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# Export-Platform Investment with Proximity and Product Differentiation: Empirical Evidence from Port-Level International Trade

Yushi Yoshida
Faculty of Economics
Kyushu Sangyo University

# Export-platform investment with proximity and product differentiation: Empirical evidence from port-level international trade*

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**[Abstract]**

Multinational firms engage in foreign direct investments to minimize production costs and trade costs. In stead of making foreign direct investment, a firm may find optimal to produce in a periphery region of home country as an export-platform base to minimize these costs. With over 1,000 products categories of exports for six major Japanese ports, this paper empirically examines exports of sub-regions within a country in a gravity model. We obtained strong evidence that proximity of local ports to foreign market increases local-port exports even when destination is fixed to a single country. More importantly, we found that sensitivity of proximity of ports to foreign markets is more pronounced for an industry with higher Asia-intensity exports and a more product-differentiated industry. We can conclude from our empirical evidences that an industry with these characteristics sets up an export-platform base in peripheral regions of home country to minimize international trade costs.

Keywords: Agglomeration; Asia-intensity; Differentiated products; Export-platform; Gravity equation; Home-market effect; Port-level international trade.

JEL classification: F12, F14, R12.

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## 1. Introduction

A decision to select production location for a manufacturing firm is very subtle. It is necessary to look for a place with lower price of land and cheaper wages to minimize *production costs*. At the same time, a firm needs to search for proximity to consumers and suppliers to minimize *transportation costs*. A multinational firm searches beyond the national borders to find an optimal production site and quite often comes to a decision of making foreign direct investments in a country where the firm benefits from less expensive factors of production, or enjoys lower transportation costs to reach consumers, or maybe both. When decision is made not to go abroad, the same criteria should remain to be applied to selecting a local region within a home country.

Rapid increase of foreign direct investments in the world is well-documented. If these foreign direct investments are driven by continuous search for lower production costs and trade costs by multinationals, then we can argue that a peripheral city of home country can also be a strong candidate production site for minimizing these costs. In this case we can call it export-platform *domestic* investment. Normally in the literature, export-platform investment is discussed in a context of the foreign direct investments[1]. A domestic peripheral region possesses several advantages to qualify for optimal production site over other candidates in foreign countries. A firm does not need to establish overseas headquarter to coordinate between subsidiary plants in foreign countries and home-country based plants, so called coordination costs in Jones(2000). In general a firm can save an extra cost which can incur if production operation expands

[1] Motta and Norman (1996) develop a seminal theoretical framework for analyzing export-platform FDIs.

beyond the national border while it can still enjoy benefit of reducing costs by establishing a plant in local periphery regions. It is always possible to find a new region where production operation can significantly cut current production costs and transportation costs.

The following example of automobile company supports this view. *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 *Toyota Automobile Kyushu* 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[2].

If we were to observe shipments of varieties of products from different local ports, e.g., Boston and San Francisco, industry composition of export flow may look very different, reflecting various location strategies for different industries. While Europe-oriented product should consist of more than proportionate part of Boston exports, Asia-oriented product should be more than proportionately large in exports of San Francisco. From observations of local port exports, we may infer location decisions of firms for each industry[3]. Unfortunately, available dataset of international trade is almost always limited to national exports, which aggregate over all local-port exports. When we use only national export data for empirical studies, we are ignoring

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

[3] Of course, a large proportion of produced goods are consumed domestically; therefore making an inference of industry location strategies from observation of only exports might be severely biased. However, exporting sectors of industry are in most of the case very essential part of industries. We can make at least a correct inference of industry location strategies for exporting sectors of industries.

very important information lost in aggregation process.

With a very new dataset for international local-ports exports of Japan, this paper examines Japanese local-port exports in an empirical gravity model[4]. Our research is a very first attempt in the literature to examine local-port international trade data at this fine product level. The data covers exports from 6 major ports in Japan to 9 Asian economies in over 1,000 HS four-digit product categories[5]. These major six ports, i.e., Tokyo, Yokohama, Nagoya, Osaka, Kobe, and Fukuoka constitute roughly fifty percent of Japanese total exports in 2004[6]. We examine how Japanese local-port export is related to income of exporting Japanese regions, income of importing economies and distance between importing country and exporting Japanese ports. We then relate estimated coefficient of distance to industry characteristics: share of Asia to the world (Asia-intensity) and the degree of product differentiation.

