Distance and Home-market effect: Japanese Local Port Trades with the Asia Region*

November 2006 (work in progress)

Yushi Yoshida**

Faculty of Economics

Kyushu Sangyo University

[Abstract]

An increasing returns model with trade cost predicts that firms are located in a larger economy. We recognize that this theory will be more appropriately applied in a context of local regional economy than a nation as a whole. However, as we move on to focus on local regions within a country, we expect to observe 'epicenter' (agglomeration) force for domestic market and 'periphery' (dispersion) force for export-platform in a complex way. With a very innovative dataset for international trades of Japanese local ports, this paper investigates Japanese local port exports in an empirical gravity model. We obtained strong evidence that difference in international distance due to locations of local ports has significant effect in local port export. More importantly, we found that distance elasticity is larger in absolute value for an industry with higher Asia-intensity and more differentiated products.

Keywords: Asia region, Gravity equation, Home-market effect, Local port trade.

JEL classification: F12, F14, R12.

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* We would like to thank especially Jin-Li Hu for his help with Taiwanese data and Chia-hui Lu and An-Chi Tung for their insightful comments. We would also like to thank participants of the seminar at Academia Sinica.

** Yushi Yoshida, 2-3-1 Matsukadai, Higashi-ku, Fukuoka, 813-8503 Japan. e-mail: yushi@ip.kyusan-u.ac.jp

1. Introduction

A large number of empirical researches support the important role of distance to explain the trade volume between two countries. Distance is most likely to represent transportation cost among other trade barriers associated with trade cost, namely adjacency, preferential trade arrangements, languages, and others as discussed thoroughly in Anderson and van Wincoop (2004). As a measure for international distance between two countries, gravity models usually use distance between two national capitals or commercial centers of countries. However, these measures are not appropriate if an exporting port is different from the capital. For a clear example, difference in distance is enormous between San Francisco and Washington DC. For a fixed final market we should expect differences in distance due to location differences among exporting local ports within the same national boundary should also matter for international trade.

It is just interesting to see whether distance measured from departing local ports has any significant effect on local port international trade. At an aggregate level international trade among US states and Canadian provinces are empirically investigated in a seminal paper by McCallum (1995). In this study he found statistically significant coefficient of distance to explain trades among cities in North American regions. However, due to the lack of appropriate trade data at local region level, the research along the line of McCallum (1995) could not be pursued.

With a very innovative dataset for international trades of Japanese local ports, this paper investigates Japanese local port exports in an empirical gravity model. Our research is probably a very first attempt in the literature to use local port international trade data at this fine disaggregation, namely 4-digit HS classification products. It is our hope to find variety of future agenda from this basic research project. A priori location difference of local ports within a country seems to matter more for international trade with proximate countries because international long distance overwhelms differences in within-national distance. So it is more intriguing to restrict our partner countries to the Asia region.

Significant role of distance in international trade has different implications for port level trade. For a bilateral country trade, significant role of distance just implies that a pair of countries will trade more if they are closer or a country would tend to trade more with a nearby country than with a distant country. It does not have any implications regarding to geographical structures of domestic industries. However, if we have some evidence that distance also matters even for local port international trades, then locations of industry might be affected by international trades. Let us go through this thought experiment.

With two regions (points) models Krugman (1991) shows externalities from both forward and backward linkages can lead manufacturing firms to agglomerate in the core region. With a natural extension to a real world of closed economy, firms may choose the geographical center of country to minimize intra-national transportation cost as in a linear-city model. We might call this 'epicenter effect' for domestic market. Suppose international trade is introduced with presumption that differences in distance among local exporting ports matters. Then it could force industries to reallocate their production site to a peripheral city to reduce international transport cost due to its proximity to trading countries. We might call this 'periphery effect' for export platform. Therefore, as we move on to focus on local regions within a country, we expect to observe 'epicenter' (agglomeration) force for domestic market and 'periphery' (dispersion) force for export-platform in a complex way.

Normally in the literature, export-platform investment is discussed in a context of the foreign direct investments. Motta and Norman (1996) develop a seminal theoretical framework for analyzing export-platform FDIs. Empirical findings in Yoshida and Ito (2006) support the effect of Japanese export- platform FDI in the Asia to promote exports of investment-recipient country. Here we assume a firm reallocate its production site to a periphery region as an export-platform for trades with the Asia region.

Closely related literature to our study is empirical investigation of home-market effect. A model with increasing return to scale and trade cost implies that a larger economy tends to export in contrast to comparative advantage model. More precisely, Feenstra et al. (2001) provide a framework in which income elasticity of exporting region is larger than that of importing country for differentiated products. With our dataset we can also investigate whether we observe home-market effects using disaggregated industry classification.

We aim to provide some evidences to answer the following important questions. Does the difference in distance to a specific country matters even among local ports within the same national boundary? The difference in distance among domestic ports is much smaller in comparison with international distance among countries. We investigate whether we can still observe some significant effect of distance on international trade among local ports even when we fix an importing country. An increasing returns model suggest that for differentiated products a region tends to export disproportionately more than income of the region. By comparing income elasticity of exporting region and importing country, we can investigate how pervasive home-market effects are with Japanese local port trades. If distance matters for port-level international trade, we also analyze how distance is related with other structures such as industry characteristics.

The structure of this paper is as follows. The next section reviews previous related researches in the literature. Section 3 describes the data, especially Japanese local port international trade. The empirical evidence of gravity model regression using local port international trade is presented in section 4. Additionally, we investigate whether industry characteristics are attributable to differences in distance elasticity. The last section concludes.

2. Related Literature

Gravity Model (Distance)

The seminal paper that uses local regional international trade data is McCallum (1995). He examines the border effect on volume of trade among 10 Canadian provinces and 30 US states. From the estimated coefficient for the border dummy, the model suggests the existence of border between two cities shrinks its trade to one-twentieths. The estimated coefficient on the distance variable is about 1.2 to 1.5 in absolute value. He explains that higher cost associated to land and air transport for intra-North-America trade accounts for his larger estimated coefficients than previous studies.

Investigation of international trade at local region level in McCallum (1995) gives a great insight in understanding international trade; however, it is important to point out that it only uses total aggregated export. On the other side, also for US-Canada trade Head and Ries (2001) investigate with national level trade but disaggregated at 106 manufacturing industries. Feenstra et al. (2001) also uses bilateral international trade among over 110 countries at national trade level but with careful division of trade among differentiated goods, reference-priced goods and homogeneous goods. However, none of previous studies use disaggregate regional international trade data as our datasets.

Epicenter (Agglomeration) effect and peripheral (dispersion) effect

Brainard (1997) uses direct foreign sales and exports by multinational corporations to investigate proximity-concentration hypothesis. In terms of location choice of production, tension between agglomeration and dispersion force interact with exogenous shock in Puga and Venables (1996). Because of forward and backward linkages between firms, productions are concentrated in one country. However, as efficient labor grows exogenously, wage differentials between countries become so wide that it would be beneficial for a firm to move from a production-agglomerated country to a lower wage country.

Home market effect

An increasing returns model leads to that production should be located in a single place to realize the scale economies. Additionally, an assumption of transportation cost requires a firm to be closer to a larger market to minimize costs. As a result a country tends to export those goods with large demand at home; this is called as home-market effect by Krugman (1980). This home-market effect can not be observed in a comparative advantage model; a country will be an importer of goods with strong home demand.

