1.81	-0.30*	-0.20	-0.24	-0.86*	-0.61	-0.66
	(1.01)	(1.01)	(1.02)	(0.14)	(0.13)	(0.14)	(0.35)	(0.34)	(0.35)
constant	-62.69**	15.30	-63.32**	-62.39**	15.59	-63.09**	-59.63**	19.14	-60.15**
	(3.93)	(13.90)	(4.23)	(3.80)	(13.88)	(4.12)	(3.73)	(13.33)	(4.20)
R-sq	0.6333	0.6551	0.6459	0.6335	0.6552	0.646	0.6298	0.6525	0.643
Obs.	1144	1144	1144	1144	1144	1144	1144	1144	1144

Notes: The dependent variable is trade values of machinery parts & components. Heteroskedasticity-consistent standard errors (White) are in parentheses. ** and * show 1% and 5% significance, respectively.

Table 8. Cost Structure of Two-dimensional Fragmentation

	Service link cost connecting production blocks	Production cost per se in production blocks
Fragmentation along the distance axis	*Cost due to geographical distance* Elements (examples): transportation, telecommunications, inefficiency in distribution, trade impediments, coordination cost	*Cost reduction from location advantages* Elements (examples): wage level, access to resources, infrastructure service inputs such as electricity, water, and industrial estates, technological capability
Fragmentation along the disintegration axis	*Transaction cost due to losing controllability* Elements (examples): Information gathering cost on potential business partners, monitoring cost, risks on the stability of contracts, immature dispute settlement mechanism, other deficiency in legal system and economic institutions	*Cost reduction from (dis)internalization* Elements (examples): availability of various types of potential business partners including foreign and indigenous firms, development of supporting industry, institutional capacity for various types of contracts, degree of incomplete information

Source: Kimura and Ando (2005)

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Table 9. Investment Climate: A Ranking in 12 East Asian Countries and in the World

	Japan	Korea	Singapore	Hong Kong	Taiwan	China
Prevalence of trade barriers	8 (63)	5 (42)	1 (3)	2 (6)	3 (30)	10 (83)
Financial market sophistication	3 (22)	6 (36)	2 (10)	1 (6)	5 (31)	10 (87)
Railroad	1 (1)	5 (12)	3 (7)	2 (6)	6 (15)	7 (42)
Seaport	3 (12)	6 (19)	1 (1)	2 (4)	5 (16)	8 (62)
Airport	3 (12)	6 (31)	1 (1)	2 (5)	5 (20)	10 (77)
Electricity	1 (3)	4 (27)	2 (13)	3 (17)	5 (28)	8 (80)
Local supplier quantity	1 (1)	5 (22)	7 (33)	2 (12)	3 (14)	8 (37)
Local supplier quality	1 (1)	5 (24)	4 (20)	2 (12)	3 (16)	9 (68)
Legal framework	4 (27)	7 (48)	1 (8)	2 (10)	5 (31)	8 (57)
Business costs of crime & violence	4 (23)	7 (45)	1 (3)	2 (9)	3 (22)	9 (65)
Intellectual property protection	2 (18)	6 (27)	1 (1)	4 (25)	5 (26)	8 (63)

	Malaysia	Thailand	Philippines	Indonesia	Vietnam	Cambodia
Prevalence of trade barriers	4 (38)	9 (65)	6 (44)	7 (58)	12 (107)	11 (99)
Financial market sophistication	4 (24)	7 (41)	8 (55)	9 (70)	11 (88)	12 (112)
Railroad	4 (10)	8 (44)	12 (103)	9 (52)	10 (65)	11 (97)
Seaport	4 (13)	5 (16)	10 (84)	9 (71)	12 (89)	11 (85)
Airport	4 (15)	7 (32)	9 (75)	8 (70)	12 (92)	11 (91)
Electricity	6 (31)	7 (42)	9 (83)	10 (84)	11 (88)	12 (102)
Local supplier quantity	4 (18)	6 (32)	9 (46)	11 (81)	10 (77)	12 (116)
Local supplier quality	6 (26)	7 (32)	8 (53)	10 (83)	11 (88)	12 (112)
Legal framework	3 (16)	6 (36)	11 (91)	10 (73)	9 (64)	12 (104)
Business costs of crime & violence	5 (26)	6 (39)	11 (70)	10 (66)	8 (52)	12 (83)
Intellectual property protection	3 (20)	7 (37)	10 (84)	9 (68)	11 (92)	12 (102)