Moving from the use of national exports to the use of local-port exports, we should note some caveats about distance[7]. As a measurement of distance between two countries in gravity models, previous studies usually calculate distance between two national capitals. However, distance calculated in this way is not an appropriate measure of trade cost if an actual exporting port is located very far from the capital. For an example of US export to East Asian countries, distance from San Francisco to

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[4] These data were publicly available for quite some time on a website of the Japan Custom; however, data were widely dispersed among thousands of files. They were not in a form to be easily used in an empirical research.

[5] At an aggregate level, international trade among US states and Canadian provinces are empirically investigated in a seminal paper by McCallum (1995).

[6] The shares of individual port are Tokyo(7.2%), Yokohama(11.3%), Nagoya(13.4%), Osaka(3.3%), Kobe(7.9%) and Fukuoka(5.5%). In 1988 the share of these six major ports constitutes over sixty percent.

[7] Distance is a proxy variable which represents transportation cost as well as other trade costs associated with tariffs and trade barriers, see Anderson and van Wincoop (2004).

East Asian countries is much shorter than from Washington DC. Using distance between Washington DC to an East Asian country to examine impact of trade costs on kinds of exports actually departing from San Francisco can be misleading. Our dataset can at least improve the quality of distance measure by identifying an exact export port[8].

Should difference in distance among ports within a country also matter, then locations of industry may be affected by international trades. A location difference of local ports within a country should understandably matter more for international trade with proximate countries. If international distance between Japan and an importing country is too large, then subtle differences in within-national distance across local ports may totally be canceled out. So it is more appropriate in our framework to restrict partner countries to only 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 region with relatively larger market exports more than proportionately. Feenstra et al. (2001) provide a framework in which home-market effect can be tested as income elasticity of exporting region being larger than that of importing country for differentiated products. By comparing income elasticity of exporting region and importing country, we can investigate how pervasive home-market effects can be even when a country is divided into sub-regions.

From our empirical examination we confirmed evidences that difference in distance due to export ports within a country significantly matters. More specifically,

[8] Due to lack of information, we can not identify local ports of importing countries. So our distance calculation still has measurement error.

we found empirical evidences that decrease in trade volume with respect to longer distance is more pronounced for an *Asia-intensity* industry which focus on near-by Asian countries as primary market. As a result for this industry, more than proportionate export is observed in a local port which is closer to the foreign markets. We also found supporting evidence that distance deters international trade more severely for product differentiation industry, which is measured in terms of estimated home-market effect. Overall our empirical findings strongly support that examining international trade data at local-port level can shed a new light to understanding the effect of international trade on industry locations across regions.

The rest of the paper proceeds as follows. In section 2 we outline the concept of export –platform domestic investment with regard to previous related researches in the literature. In section 3 we discuss the data, especially Japanese local-port international trade data. 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 estimated coefficients of distance. In section 5 we offer conclusions and possible directions for future work.

## 2. Conceptual Frameworks: Exports, FDI and Domestic Investments

When serving a foreign market, multinationals can either use foreign affiliates for direct sales or export products produced at home. While overseas production by foreign affiliates can avoid transportation cost and tariff, concentration of production at home can enjoy externality of production at larger scale. For example, Brainard (1997) investigates this *proximity-concentration hypothesis* by using US multinational corporation data. The question asked in other works is also at the level of country and they examine a binary choice whether a firm chooses to produce at home or directly in the foreign country. However, firms actually have larger selections of production mode.

With regard to overseas production, firms may choose a third country to produce and export from that country to the final-market country. This kind of production strategy is called *export-platform FDI* in the literature. Real business examples can be found enormously in Asia, especially in China. The seminal theoretical work in export-platform FDI is Motta and Norman (1996) who investigate various patterns of investment strategies by multinational firms by applying game theory in a three-country framework[9]. Equilibrium outcomes depend on relative wages, fixed costs for entry, and transportation costs among other parameters.