There are two strands of empirical methodology to test home-market effects in terms of choices of variables used in regressions. One is to look at home-market effect as more than proportionate increase in production with respect to demand increase. Davis and Weinstein follow this approach to use regional demand and production data for both OECD countries in Davis and Weinstein (2003) and Japanese prefectures in Davis and Weinstein (1999). The investigation of US and Canadian industry by Head and Reis (2001) also follows this approach.

The other approach is to directly measure the income elasticity of exports in gravity model regressions, see Feenstra et al. (2001), Hanson and Xiang (2004) and Jensen (2006) among others. Feenstra et al. (2001) compares export elasticities with respect to income of exporting country and importing country. They found that income elasticity associated with exporter's income should be higher for a monopolistic competition model with free entry. This result is consistent with other varieties of increasing returns models. We will follow this latter approach to test home-market effect.

Important caveat from theoretical advancements is that the general result of home-market effect depends upon some of underlying parameters; relative size of transportation cost in the differentiated and the homogeneous industry in Davis (1998) and demand elasticity of substitution between two industries in Yu (2005). If transportation costs are same for both industries or demand elasticity of substation between two industries is low, home-market effect may disappear.

3.Data

This paper investigates into Japanese local-port international trade with very innovative dataset for each local port custom jurisdiction. The Ministry of Finance, Japan, provides the trade statistics for each custom jurisdiction. Because of the extremely large size of data, datasets are dispersed over eight hundred files for each custom jurisdiction. It is impossible to start an even simple analysis of this dataset without the use of efficient programming by the computer language programs. We needed to create an original software to construct usable datasets from original dispersed datasets.

Custom ports in Japan

The total numbers of 209 offices of Custom, Ministry of Finance, are situated closely to ports/airports which engage in international trade. The organization of Japanese Custom consists of nine major headquarters, namely Hakodate, Tokyo, Yokohama, Nagoya, Osaka, Kobe, Moji, Nagasaki, Okinawa, 67 branches and other local 133 offices. Corporations or individuals which intend to ship goods to abroad are required to submit export declaration form via internet system called the NACCS, Nippon Automated Cargo Clearance System. Information required to submit to the Custom include departing ports in Japan, destination country, the value of shipments in terms of Japanese yen, departure date and 9-digit classification code for exporting goods among other information.

Trade Values

We use exports values from six Japanese major ports, Tokyo, Yokohama, Nagoya, Osaka, Kobe, and Fukuoka, to nine Asian economies, China, Hong Kong, Taiwan, Korea, Singapore, Malaysia, Thailand, Philippines, and Malaysia between

1990 and 2004. We note that Fukuoka is actually constructed to consists of six ports to enclave Fukuoka economic region; Shimonoseki, Moji, Tobata, Kanda, Hakata and Fukuoka Airport.

Income Variables

Gross domestic products series in national currency and exchange rate in terms of national currency per US dollars are drawn from *International Financial Statistics*, IMF. For Taiwan, GDP and exchange rate series are taken from *Taiwan Statistical Data Book*, Council for Planning and Development, Executive Yuan, ROC (Taiwan). We then calculated GDP of Asian economies in terms of Japanese yen. These values are summarized in Table 1.

For the size of economy for Japanese six ports, it would be undervaluing the size of economy which engage in exports from the port if only adjacent city is considered because it is pervasive for plants located in other distant cities to bring their products to these major ports by using land transportations. We used 'values of manufacturing goods shipments' in prefectures containing these major ports[1]. These are Tokyo, Kanagawa, Aichi, Osaka, Hyogo, and Fukuoka prefectures for respectively Tokyo, Yokohama, Nagoya, Osaka, Kobe, and Fukuoka cities. These values are from various issues of *Census of Manufacturing*, Ministry of Economy, Trade and Industry and reported in Table 2.

Distance

[1] The definition for 'values of manufactured goods in shipments' in Census of Manufacturing actually include other incomes from processing fees, repair fees, shipments for scraps, and consumption tax as well.

Distance was measured as great circle distance between two cities following two steps. First, we used capital city for the exact location of Asian economies while Japanese port names exactly corresponds with Japanese city names. Then, latitude and longitude data for each city are drawn from Heaven-Above GmbH homepage. Second, with these latitude and longitude data, surface distances between two cities are calculate by Java program maintained by Dr. John Byers homepage. Calculated distances are in Table 3.

Statistical summary

The difference in distance between Asian countries and major Japanese ports should become clearer for a country in close proximity to Japan. For example, being the closest country to Japan, the difference among Japanese ports in distance to Korea are quite dramatic. While the distance between Soul and Fukuoka is only 539 kilometers, the distance between Soul and Tokyo is more than two-folds, 1,188 kilometers. In contrast, as a country being located at the furthest southwest from Japan, the distance from Tokyo to Jakarta is only 13% longer than the distance between Jakarta and Fukuoka.

We should note that there are large fluctuations in nominal GDP in terms of yen for Asian countries due to exchange rate fluctuations of their currencies with respect to Japanese yen. It is also noteworthy that manufactured goods shipments for Japanese prefectures for Aichi and Fukuoka remained at same level while other prefectures experienced dramatic drop in their figures due to the sluggish economy and outward shifts of production during this period.

4. Empirical Results

A. Share index (By country)

To see whether a particular port has any inclination to export more toward Asian countries, we calculated the share index, the ratio of local port export to Japanese national export, for each Asian country. Direct comparison of this share index across ports does not give tell us much about geographical structure of Japanese exports because share index will simply have tendency to be higher for the ports with larger volume of trade over all. We also calculated this share index for total exports to the world. This total share index can be considered as average tendency of a port to export to any particular countries.

As a preliminary investigation for example, exports of Fukuoka region defined as six local ports, namely Moji, Shimonoseki, Kanda, Tobata, Hakata, and Fukuoka Airports, are depicted in Figure 6. Fukuoka is the metropolitan city in Kyushu, the third largest island, and enjoys the close proximity with Busan in Korea. The ratios of Fukuoka region exports to Japanese national export are shown for the nine Asian economies along the total exports to the world for the period between 1988 and 2005. The ratio of Fukuoka region total export increased slightly during the sample period from 3.5 percent in 1988 to 5.3 percent in 2005. Whereas export ratios to other Asian economies are similar to the ratio of total exports, we can observe the evidence of Fukuoka exports to Korea and Philippines are much larger than its proportion. The ratio of Fukuoka export to Japanese national export for Korea is 14.2 percent, almost three folds of total export ratio, in 2005. It is important to note that this evidence does not necessarily imply that Fukuoka region exports more to Korea than to the rest of the world. What is shown in this figure is the fact that Fukuoka region tends to export more than its proportion to Korea in comparison with other regions in Japan.

Export share indices for Kobe is also noteworthy in Figure 5. For Kobe port, share indices of many of Asian economies are well above the total export index. Kobe exports to China and Indonesia have always had about ten percent higher share than overall Kobe export share in Japanese national exports. Exports to Malaysia and Thailand also maintained higher share than the total export share.

