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# How big is the Extensive Margin of Trade? :

## Evidence from Trade Data in Japan

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## 1. Introduction

Decrease in trade costs is one of the most important economic factors to explain trade growth and the gains to consumers and suppliers from trade<sup>1</sup>. One benefit from trade to consumers is the expansion in the variety of products they can consume and to suppliers is availability of the variety of inputs through trade. As we have already known from trade theories, it indicates that it is important to increase variety of products, and it describes increased product variety as the term, extensive margin of trade. In this study, we simply observe the extensive margin of trade in terms of both values of trade the number of products traded in Japan.

With the decline in trade costs, a firm has actively engaged in global economic activity and it has dramatically changed the structure of international specialization. Fragmentation theory is the one that can explain the new economic phenomenon. We add a new aspect that is the extensive margin and intensive margin of trade to analyze fragmentation. Many studies have analyzed fragmentation from trade in intermediate products since linking disintegrated production blocks by the intra-product trade. Recent international specialization is a very complicated production process sharing that consists of intra-firm trade and arm's length trade unlike traditional style that simply trades a final product. Until a producer sells a final product, trade in parts and components occur for many times across the borders. Therefore, we deal with trade in intermediate products as one of analytical views in order to observe the new production sharing. However, we do not ensure that trade growth is accounted for with accuracy from only perspective to look at trade value for parts and components. That is, it is unclear whether increase in trade in existing products induces total trade, or newly traded products. The former is called growth of intensive margin of trade, and the latter is growth of extensive margin of trade. In addition to study for trade in intermediate products, we introduce those two margins to attempt to capture international production sharing more in detail.

As we know, a reduction of trade costs induces fragmentation and it leads to enabling more effective production by extending tradable products which used to be unable to trade or pay a higher price. However, trade growth through achieving the effective international production sharing is induced by growth of trade in existing products or in new products. We need more disaggregated trade data to clarify this issue and analyze trade structure from the views of extensive and intensive margins. In this study, we use the trade statistics of the 9-digits level of Harmonized System (HS) available from Ministry Finance of Japan.

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<sup>1</sup> Feenstra (2006) states three research points for the gains from trade.

To investigate expanding product variety is very limited due to availability of trade data at the disaggregated level. There are few countries to have such a highly disaggregated product data<sup>2</sup>. Therefore, we have to use a certain degree of aggregated trade data and it is hard to observe some change in the extensive and intensive margins. Also, although some countries have highly disaggregated trade data, it must be impossible to obtain the detailed product level trade data for many countries. Despite the lacks of highly disaggregated trade data, we make an attempt to analyze the pattern of the extensive and intensive margins by Japanese trade data and provide some results.

From empirical evidence, the extensive margin of export from Japan has a positive relation to market size for partner countries and their income level. It means that Japan widens its range of tradable products as destination countries increase their production level and consumption level. Also, some of Japanese manufactured industries tend to have more diversified their products. Some early studies, for example Imbs & Warziarg (2003), have mentioned that, as the income level in a country increases, their production pattern is toward to more specialization. However, we cannot obtain the same results. Our investigation is that Japan tends to have both product diversification and product specialization, depending on the types of industries that traded products belong to. So, at the product level trade data, Japan seems to make both diversification and specialization between most partner countries. This pattern from analysis of the extensive and intensive margins can help us to observe the recent production sharing.

The rest of our study is organized as follows. We define the meaning of extensive margin and intensive margin in the next section. In the third section, we review some early studies, mainly empirical ones, for the extensive margin of trade and trade costs. We follow those early studies with some types of trade costs. In the fourth section, we provide empirical evidence and consider whether the trade structure in Japan has large share of the extensive margin of trade or not. Also, we take a trade gravity model to estimate some determinants for the extensive margin of trade between Japan and 63 countries.

## **2. Extensive Margin and Intensive Margin**

In the second section, we will follow a definition and an interpretation of the extensive

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<sup>2</sup> For example, Amiti & Freund (2008) have used the HS 8-digits level export data for China and the HS 10-digits trade data for US to analyze export growth. Also, Persson (2008) has used the 8-digits trade data from Eurostat to analyze some effects of trade costs.

margin and the intensive margin of trade. Depending on some contents, we can follow two different aspects of each margin. That is, one view is from traded products data and the other is from firm level data. The extensive margin of trade from trade data is the aggregated trade values or the number of products which are newly traded. In fact, there is no trade in the earlier period, but positive values of trade show up in the present period. On the other hand, for the intensive margin of trade, it is aggregated trade values which products are already traded in both earlier and present periods. From analysis of both margins from firm level data, the number of exporting firms or the value of trade by new entrants and the values of trade per firm are taken as the extensive margin and the intensive margin, respectively. Since firm heterogeneity becomes an important factor in the international trade field, we would use the firm level data. However, due to constraints on availability of statistics for the firm level data, we use highly disaggregated trade data to analyze the extensive margin of trade.