With regard to producing at home country, firms still have large selections of sub-regions for potential production. Here, same concept of proximity-concentration hypothesis and export-platform investment should also apply. A firm can enjoy larger scale of economy if all production takes place in only one sub-region, however a new region may provide other advantages such as cheaper prices for factors of production and proximity to foreign countries. For example, theoretical work of Puga and Venables (1996) suggests that it would be beneficial for a firm to move from a production-agglomerated region to a lower wage region when wage differentials between regions become so wide. With regard to distance to foreign markets, e.g., distance from Fukuoka (Japan) to Soul (Korea) is half of distance between Tokyo and Soul.

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[9] Other important works include Neary (2002), Yeaple (2003), Ekholm et al. (2003) and Grossman et al. (2003).

We call this behavior of multinational firms to choose domestic sub-region for export production as *export-platform domestic investment*. Once a sub-region is found to be an optimal production site for a multinational firm, then many others in the same industry might follow the pioneer firm and form a new industry cluster. Then we should be able to observe proportionately larger exports for this region.

In section 4 we use finely detailed datasets to compare the estimated coefficients of distance in the gravity model regression across HS 2-digit industries. When we have negatively larger estimates of distance for a given industry, the exports for the industry decreases more proportionately with longer distance. We interpret this negatively larger distance estimate as evidence for industry to export proportionately more from sub-regions closer to foreign countries.

**Product Differentiation and Home market effect**

In empirical section we relate industry characteristics to variation of estimates of distance among industries. One possible industry characteristics is the degree of product differentiation. Lu (2007) provides a model in which industrial heterogeneity in R&D productivity influences how firms choose between R&D and foreign direct investment. Theoretical proposition predicts that high-tech industry stay in home country while medium-tech or low-tech industry may move to foreign countries. Then search for a production site which minimizes international costs within home country becomes imperative for high-tech industry since option for FDI is already ruled out. If highly product-differentiated industries are interpreted to represent high-tech industry, estimated coefficient of distance is expected to be negatively larger for product differentiation industries.

As a measure of product differentiation for industry we use *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)[10].

The empirical approach to test home-market effect is to measure the income elasticity of exports in gravity model regressions, see Feenstra et al. (2001), Hanson and Xiang (2004) and Jensen (2006) among others[11]. 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 approach to test home-market effect and use this estimated home market effect as index for product differentiation in section 4.

## 3. Data Description

[10] 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.

[11] There are two strands of empirical methodology to test home-market effects in terms of choices of variables used in regressions. The other approach 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.

In order to examine choice of production location at sub-region level by multinational firms, we need international trade data also at sub-region level. 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. However, datasets used in the study is at the level of 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. However, none of previous studies use many product categories at sub-regional level for international trade data as our datasets. Our dataset covers three important variables: trade values, national/regional income and distance. Our sample period covers 15 years from 1990 to 2004.

**Trade Values**

The Ministry of Finance, Japan, provides very large trade datasets for each local port according to custom jurisdiction. The total numbers of 209 offices of Custom, Ministry of Finance, are situated closely to sea ports (or 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.

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 we constructed Fukuoka to include six ports to enclave Fukuoka economic region: Shimonoseki, Moji, Tobata, Kanda, Hakata and Fukuoka Airport. For decades ago Moji port had been one of the major international ports in Japan, but recent structural changes in industry caused the region's export to be dispersed among other nearby ports. Tokyo, Yokohama, Nogoya, Osaka and Kobe represent only single port.

Because of the extremely large size of data for a heavily traded port, datasets are dispersed over four hundred files for a single port[12]. The datasets are not either made ready for statistical analysis besides being dispersed over many files. We constructed a program to convert original dispersed datasets to a usable dataset format.

**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.

[12] For each port in our sample, there are 28 files for each year. Therefore, we have 420 files for our sample period of 15 years.

For the size of economy for Japanese six ports, it would be undervaluing the size of economy if only adjacent city is considered. There are many plants in other cities to bring their products to these major ports by using land transportations. For this reason, we decided to use prefecture level income instead of city level. For income variable, we actually use 'values of manufacturing goods shipments' in prefectures containing these major ports[13]. 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.

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.

**Distance**

Distance was measured as great circle distance between two cities following two steps. First, we use capital city for the exact location of Asian economies while we use Japanese city which exactly corresponds with Japanese port names. Then,

[13] 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. We note that the major discrepancy between this variable and prefecture income comes from exclusion of service sector. However, a possible bias would be minimal since we do not consider exports in services.