Figure 1 through Figure 4 depicts these indices for other Japanese major ports. For Tokyo ports, the share of Singapore used to be higher than average but declined to average level in recent years. For Yokohama port, share indices for China and Thailand in 1988 were almost ten percent above the total share index; however, these spread declined gradually to near five percent. For Nagoya port no Asian countries is prominently above the average tendency of exporting. Exports to Singapore and Korea had been kept as low as half the level of total share index. For Osaka port, exports to Korea and Taiwan have constantly stayed above the over all tendency of exports.

From comparing share indices across ports, we can observe some evidence of more than proportionate share of exports to Asian economies for Asia-proximate Japanese ports.

B. Gravity regression (Aggregate)

We formally estimate distance effect we observed in previous subsection. Estimation model closely follow a general form of gravity model.

$$LEXP_{ijt} = \alpha LPGDP_{it} + \beta LCGDP_{jt} + \gamma LDIST_{ij} + \lambda_i + \eta_j + \varepsilon_{ijt} \qquad (1)$$

where $LEXP_{ijt}$ is log of export value from port i to country j at year t, $LPGDP_{it}$ is log value of manufactured goods shipments in prefecture containing port i, $LCGDP_{jt}$ is log gross domestic product of importing country j and $LDIST_{ij}$ is log distance between port i and country j. Port dummies and country dummies are λ_i and η_j, respectively. The first row in Table 4 presents positive effect of economic size for exporting economy and importing economy and distance between these economies at one percent significance level. This result is consistent with previous literature and provides evidence for significant effect of distance even when exports are divided among custom ports. However, this result might be spurious because significant effect of distance might be driven by different location of importing countries rather than different locations of exporting custom ports. Therefore, we re-estimate equation (1) separately with each importing country to control for difference in distance caused by importing country locations.

The second row through the tenth row in Table 4 show estimated coefficients for these variables when samples are split for each importing country. Interestingly, coefficients for distance remained statistically significantly negative for all countries except China and Hong Kong even when an importing country is fixed to single country and difference in distance is only driven by locations of local ports. We confirm this evidence as significant role of distance even in a context of departing ports within a country.

C. Gravity regression (Disaggregate at HS2 industry)

With our finely disaggregated dataset, we can investigate whether difference in industry characteristics has any significant impact on the coefficients of distance. We run regressions very similar to equation (1) with export values disaggregated to HS 4-digit commodity as in equation (2). For each HS2-digit industry,

$$LEXP_{ijkt} = \alpha LPGDP_{it} + \beta LCGDP_{jt} + \gamma LDIST_{ij} + \lambda_i + \eta_j + \mu_k + \varepsilon_{ijt} \qquad (2)$$

where only differences from equation (1) are additional subscript k for log of export value and HS4-digit commodity fixed effects, μ_k. Export value of port i to importing country j for HS 4-digit commodity k belonging to the same HS 2-digit industry is regressed on income of port and country and distance between them.

Estimated coefficients of log distance for each HS 2-digit industry is presented in Table 5. The HS 2-digit industry is reordered to ascending order of distance coefficients. From these regressions we can observe three important findings. First, the range for coefficients of distance is quite large from- 6.4 to + 6.9. Second, although the range for estimated coefficients is large, most of them fall into the negative range. 78 HS 2-digit industries have negative estimated coefficients and 60 of them are statistically significant at ten percent level. Only 8 HS 2-digit industry have statistically significant positive estimated coefficients.

Third, with casual observation we can associate some group of industry to have negatively larger coefficients. With definitions of HS 2-digit industry in Appendix A, HS2 (50) through HS2 (63) belong to Section XI [Textiles and Textile Articles]. Nine of these 14 industries are ranked above the 18th in negatively large coefficients. More sophisticated analysis requires some characteristics indices for industry such as share of Asian economy in Japanese export to the world, degree of differentiation products, and industry average for product unit weights and unit prices. In the following we discuss briefly each of these important industry characteristics.

Since we are restricting our sample of importing countries to nine Asian economies, distance with consideration to exporting ports should matter more if exports of a particular industry are concentrated in the Asia region.

Feenstra et al. (2001) estimate gravity model regression for bilateral trade of differentiated goods, reference priced goods, and homogeneous goods. However, they unfortunately do not discuss the evidence for industry differences in estimated coefficients of distance in their paper, because the paper focuses on differences in income coefficients between an exporter country and an importer country. In Table 2 of their paper, estimated coefficients of distance for differentiated goods are higher than those of homogeneous goods.

We could assume that transportation cost would be higher for industry, the heavier and less expensive an average unit product in industry is.

D. Home market effect

In Table 5 we calculated statistics to test home-market effecs as in equation (3).

$$HME = \frac{\alpha - \beta}{\sqrt{Var(\alpha - \beta)}} \qquad (3)$$

where α and β are estimated coefficients from equation (2). The null hypothesis is HME < 0, that is, income elasticity of exports for local port income is less than that of importing country. With ten percent level of statistical significance, the home-market effects are observed for 37 industries. An increasing returns model with higher transportation cost for manufacturing products suggests that products in these HS 2-digt industry are differentiated products. In turn we use these measures to indicate industry characteristics for heterogeneity of products.

E. Distance impact, Asia intensity, and home-market effect

In previous subsections, we presented pervasive evidence of significant effect of distance in Japanese local port exports to Asian economies. At the same time, we also observed large differences in estimated coefficients for distance among HS 2-digit industries. In this subsection we would like to further investigate into industry characteristics for an explanation to variations in distance elasticities. We explore two forces: importance of Asian economies as a market for an industry and degree of product differentiation in terms of home-market effect.

For the objective of this paper to determine whether location differences of local ports influence international trade, sample counties are selected to include only countries proximate to Japan to emphasize differences in distance among local ports. The intuition is straightforward that reduction in transportation cost to locate export-platform plants in a region closest to destination country is more prominent especially for a country closer to an exporting country. This mechanism should actually work in our empirical sample countries only if Asian economies as an export market are relatively important for a particular industry.

In Table 6 we calculated the ratios of Japanese exports for nine Asian economies to Japanese total exports to the world, ASIA9RATIO, for each HS 2-digit industry. The ratio is calculated by summing up all export values during sample period from 1990 to 2004 under the same HS2-digit industry. The smallest ratios are 0.02 for aircraft industry (88 for HS2) and 0.05 for headgear industry (65 for HS2) and the largest ratio is 0.75 for Wool and other fabric industry (51 for HS2). For more important industry in terms of trade volumes, the ratios are 0.33 for general machinery industry (84 for HS2), 0.41 for electrical machinery industry (85 for HS2) and 0.10 for automobile industry (87 for HS2).

For an industry with small export ratio for Asian economies, exports are intended for countries located further in a global term and therefore small differences in distance caused by local ports should not matter greatly for Japanese local port exports to these Asian countries. On the other hand, if a ratio is relatively large, firm has strong incentive to locate a plant for exports in a region closer to destination countries to benefit most by minimizing transportation cost. We should be able to observe geographical dispersion of such an industry that export volume declines as local ports are located from Asian economies. As to their exports, local ports are penalized more severely for their distance from destination market. Therefore, expected sign of the ASIA9RATIO as an explanatory variable for a distance elasticity regression is negative.

HME variable is not an index but just a t-statistics, the difference in estimated income elasticity for port and importing country divided by its corresponding standard deviation. It is not clear whether statistically insignificant values should be included in a first place. Therefore, a dummy variable, D_HME, is created to take value one if null hypothesis of income elasticity of Japanese local port is equal or less than income elasticity of income of importing country.