One of the important economic factors to explain worldwide trade growth is international production sharing induced by decrease in trade costs and increase in firm's global activity. This economic phenomenon is called fragmentation and fragmentation can explain the recent structure of international specialization which is difficult to explain by the traditional trade theories<sup>3</sup>. Many studies have analyzed it is important to see the trade structure of intermediate products to explain recent production sharing<sup>4</sup>. Fragmentation is the vertical production linkage that firms spread some production process into several production blocks to produce some intermediate products, and then combine them to produce a final product and to export to the final consumer. Thus, firms export many intermediate products across borders to produce a final product. This is one of the reasons that trade growth of intermediate products is faster than total trade, and from these concepts it might be true we should look at trade structure of intermediate products. In the case of observing intermediate trade, however, we mainly focus on issues how much volume of trade in some existing products changes (intensive margin of trade), but not particularly how much volume and the number of product in some new traded products change (extensive margin of trade). In this study, we mostly observe trade structure of extensive margin.

Figure 2-1 shows a structure of extensive and intensive margins of trade and it expresses the change of trade structure by declining trade costs in term of the concepts

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<sup>3</sup> Jones & Kierzkowski (1990) have used the word, fragmentation, to explain the new economic phenomenon.

<sup>4</sup> See Arndt & Kierzkowski (2001), Ando(2006), Ando & Kimura(2005), Athukorala & Yamashita(2006), Honda(2006), Jones & Kierzkowski (1990), Jones and Kierzkowski (2001), and Yi (2003).

of both margins<sup>5</sup>. ① indicates the intensive margin of trade and, it represents as trade costs fall, volume of trade in existing products can increase. It is relatively easier to observe the recent expansion of trade due to globalization from the aspects of intensive margin, and we generally take an increase in the intensive margin of trade as trade growth. In addition to it, when the value added of a product increases by achieving industrial advances and by rising country's productivity, it is also able to explain the growth of trade volume per product.

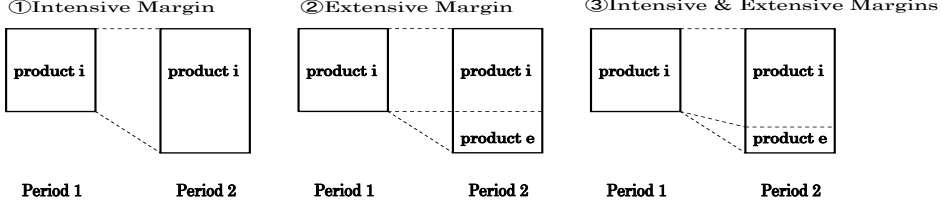
In contrast, ② represents the growth of extensive margin of trade. For here, there are some products that firms cannot trade due to extremely high trade costs, but as trade costs fall, firms can newly trade those products. Thus, we can observe the change of extensive margin of trade and it also means achievement of product diversification. As countries achieve the higher economic growth or the industrial advances, they are able to become to import relatively more intermediate inputs and the range of consuming products can be wider. Imbs & Warziarg (2003) is one of studies that mention some relations between product diversification and product specialization. They have analyzed, as countries achieve economic growth, those countries tend to move toward with product diversification, and when they reach higher level of income rather than earlier period, gradually they shift to a production specialization. By considering both views of the aspects of Imbs & Warziarg (2003) and the aspects of the concept of the extensive and intensive margins of trade, we can follow the way that countries' production, consumption, and trade patterns may move from the diversification (extensive margin) to the specialization (intensive margin).

Lastly, ③ has both concepts of increase in value added of traded goods and in product diversification. The meaning of trade costs is very broad and it depends on researchers what costs they take as trade costs. When we analyze international production sharing based on the fragmentation theory, a change of trade costs may not only increase the volume of trade in existing products, but also begin to trade in the new products. ① and ② can explain the intensive and extensive margin of trade, but they focus on each margin separately. However, growth of the intensive and extensive margins of trade due to declining trade costs may occur simultaneously. Thus, ③ can be more realistic and practical to observe the change of trade structure in this study.