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 calculated.[14] Although we still have measurement problem for distance, we improved a lot in measurement of distance for international trade from previous studies.

In Table 3 the difference in distance between Asian countries and major Japanese ports are significant especially 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.

## 4. Empirical Results

### A. Port Share Index

To see whether a particular port has any inclination to export more than its proportion toward Asian countries, we calculated the *port share index*,

$$PS_{ijt} = \frac{EXP_{ijt}}{\sum_{i \in I} EXP_{ijt}}$$

where $EXP_{ijt}$ denotes exports from port $i$ to country $j$ at year $t$ and $I$ is the set of all ports in Japan. $PS_{ijt}$ is the ratio of local port export to Japanese national export for a given importing country. Direct comparison of this port share index across ports does

[14] Calculations was done by the Java program maintained in Dr. John Byers homepage.

not give tell us much about geographical structure of Japanese exports because share index has tendency to be simply higher for the ports with larger volume of trade over all.

Then we also calculated port share index for exports to the world,i.e., *j* being the world. This share index for exports to the world can be considered as average tendency of a port to export to any particular countries. By comparing port share for export to a given country with port share for export to the world, we can examine whether a port has relatively higher tendency to export to a given importing country.

As a preliminary investigation for example, exports of Fukuoka region is 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 port share index for Fukuoka, i.e., ratio of Fukuoka region exports to Japanese national export, is shown for the nine Asian economies as well as for the world for the period between 1988 and 2005. The port share index of Fukuoka region for the world increased slightly during the sample period from 3.5 percent in 1988 to 5.3 percent in 2005. While export share of Fukuoka to most of the Asian economies show similar pattern, we can observe the evidence of Fukuoka exports to Korea and Philippines are continuously much larger than Fukuoka export share to the world. The port share of Fukuoka export for Korea in 2005 is 14.2 percent, almost three folds of Fukuoka port share for the world. 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 index 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 kept about ten percent higher share than Kobe export share for the world. Exports to Malaysia and Thailand also maintained higher share than the export share to the world.

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 observed some evidence that Japanese ports relatively closer to Asian economies have more than proportionate share of exports to Asian economies. In next subsection we use aggregate exports to examine this hypothesis more formally with gravity regression. We should note that both port share index and aggregate exports combine all industries and do not consider differences in the industry structure among the ports. In the following subsection after next subsection we further examine this hypothesis by industry decomposition using over 1,000 product categories of exports.

### B. Gravity Model Panel Regression with Aggregate Export

We formally estimate distance effect we observed in previous subsection. Estimation model closely follow a general form of gravity model as in equation (1).

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

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 $\lambda_i$ and $\eta_j$, respectively.

The first row in Table 4 presents positive effect of economic size for exporting economy and importing economy and negative effect of distance between these economies, all at one percent significance level. This result is consistent with the previous literature and provides evidence for significant effect of distance even when national exports are divided among sub-regions. 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 ports. Therefore, we re-estimate equation (1) separately by 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 for most of the countries, coefficients for distance remained negative and statistically significant at one percent level even when an importing country is fixed to single country and difference in distance is only driven by locations of local ports. For Hong Kong and Thailand coefficients are negative but not statistically significant. We suspect insignificant but positive coefficients of distance in regression for China comes from measuring distance from only Beijing instead of other various ports wide-spread in

China. We confirm the result as evidence of significant effect of *marginal distance within a country* on international trade of departing ports within a country.

For income variables, we obtained estimated coefficients consistent with expected positive sign for most of the case. For income of exporting ports, however, we have negative coefficients for China and Thailand. Again, we suspect for China regression that the estimated coefficients suffer from measurement error in distance variable. For income of importing country, all coefficients are positive and statistically significant. However, we should note that coefficient of income variable for importing country only picks up time-series variation of that importing country only.

## C. Gravity Model Panel Regression by Industry

With our highly detailed dataset, we can investigate whether estimation results demonstrate significant differences when we run regression separately by industries. We run regressions very similar to equation (1) with export values disaggregated to HS 4-digit commodity as in equation (2). For each HS 2-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, $\mu_k$. 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 are 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 (82%) HS 2-digit industries have negative estimated coefficients and 60 (63%) of them are statistically significant at ten percent level. Only 8 HS 2-digit industries have statistically significant positive estimated coefficients.