Table 7 presents the results when distance elasticity is regressed on constant, ASIA9RATIO and HME or D_HME variables. The negative effect of high ratio of Asia trade in industry on distance elasticity is robust to the choice of home-market effect variable. In order to grasp the impact of this estimated coefficient of about -2.8 for ASIA9RATIO, for example, given other things being equal we can calculate that for 10 percent increase in share of Asian economies in Japanese exports. For export to Korea, it would increase the ratio of Fukuoka export to Tokyo export by about 25 percent[2].

Although home-market effect is statistically insignificant when t-statistics is used, dummy variable for home-market effect picks up significant negative effect on distance elasticity and improves the overall fit of the regression in terms of adjusted R-squared. For the same calculation method, given other things being equal, it would be 3.8 times larger ratio of Fukuoka export to Tokyo export for Korea when industry shows home-market effect. Therefore, this result is consistent with a casual observation on the results of Feenstra et al. (2001) in which industry with differentiated products is shown to have home-market effect and also higher distance elasticity in absolute value.

5. Conclusion

Puga and Venables (1996) explain dispersion effect in terms of real wages differences between core and periphery. Of course this real wage differences should also influence firms to start new production cluster in a periphery region in our framework. However, the mechanism underlying in Puga and Venables (1996) can not explain positive correlation between Asia intensity and distant elasticity in absolute value. It is an export-platform effect of dispersion in effect to make periphery region to

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[2] $\left(\text{distance(Korea = Fukuoka)} \big/ \text{distance(Korea = Tokyo} \right)^{0.1*(-2.8)} = \left(539 \big/ 1188 \right)^{-0.28} = 1.247$

trade disproportionately more with proximate foreign regions.

Probably we believe the following statements made by the president of automobile company make our analysis more convincing. Toyota Automobiles Kyushu newly established an engine plant in Kanda, Fukuoka in April of 2006. This is the first Toyota engine plant in Japan ever built outside of Aichi prefecture. The president of TAK responded to interviewers that easiness in recruiting able employees due to slack labor market condition and potentiality for future export-platform are for the reason expanding production in Fukuoka[3].

Although it is well beyond the scope of this paper, it would be very interesting to investigate the decision of multinational corporations to choose investment strategies between foreign direct investments and domestic export-platform investments. For Japanese multinational corporations less inexpensive factor of production in periphery region in domestic market might be compensated by avoiding costs associated with adjustments to foreign regulations, collection of local information and difficulty to coordinate with a headquarter.

[3] Nikkei Sangyo Newspaper, p14, April 19, 2006

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Figure 1: Ratio of Tokyo Exports to Japanese National Exports