Note: A ranking in the world is shown in parentheses.
Source: The World Economic Forum, *The Global Competitiveness Report 2005-2006.*

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Table 10. Weak Points in Developing Countries

Country FY	China 2005		Thailand 2005		Vietnam 2005		Indonesia 2005		Malaysia 2004	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Number of Respondent Companies	380	100	103	100	94	100	39	100	18	100
Laws and taxation systems										
Under-development of local legal system	108	28.1	7	6.8	37	39.4	9	23.1	1	5.6
Unclare operation of local legal system	263	69.2	11	10.7	35	37.2	13	33.3	1	5.6
Complex local tax collection systems	93	24.5	6	5.8	8	8.5	7	17.9	2	11.1
Unclear operation of taxation system	152	40	8	7.8	14	14.9	9	23.1	1	5.6
Increase in tax burden	83	21.8	17	16.5	4	4.3	2	5.1	2	11.1
Administration, overall										
Restrictions on foreign capital	126	33.2	9	8.7	17	18.1	6	15.4	3	16.7
Complex and vague investment permit procedures	98	25.8	7	6.8	12	12.8	6	15.4	2	11.1
Difficulty in obtaining immigration or working visas	5	1.3	4	3.9	-	-	3	7.7	-	-
Insufficient protection of intellectual property rights	202	53.2	6	5.8	9	9.6	7	17.9	1	5.6
Local restrictions on currency exchange and remittance	172	45.3	8	7.8	8	8.5	3	7.7	3	16.7
Import restrictions	76	20	10	9.7	5	5.3	5	12.8	-	-
Anti-dumping measures	16	4.2	2	1.9	2	2.1	-	-	-	-
Labor problems										
Difficulty in securing local personnel(management level)	111	29.2	53	51.5	18	19.1	18	46.2	3	16.7
Increase in labor costs	147	38.7	35	34	10	10.6	4	10.3	10	55.6
Local labor problems	74	19.5	12	11.7	5	5.3	13	33.3	3	16.7
General problems										
Intense local competition	169	44.5	46	44.7	9	9.6	13	33.3	4	22.2
Difficulty in collecting receivables	144	37.9	-	-	4	4.3	-	-	-	-
Difficulty in local financial access	26	6.8	2	1.9	-	-	1	2.6	1	5.6
Under-development of local supporting industries	36	9.5	7	6.8	26	27.7	4	10.3	1	5.6
Instability of local currency and price	24	6.3	-	-	4	4.3	11	28.2	-	-
Under-development of infrastructure	134	35.3	11	10.7	48	51.1	11	28.2	1	5.6
Under-development of physical distribution service	50	13.2	6	5.8	24	25.5	7	17.9	-	-
Unstable local security and social conditions	128	33.7	2	1.9	8	8.5	26	66.7	1	5.6
Insufficient information on investment climate	13	3.4	2	1.9	26	27.7	6	15.4	-	-