Third, with casual observation we can associate some group of industry to have negatively larger value for distance coefficients. For example, by 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 terms of negatively large coefficients in Table 5. For apparel industry, price in terms of weight is relatively cheaper than products in other high-tech manufacturing industries. It is more likely for transportation cost to have more impacts on the apparel industry, so we obtained the estimated larger negative value of distance coefficients for the industry.

Although share of transportation costs in over all costs obviously matters for the example given above, we suggest some other industry characteristics may even more importantly affect the sensitivity of trade on transportation costs. Two features we suggest are share of Asian economy in the world for Japanese export and degree of differentiation in products. In the following we discuss briefly each of these important industry characteristics.

The first industry characteristic we consider is the Asia-intensity, i.e., the ratio of Japanese exports to nine Asian economies to the world. 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. For a counter example, decision for choosing a location for production or export platform within Japan does not need to consider seriously in terms of transportation costs because it cannot save proportionately much if the industry exports most of products only to the U.S.

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).

The second industry characteristic is the degree of product differentiation. 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.

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

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

where $\alpha$ and $\beta$ 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. Our empirical result for home market effect compliments previous findings in Feenstra et al. (2001). In turn we use these measures to indicate industry characteristics for heterogeneity of products.

**D. Distance impact, Asia intensity, and Product Differentiation**

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.

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[15].

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

We confirmed marginal distance among departing ports within an exporting country still affects international trade. By fixing importing country to single destination in regressions, we controlled for distance variation arising from importing countries. Significant negative coefficients of distance with port-level exports show that ports located nearer to the Asian economies exports more than proportionately its size of economy. By using highly detailed port-level datasets, we also found evidence on wide range of variation for estimates in distance coefficients across industries.

15

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

Partial explanations for this variation across industries are shown to be the share of Asia in industry exports and the degree of product differentiation.

Puga and Venables (1996) explain real wage differences influence firms to start new production cluster in a periphery region. However, this mechanism can not explain correlation between Asia intensity and distant elasticity. It is the export-platform effect which makes periphery regions to trade disproportionately more with proximate foreign regions.

In a two-regions model Krugman (1991) shows externalities from both forward and backward linkages drive manufacturing firms to agglomerate in one region. If externality within industry is very strong, we may observe industry clustering to take place in various locations for different industries. In this paper we provided one possibility of industry agglomeration driven by international trade.

Of course we do not exclude other possible characteristics of industry to affect distance elasticity. For example, industry average for product unit weights and unit prices might also affect distance elasticity. We could assume that transportation cost would be higher for industry, the heavier and less expensive an average unit product in industry is. For example of raw metal, it is heavy and relatively low price per weight so it might be most affected by transportation costs. On the other hand, IC is light and relatively high price per weight, so it might be least affected by transportation costs.

For the sake of foreign market sales, multinationals make decisions about locations of production with candidate sites including foreign countries as well as domestic sub-regions. We call it foreign direct investments if a foreign country is chosen and especially export-platform foreign direct investments if other foreign country besides final market is chosen. The effect of foreign direct investments on exports can be observed with trade data at *national* level. After foreign direct investment export from home country should decrease or may even disappear. For the case of export-platform domestic investments, however, we can not observe any change in exports at national level. The effect of export-platform domestic investments can be only detected by facilitating export data at *port* level.

For future research agenda 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 may be compensated by avoiding costs associated with adjustments to foreign regulations, collection of local information and difficulty of foreign affiliates to coordinate with the headquarter.

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## 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

## 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)

| Lat. | Longi. | City | | Kobe (Hyogo) | Osaka (Osaka) | Nagoya (Aichi) | Yokahama (Kanagawa) | Tokyo (Tokyo) | Fukuoka (Fukuoka) |
|---|---|---|---|---|---|---|---|---|---|
| | | | 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 |
| 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.