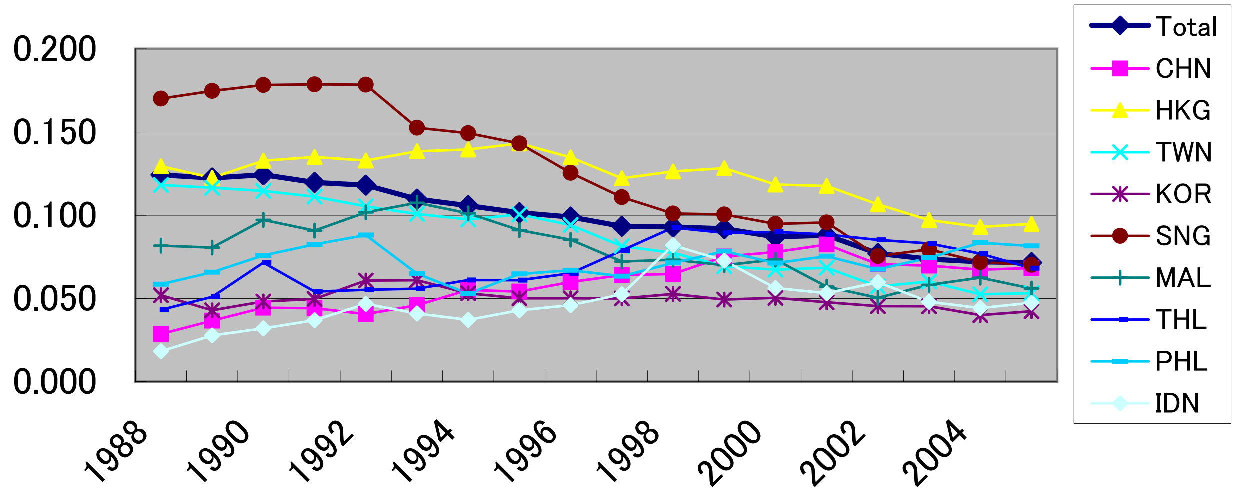

Figure 2: Ratio of Yokohama Exports to Japanese National Exports

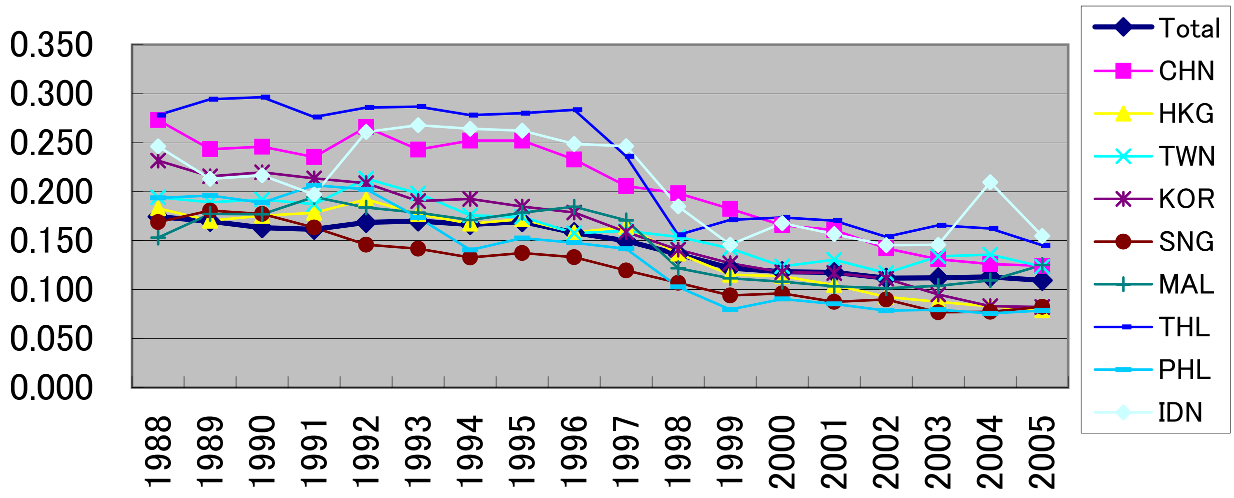

Figure 3: Ratio of Nagoya Exports to Japanes National Exports

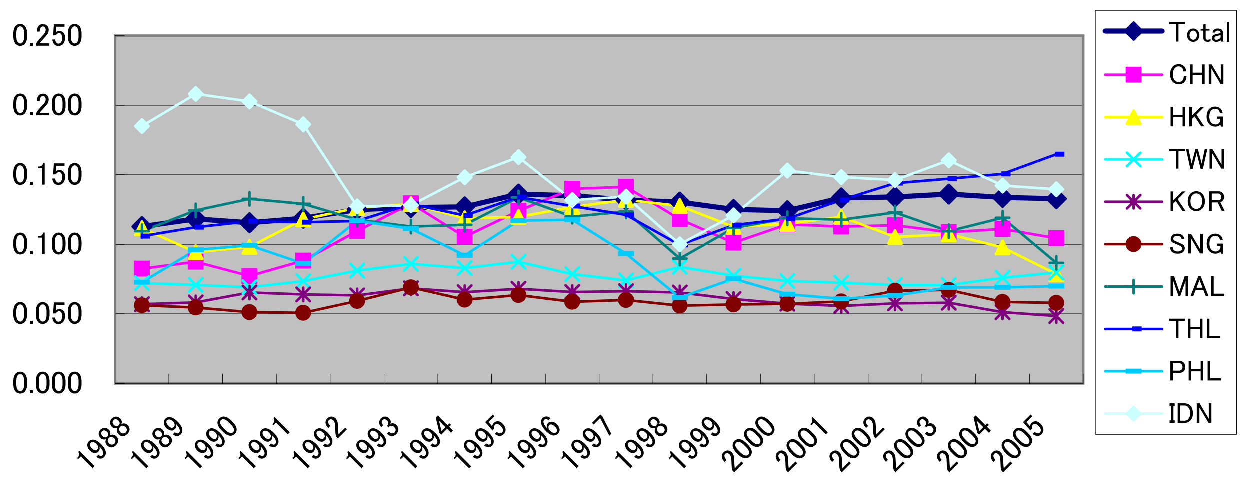

Figure 4: Ratio of Osaka Exports to Japanese National Exports

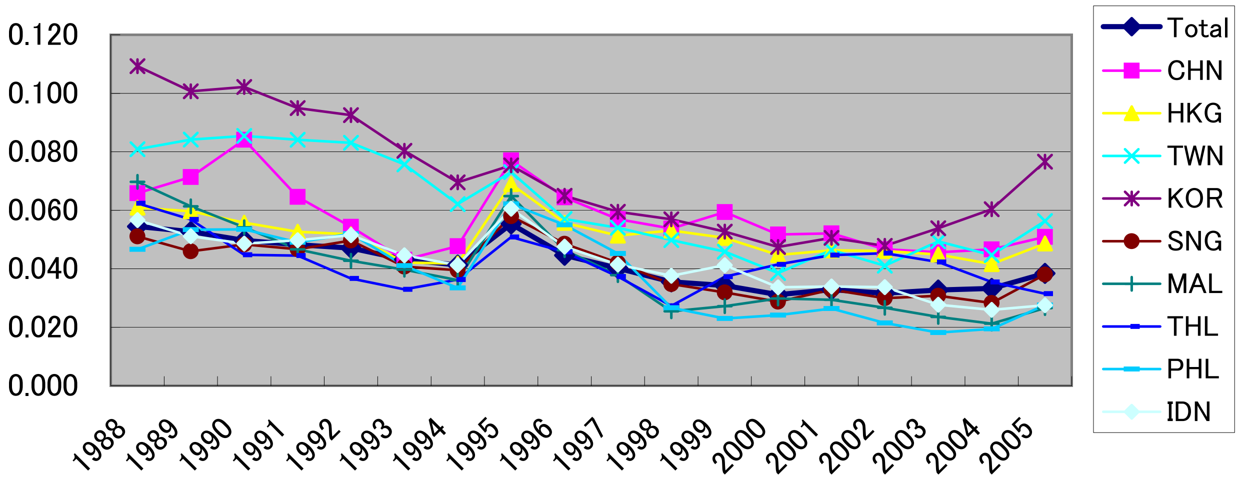

Figure 5: Ratio of Kobe Exports to Japanese National Exports

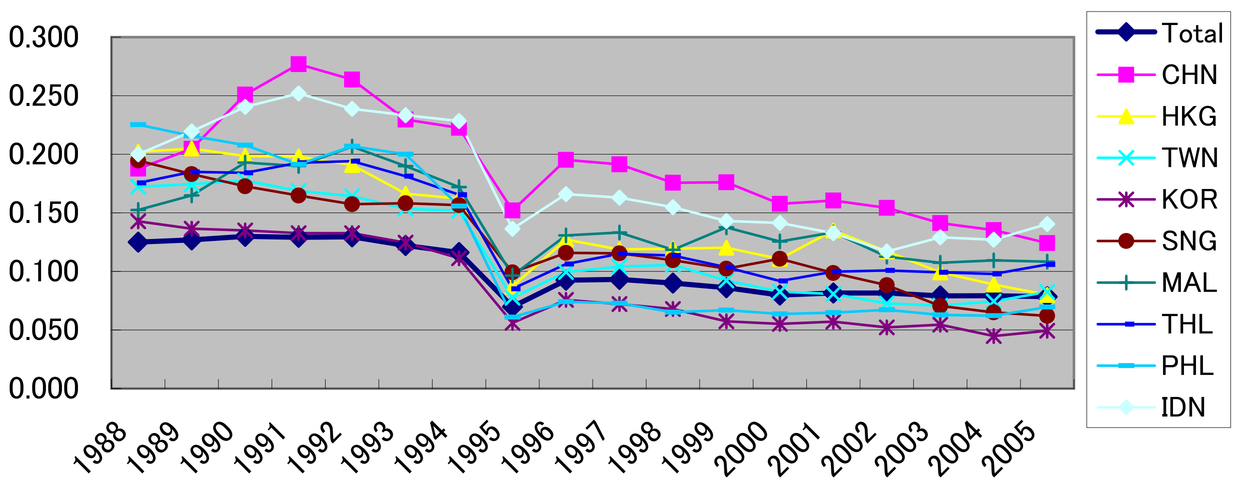

Figure 6: Ratio of Fukuoka Exports to Japanese National Exports

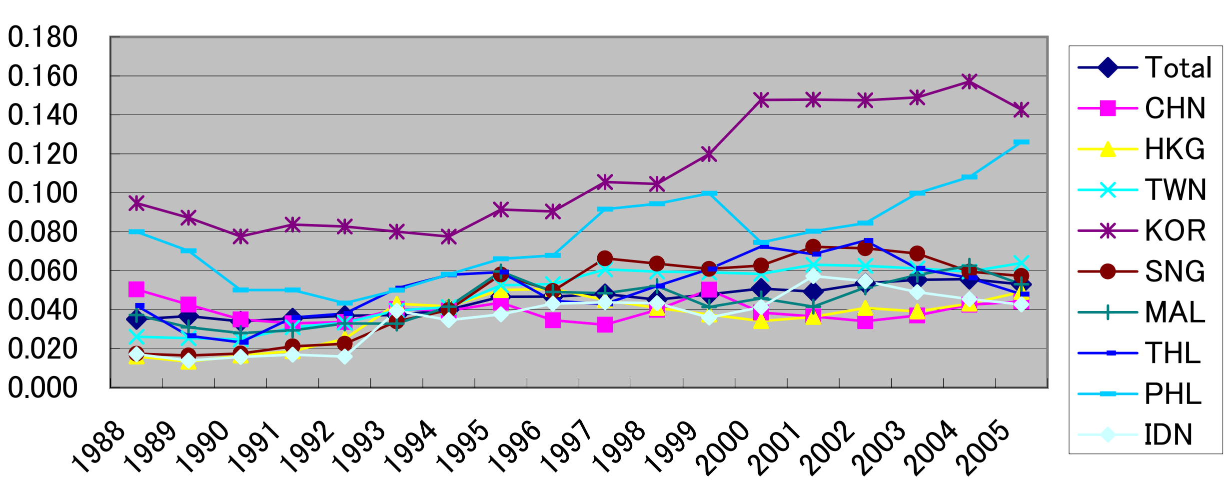

Table 1: Values of manufactured goods shipments for Japanese prefectures

(Billion Yen)