Notes: (1) indicates the number of Japanese manufacturing firms who answered the question on weak points among those who chose the country as a prospective destination for their FDI. (2) is its share in those who chose the country. These JBIC 2004 F/Y and 2005 F/Y questionnaire surveys conducted for Japanese manufacturing firms with three or more foreign affiliates including at least one manufacturing foreign affiliate. Multiple listings of destination countries are allowed.
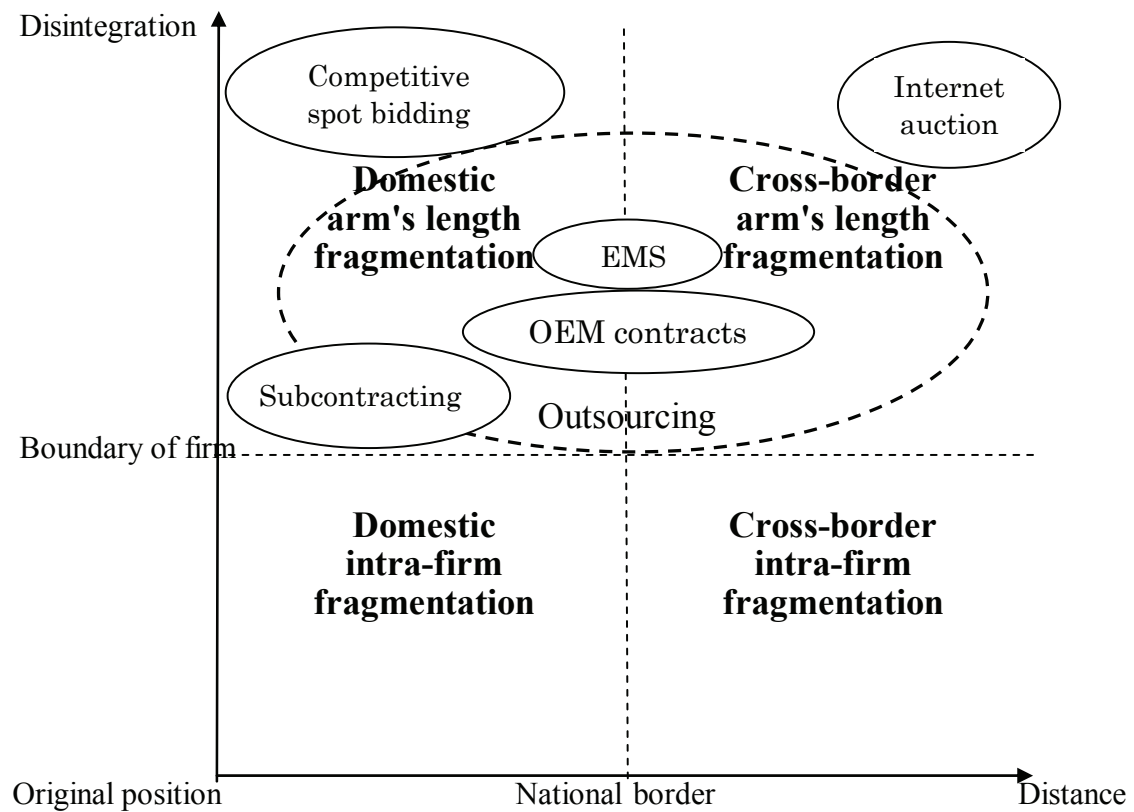
Sources: Marugami et al. (2005) and Satake et al. (2006)

Table 11. Proposal for the Development of Infrastructure

	Present situation	Proposal
China	1 Long-term weak points are the shortage of electric power, that of water in the northern provinces, and the lack of general road. 2 To supply parts within the nation, the infrastructure such as intra- and inter-regional road is needed. 3 Infrastructure to develop industrial cluster is needed. 4 The execution ability of the government for developing infrastructure is trusted. 5 The institutional difference in customs procedure and home generation of electricity among regions is a serious problem.	1 Continue the current effort basically. 2 Allow for flexible responses to requests for electric power and water. 3 Develop infrastructure such as general road to stimulate domestic industrial cooperation.
Thailand	1 Infrastructure is quite high level. Traffic jam in the city is a big problem, but is being improved. 2 Infrastructure to accelerate intra-ASEAN cooperation starts to develop. 3 The execution ability of the government for developing infrastructure is highly appreciated.	1 Continue the current effort basically. 2 Satisfy the demand of existing firms to prevent them from moving out.
Philippines	1 Infrastructure is under-developed, but economic activities are possible. 2 The lack of access road, traffic jam, and airport operation are serious problems. 3 The execution ability of the government for developing infrastructure is not appreciated.	1 Develop infrastructure, say, road and ports, for suppliers. 2 Cultivate human resources. 3 Improve the execution ability of the government. 4 Satisfy the demand of existing firms to prevent them from moving out.
Indonesia	1 Infrastructure is under-developed, but economic activities are possible. 2 The lack and decrepit of road, traffic jam, and slowness of customs procesdure are serious problems. 3 The execution ability of the government for developing infrastructure is not appreciated.	1 Almost the same as the Philippines.
Vietnam	1 Any infrastructure has not been maintained comparatively as a whole yet.	1 Develop road and railway, and enhance sea ports in the southern, for the cooperation with China and Thailand. 2 Develop domestic distribution networks.
Cambodia	1 Infrastructure is hardly maintained in all fields.	1 Develop airports and industrial road. 2 Develop the road network connected with Thailand.

Source: Furukawa (2005)

Figure 1. Two Dimensions of Fragmentation

Source: Kimura and Ando (2005)