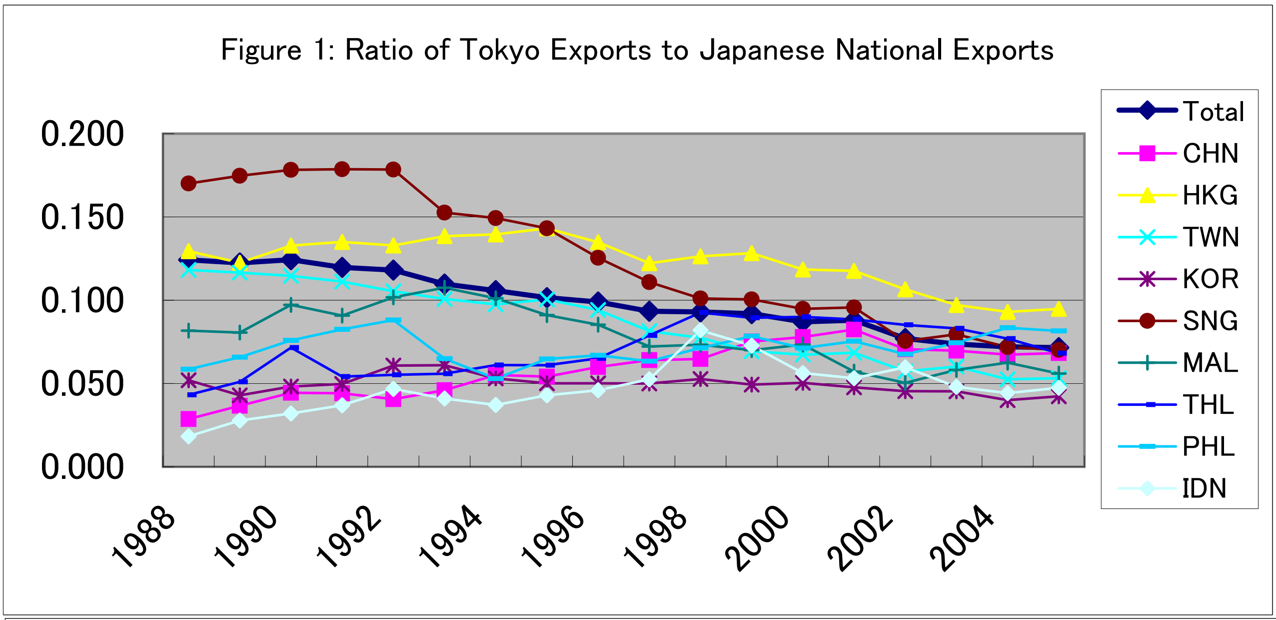
Figure 1: Ratio of Tokyo Exports to Japanese National Exports
0.200
0.150
0.100
0.050
0.000
1988
1990
1992
1994
1996
1998
2000
2002
2004
Total
CHN
HKG
TWN
KOR
SNG
MAL
THL
PHL
IDN

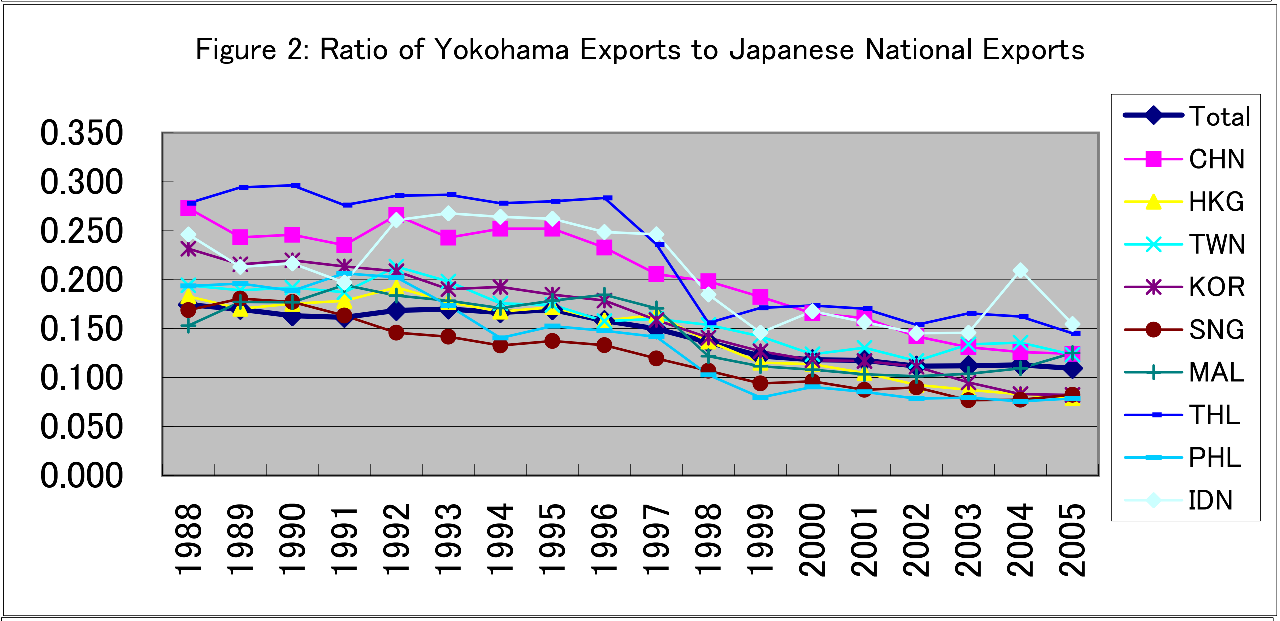
Figure 2: Ratio of Yokohama Exports to Japanese National Exports
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Total
CHN
HKG
TWN
KOR
SNG
MAL
THL
PHL
IDN