	Tokyo	Kanagawa	Aichi	Osaka	Hyogo	Fukuoka
1990	22,846	28,045	36,620	24,553	15,424	7,711
1991	23,277	28,847	38,759	25,403	16,293	8,341
1992	21,934	27,102	38,097	24,268	15,771	8,128
1993	20,213	25,275	35,466	22,184	14,898	7,952
1994	19,377	23,801	33,732	20,593	12,788	7,712
1995	19,679	24,144	33,641	20,889	14,403	7,816
1996	19,671	24,416	35,235	20,990	14,580	8,065
1997	20,064	24,937	36,660	21,036	15,195	8,305
1998	19,432	22,979	34,948	19,567	14,394	7,908
1999	18,097	21,318	33,053	18,121	13,579	7,549
2000	17,959	21,728	34,336	18,020	14,070	7,368
2001	16,569	19,862	34,536	17,278	13,121	7,357
2002	11,750	17,964	34,525	15,797	12,459	6,982
2003	11,306	18,752	35,484	15,545	12,345	7,258
2004	11,199	18,566	36,814	15,961	12,945	7,332

Source: "Value of manufactured goods shipments" from various issues of Census of Manufactures.

Table 2: Gross domestic products for 9 Asian economies

(Billion Yen)

	China	Hong Kong	Taiwan	Korea	Singapore	Malaysia	Thailand	Philippines	Indonesia
1990	55,455	10,922	23,629	36,578	5,343	6,374	12,357	6,416	16,568
1991	53,849	11,740	25,856	39,770	5,818	6,619	13,233	6,118	17,265
1992	59,400	12,948	27,436	39,862	6,315	7,492	14,116	6,710	17,619
1993	66,581	13,340	25,451	40,269	6,489	7,439	13,901	6,046	17,570
1994	55,370	13,853	25,996	43,279	7,217	7,613	14,749	6,550	18,080
1995	65,899	13,566	25,021	48,640	7,895	8,356	15,804	6,972	19,012
1996	89,401	17,292	31,436	60,660	10,024	10,970	19,792	9,012	24,733
1997	109,309	21,332	31,918	62,466	11,541	12,120	18,257	9,963	26,104
1998	124,918	21,849	37,539	45,219	10,742	9,448	14,643	8,531	12,494
1999	113,756	18,600	34,979	50,734	9,402	9,016	13,968	8,675	15,947
2000	116,299	18,186	32,769	55,139	9,992	9,733	13,225	8,181	17,783
2001	144,760	20,240	34,245	58,564	10,404	10,695	14,041	8,655	19,948
2002	163,455	20,527	36,781	68,579	11,093	11,945	15,909	9,632	25,091
2003	170,502	18,372	35,207	70,504	10,750	12,051	16,569	9,232	27,524
2004	209,515	17,943	36,510	73,624	11,631	12,817	17,494	9,381	27,513

Note: data are constructed from GDP in national currency and national currency per US dollars from International Financial Statistics, IMF. We used Taiwan Statistical Databook (2006) for Taiwan GDP and Taiwanese exchange rates.

Table 3: Distance between Asian cities and Japanese cities (kilometers)

			Latitude	34.68	34.67	35.17	35.45	35.70	33.58
			Longitude	135.17	135.50	136.92	139.65	139.77	130.40
			City	Kobe	Osaka	Nagoya	Yokahama	Tokyo	Fukuoka
				(Hyogo)	(Osaka)	(Aichi)	(Kanagawa)	(Tokyo)	(Fukuoka)
Lat.	Longi.	City							
39.90	116.41	Beijing	(China)	1752	1781	1922	2096	2137	1427
22.28	114.15	HongKong	(HongKong)	2464	2490	2582	2867	2845	2026
25.02	121.45	Taipei	(Taiwan)	1700	1724	1804	2091	2062	1287
37.57	127.00	Soul	(Korea)	800	828	969	1153	1188	539
1.29	103.86	Singapore	(Singapore)	4927	4949	5011	5295	5253	4528
3.17	101.70	KualaLumpur	(Malaysia)	4960	4983	5056	5342	5306	4544
13.75	100.52	Bangkok	(Thailand)	4178	4204	4301	4586	4565	3732
14.58	121.00	Manila	(Philippines)	2646	2662	2699	2972	2920	2314
-6.17	106.80	Jakarta	(Indonesia)	5426	5444	5485	5759	5706	5068

Note: latitude and logitude data are drawn from Heavens-Above GmbH, (http://www.heavens-above.com) and surface distance between two cities are calculated via Java programm maintained by Dr. John Byers (http://www.wcrl.ars.usda.gov/cec/java/lat-long.htm).

Table4: Local port export regressions with aggregate export value

	LPGDP	LCGDP	LDIST	adj R^2	NOB
Total	0.682***	0.901***	-1.388***	0.78	810
	(0.118)	(0.067)	(0.199)		
China	-0.769***	0.953***	0.214	0.90	90
	(0.292)	(0.090)	(0.477)		
Hong Kong	0.494**	0.555***	-0.550	0.85	90
	(0.209)	(0.130)	(0.366)		
Taiwan	0.841***	0.793***	-1.429***	0.76	90
	(0.215)	(0.188)	(0.476)		
Korea	0.704**	0.669***	-1.294**	0.68	90
	(0.268)	(0.165)	(0.570)		
Singapore	1.760***	0.553***	-1.964***	0.76	90
	(0.269)	(0.142)	(0.415)		
Malaysia	1.430***	0.799***	-1.946***	0.84	90
	(0.246)	(0.150)	(0.401)		
Thailand	-0.111	1.101***	-0.568	0.83	90
	(0.213)	(0.230)	(0.408)		
Philippines	0.292	1.419***	-1.454**	0.65	90
	(0.305)	(0.243)	(0.574)		
Indonesia	0.899***	0.893***	-1.616***	0.86	90
	(0.257)	(0.157)	(0.401)		

Note: Figures in parenthesis are standard error and "***", "**", and "*" represents statistical significance at one, five and ten percent, respectively. The results for port and country dummies are suppressed.