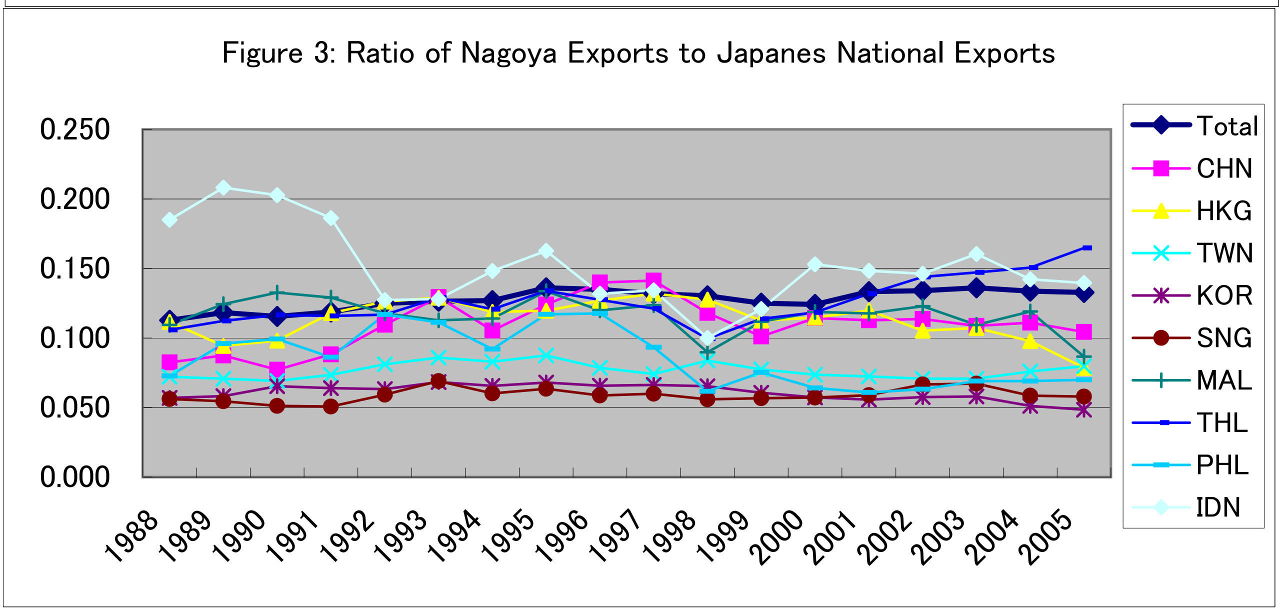
Figure 3: Ratio of Nagoya Exports to Japanes National Exports
0.250
0.200
0.150
0.100
0.050
0.000
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Total
CHN
HKG
TWN
KOR
SNG
MAL
THL
PHL
IDN

Figure 4: Ratio of Osaka Exports to Japanese National Exports

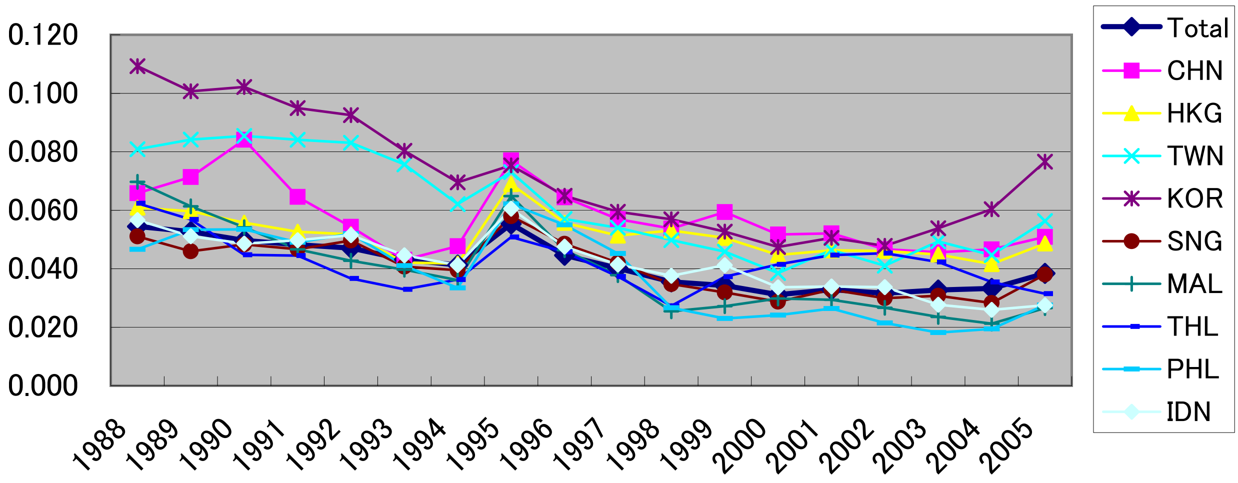


Figure 5: Ratio of Kobe Exports to Japanese National Exports

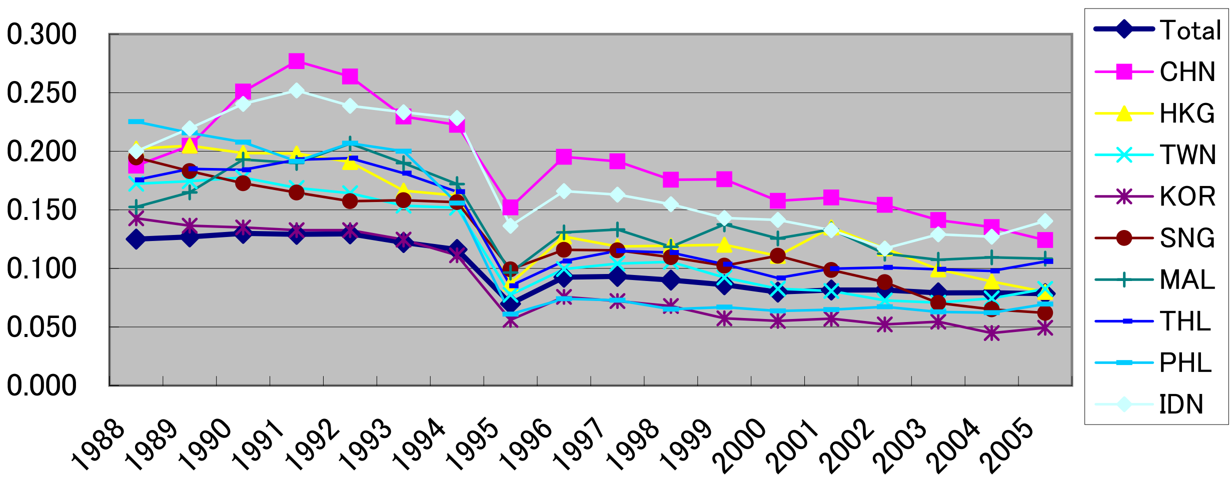


Figure 6: Ratio of Fukuoka Exports to Japanese National Exports