Table 5: Estimated coefficients of Income, Distance, and Home-market effect

	HS2	PGDP	CGDP	Distance	Adj-R^2	NOB	HME
1	60	2.393***	−0.176	−6.414***	0.57	1206	7.48***
2	58	1.241***	0.170*	−5.488***	0.49	4343	6.48***
3	54	1.533***	0.595***	−5.116***	0.55	4214	4.83***
4	51	0.983***	−0.310**	−4.628***	0.49	2337	5.00***
5	21	−0.559***	1.144***	−4.355***	0.57	3034	−9.63
6	91	2.134***	0.076	−4.320***	0.26	3793	8.72***
7	64	1.505***	0.329**	−4.123***	0.39	2822	6.12***
8	52	0.683***	0.312***	−4.085***	0.60	4296	2.14**
9	49	0.706***	0.127	−4.035***	0.46	4073	3.67***
10	3	0.249	0.799***	−3.595***	0.32	2464	−2.31
11	43	1.114*	−0.548**	−3.512**	0.32	420	3.44***
12	16	0.364	0.817***	−3.502***	0.47	1777	−1.70
13	65	−0.303	0.412**	−3.481***	0.33	1137	−2.76
14	47	−3.577***	1.852***	−3.290***	0.48	841	−11.88
15	56	0.089	0.329***	−2.975***	0.49	5004	−1.59
16	62	1.182***	−0.530***	−2.822***	0.33	5802	13.05***
17	61	0.442***	−0.295***	−2.809***	0.39	5055	5.37***
18	55	1.256***	0.035	−2.747***	0.51	6160	6.98***
19	69	0.291	0.065	−2.730***	0.38	6110	1.35*
20	1	2.442	1.288*	−2.729	0.18	89	0.45
21	19	−0.315	1.048***	−2.716***	0.45	2126	−6.10
22	85	1.567***	0.983***	−2.708***	0.48	35035	8.78***
23	35	0.318	0.611***	−2.589***	0.58	2862	−1.62
24	12	0.835***	0.628***	−2.548***	0.40	1685	0.79
25	22	−0.917***	0.915***	−2.495***	0.39	2861	−9.93
26	39	0.029	1.172***	−2.329***	0.60	19063	−16.04
27	41	0.564*	−0.391**	−2.144***	0.41	2083	3.42***
28	84	1.051***	0.777***	−2.137***	0.55	54031	5.50***
29	18	−1.141**	0.069	−2.129**	0.50	626	−3.23
30	42	1.466***	−0.277*	−2.106***	0.36	1930	7.92***
31	27	0.021	0.104	−2.077***	0.40	2870	−0.36
32	37	0.365	1.550***	−2.061***	0.60	2886	−5.36
33	57	1.142***	0.214	−1.987**	0.33	1279	3.31***
34	40	−0.073	0.783***	−1.923***	0.61	8569	−7.14
35	13	0.247	0.242	−1.856**	0.34	860	0.02
36	59	0.268	0.289***	−1.790***	0.53	4311	−0.13
37	34	−0.284	1.073***	−1.765***	0.65	4179	−9.49
38	76	0.258	0.966***	−1.690***	0.47	7608	−5.21
39	20	−0.397*	0.733***	−1.689***	0.29	2179	−5.70
40	45	−0.351	0.167	−1.639	0.16	525	−1.75
41	7	0.958***	0.001	−1.616**	0.21	1301	3.38***
42	70	0.625***	0.803***	−1.567***	0.35	8599	−1.31
43	11	−1.124***	−0.047	−1.517*	0.52	1328	−3.59
44	63	0.163	0.107	−1.462***	0.36	3409	0.30
45	50	2.098***	−0.233	−1.426	0.34	825	5.16***
46	81	−0.364	0.801***	−1.420***	0.35	3336	−6.15
47	44	0.426**	0.315***	−1.398***	0.19	4736	0.73
48	83	1.384***	0.579***	−1.390***	0.42	6435	6.09***
49	29	0.026	0.370***	−1.385***	0.39	21949	−4.36
50	90	0.737***	0.991***	−1.346***	0.54	21091	−3.23
51	17	0.015	0.707***	−1.251	0.33	1328	−2.21
52	94	0.798***	0.298**	−1.238***	0.31	3802	2.78***
53	96	0.874***	0.384***	−1.194***	0.42	8046	3.81***
54	75	−0.262	0.760***	−1.181**	0.22	2459	−4.17
55	66	1.651***	−0.595**	−1.179	0.39	468	5.97***
56	68	0.647***	0.410***	−1.129***	0.45	6483	1.71**
57	23	−0.582	−0.356*	−1.101*	0.53	1056	−0.74
58	88	−0.187	0.916*	−1.075	0.33	314	−1.80
59	95	0.638***	0.488***	−1.043**	0.52	3523	0.78
60	32	0.113	1.151***	−1.001***	0.54	8077	−8.74
61	48	0.962***	0.648***	−0.993***	0.47	12274	3.10***
62	5	0.198	−0.217	−0.935	0.28	949	1.12
63	72	0.625***	0.657***	−0.810***	0.29	16493	−0.30
64	82	0.809***	0.524***	−0.797***	0.56	9112	2.64***
65	6	−0.280	0.362	−0.730	0.18	446	−1.27
66	87	0.747***	0.233**	−0.609*	0.46	8589	3.03***
67	73	1.089***	0.453***	−0.605***	0.50	15718	7.04***
68	74	0.277*	0.859***	−0.547**	0.47	9072	−4.59
69	30	0.463*	0.537***	−0.541	0.35	2505	−0.33
70	2	0.352	0.046	−0.378	0.42	348	0.52
71	38	−0.118	0.426***	−0.304	0.48	11011	−4.79
72	86	−0.083	0.392	−0.272	0.23	1345	−1.15
73	4	−0.034	0.620**	−0.217	0.10	806	−2.08
74	28	−0.329***	0.621***	−0.212	0.29	19607	−11.23
75	92	0.302	−0.303*	−0.171	0.29	2663	2.80***
76	53	0.364	−0.317*	−0.134	0.36	1213	1.93**
77	26	0.138	0.465*	−0.125	0.34	707	−0.76
78	89	0.822**	−0.009	−0.009	0.50	1185	2.53***
79	71	0.290	0.441***	0.024	0.24	3786	−0.72
80	78	−0.106	0.787***	0.032	0.21	1519	−3.51
81	9	−0.921***	1.035***	0.160	0.19	1212	−7.44
82	46	0.000	−0.514**	0.208	0.18	494	1.35*
83	8	0.407	−0.151	0.441	0.52	949	1.74**
84	25	−0.216	0.361***	0.561**	0.16	7367	−4.13
85	97	0.118	−0.206	0.821	0.18	353	0.66
86	31	−0.099	−0.482*	0.825	0.39	1101	1.07
87	15	−0.102	0.013	1.172***	0.21	3719	−0.67
88	24	1.543	0.408	1.518	0.34	246	1.15
89	80	−1.753***	0.595***	1.835***	0.28	1526	−9.63
90	79	0.891***	0.436**	2.632***	0.25	1990	1.69**
91	67	1.468***	0.760***	2.944***	0.19	376	1.83**
92	93	−1.310	−0.738	3.596	0.34	117	−0.78
93	14	0.401	−0.522*	5.805***	0.10	391	2.00**
94	36	0.642	−0.142	5.874***	0.52	262	1.23
95	10	−0.731	−1.606**	6.889*	0.29	168	0.95

Note: HS2 industry is in ascending order for estimated distance coefficients. HME is the t-statistcs for H0: PGDP-CGDP <= 0. One percent significant level for one-sided test is 2.326 (same as Normal distribution.) Statistical significance at one, five, and ten percent is represented by ***, **, *, respectively.

Table 6: The ratios of Japanese exports for 9 Asian economies to total exports

HS2	ASIA9RATIO	HS2	ASIA9RATIO	HS2	ASIA9RATIO	HS2	ASIA9RATIO	HS2	ASIA9RATIO
1	0.28	20	0.41	40	0.22	60	0.74	80	0.70
2	0.73	21	0.50	41	0.73	61	0.63	81	0.31
3	0.44	22	0.48	42	0.45	62	0.41	82	0.33
4	0.58	23	0.51	43	0.62	63	0.54	83	0.33
5	0.63	24	0.73	44	0.53	64	0.73	84	0.33
6	0.28	25	0.70	45	0.73	65	0.05	85	0.41
7	0.62	26	0.47	46	0.30	66	0.65	86	0.26
8	0.53	27	0.59	47	0.72	67	0.56	87	0.10
9	0.37	28	0.50	48	0.52	68	0.42	88	0.02
10	0.16	29	0.42	49	0.32	69	0.39	89	0.13
11	0.73	30	0.17	50	0.43	70	0.53	90	0.31
12	0.37	31	0.49	51	0.75	71	0.53	91	0.57
13	0.46	32	0.53	52	0.62	72	0.59	92	0.16
14	0.63	34	0.65	53	0.66	73	0.35	93	0.00
15	0.39	35	0.42	54	0.49	74	0.70	94	0.32
16	0.52	36	0.11	55	0.56	75	0.54	95	0.23
17	0.59	37	0.27	56	0.47	76	0.63	96	0.29
18	0.65	38	0.48	57	0.43	78	0.70	97	0.15
19	0.45	39	0.55	58	0.64	79	0.66		
				59	0.56				

Note: The ratio is calculated as the value of exports to nine Asian economies divided by the value of exports to the world.

Table 7: Distance, Asia Intensity, and Product differentiation

dependent variable: estimated distance elasticity

	(1)	(2)
constant	0.085	0.579
	(0.595)	(0.574)
ASIA9RATIO	−2.861**	−2.821**
	(1.184)	(1.109)
HME	−0.054	
	(0.044)	
D_HME		−1.704***
		(0.451)
NOB	95	95
adj R^2	0.05	0.17

Note: D_HME takes value one if HME is larger than 2.326 which is one percent significant level for the number of observations used in gravity model regressions. Figures in parenthesis are standard error and "***", "**", and "*" represents statistical significance at one, five and ten percent, respectively.

Appendix A: Descriptions of Chapters (Two-digit HS Classification Codes)

1 Live animals.
2 Meat and edible meat offal.
3 Fish & crustacean, mollusc & other aquatic invertebrate
4 Dairy prod; birds' eggs; natural honey; edible prod nes
5 Products of animal origin, nes or included.
6 Live tree & other plant; bulb, root; cut flowers etc
7 Edible vegetables and certain roots and tubers.
8 Edible fruit and nuts; peel of citrus fruit or melons.
9 Coffee, tea, mat・and spices.
10 Cereals.
11 Prod mill indust; malt; starches; inulin; wheat gluten
12 oil seed, oleagi fruits; miscell grain, seed, fruit etc
13 Lac; gums, resins & other vegetable saps & extracts.
14 Vegetable plaiting materials; vegetable products nes
15 Animal/veg fats & oils & their cleavage products; etc
16 Prep of meat, fish or crustaceans, molluscs etc
17 Sugars and sugar confectionery.
18 Cocoa and cocoa preparations.
19 Prep of cereal, flour, starch/milk; pastrycooks' prod
20 Prep of vegetable, fruit, nuts or other parts of plants
21 Miscellaneous edible preparations.
22 Beverages, spirits and vinegar.
23 Residues & waste from the food indust; prepr ani fodder
24 Tobacco and manufactured tobacco substitutes.
25 Salt; sulphur; earth & ston; plastering mat; lime & cem
26 ores, slag and ash.
27 Mineral fuels, oils & product of their distillation; etc
28 Inorgn chem; compds of prec met, radioact elements etc
29 organic chemicals.
30 Pharmaceutical products.
31 Fertilizers.
32 Tanning/dyeing extract; tannins & derivs; pigm etc
33 Essential oils & resinoids; perf, cosmetic/toilet prep
34 Soap, organic surface-active agents, washing prep, etc
35 Albuminoidal subs; modified starches; glues; enzymes.
36 Explosives; pyrotechnic prod; matches; pyrop alloy; etc
37 Photographic or cinematographic goods.
38 Miscellaneous chemical products.
39 Plastics and articles thereof.
40 Rubber and articles thereof.
41 Raw hides and skins (other than furskins) and leather.
42 Articles of leather; saddlery/harness; travel goods etc
43 Furskins and artificial fur; manufactures thereof.
44 Wood and articles of wood; wood charcoal.
45 Cork and articles of cork.
46 Manufactures of straw, esparto/other plaiting mat; etc
47 Pulp of wood/of other fibrous cellulosic mat; waste etc
48 Paper & paperboard; art of paper pulp, paper/paperboard
49 Printed books, newspapers, pictures & other product etc
50 Silk.
51 Wool, fine/coarse animal hair, horsehair yarn & fabric
52 Cotton.
53 other vegetable textile fibres; paper yarn & woven fab
54 Man-made filaments.
55 Man-made staple fibres.
56 Wadding, felt & nonwoven; yarns; twine, cordage, etc
57 Carpets and other textile floor coverings.
58 Special woven fab; tufted tex fab; lace; tapestries etc
59 Impregnated, coated, cover/laminated textile fabric etc
60 Knitted or crocheted fabrics.
61 Art of apparel & clothing access, knitted or crocheted.
62 Art of apparel & clothing access, not knitted/crocheted
63 other made up textile articles; sets; worn clothing etc
64 Footwear, gaiters and the like; parts of such articles.
65 Headgear and parts thereof.
66 Umbrellas, walking-sticks, seat-sticks, whips, etc
67 Prepr feathers & down; arti flower; articles human hair
68 Art of stone, plaster, cement, asbestos, mica/sim mat
69 Ceramic products.
70 Glass and glassware.
71 Natural/cultured pearls, prec stones & metals, coin etc
72 Iron and steel.
73 Articles of iron or steel.
74 Copper and articles thereof.
75 Nickel and articles thereof.
76 Aluminium and articles thereof.
78 Lead and articles thereof.
79 Zinc and articles thereof.
80 Tin and articles thereof.
81 other base metals; cermets; articles thereof.
82 Tool, implement, cutlery, spoon & fork, of base met etc
83 Miscellaneous articles of base metal.
84 Nuclear reactors, boilers, mchy & mech appliance; parts
85 Electrical mchy equip parts thereof; sound recorder etc
86 Railw/tramw locom, rolling-stock & parts thereof; etc
87 Vehicles o/t railw/tramw roll-stock, pts & accessories
88 Aircraft, spacecraft, and parts thereof.
89 Ships, boats and floating structures.
90 optical, photo, cine, meas, checking, precision, etc
91 Clocks and watches and parts thereof.
92 Musical instruments; parts and access of such articles
93 Arms and ammunition; parts and accessories thereof.
94 Furniture; bedding, mattress, matt support, cushion etc
95 Toys, games & sports requisites; parts & access thereof
96 Miscellaneous manufactured articles.
97 Works of art, collectors' pieces and antiques.
98 Special Classification Provisions
99 Special Transaction Trade.

Note: Descriptions are from OECD International Trade by Commodity Statistics