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<sup>5</sup> Here, trade costs indicate not only the change of tariff or improvement of transportation technology but also any costs to coordinate between production blocks. Jones & Kierzkowski (1990) have called it *service link costs*.

Figure 2-1. Extensive Margin and Intensive Margin



Here, we will see whether the extensive margin of trade is as big as we should analyze. Although we can see many studies to analyze of the intensive and extensive margins of trade recently, due to easily having trade data, there are some studies to discuss the variety growth<sup>6</sup>. We follow some parts of measurement in Amiti & Freund (2008). They take the shares of trade growth as follows<sup>7</sup>.

$$\frac{\sum_i V_{it} - \sum_i V_{it-1}}{\sum_i V_{it-1}} = \frac{\sum_{i \in I} V_{it} - \sum_{i \in I} V_{it-1}}{\sum V_{it-1}} - \frac{\sum_{i \in I_{t-1}^D} V_{it-1}}{\sum V_{it-1}} + \frac{\sum_{i \in I_t^N} V_{it}}{\sum V_{it-1}}, \quad (2.1)$$

This measurement indicates that the share of trade growth in terms of variety is decomposed to three parts such as existing goods, disappearing goods, and new goods and gives us clear implication of variety growth in detail. This explains that trade growth is consisted of three components such that one is value of trade in existing products which shows up in both periods, the other one is value of trade in disappearing products which exist only in earlier period, and, last one is value of trade in new products. In our study, however, we are more interested in the third term in the right hand side in the measurement equation. So, we simply decompose the value of trade in one sector into the value of intensive margin and the value of extensive margin, and take the extensive margin for our study. Since we expect the growth of variety may induce the acceleration of international production sharing, the extensive margin of

<sup>6</sup> Those studies focus on the topics mainly between variety and economic growth. See Feenstra (1994), Feenstra (2004), Feenstra & Kee (2004), Funke and Ruhwedel (2002), and Grossman and Helpman (1991).

<sup>7</sup> This is the measurement equation (6.1) in Amiti & Freund (2008), and they provide a simple analysis of extensive margin of trade between US and China by comparing this measurement equation and one in Feenstra (1994).

trade can be important determinant to explain the recent trade growth.

International production sharing is to fragment a production process into several blocks which can produce most effectively. In this kind of production sharing, manufactured products are produced not only by developed countries but by developing countries to effectively utilize their comparative advantages. This means that developing countries can participate and play a key role to produce some parts of manufactured products at particular production stages. That is, the result that the extensive margin of trade can account for comparatively large share of trade volume is expected.

How big is the share of extensive margin of trade related to total trade? Table 2-1 shows the value and share of extensive and intensive margin of trade for two periods between Japan and 63 countries. We calculate a sum of each margin for total and manufactured products in 1998 by comparing to trade data for 1988<sup>8</sup>. We regard a product as the product categorized in the group of extensive margin of trade if the product is newly traded in 1998 in comparison to 1988 and in the group of intensive margin of trade if the product is traded in both 1988 and 1998. We equally do the same calculation for 1998 and 2007.

From Table 2-1, the total value of extensive margin of export to total value of export accounts for about 23% from 1988 to 1998, and it is about 77% for the intensive margin of export. For manufactured products, the share of the extensive margin is about 25% that is higher than total extensive margin of export<sup>9</sup>. Furthermore, the share of the extensive margin of export for total and manufactured products in 2007, compared to 1998, accounts for about 40% and 50% respectively. As we know from this results, although we take broad periods, the share of the extensive margin in terms of Japanese export products is very large and we can observe that the value of trade have grown with the range of tradable products. In addition, the extensive margin of import has also increased both in 1998 and 2007, although it is not as much as export side. That is, we can say that the range of bilaterally tradable products has expanded for two decades. Thus, it is conceivable that the growth of the extensive margin of trade can become one of important factors for trade growth.

To analyze the extensive margin of trade is an important aspect in order to see production sharing in the world. Many studies focus on the view how much the volume of trade in intermediate products increase, and to see the intensive margin is also

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<sup>8</sup> We use trade data, Trade Statistics of Japan, available from Ministry Finance of Japan.

<sup>9</sup> We take HS84 to HS92 as manufactured products.

crucial. However, at the same time, we also need to shift our research interest to the extensive margin of trade since it is not a few amounts of trade at all. In this study, we do not classify products into intermediate and final products, but instead, we are more interested in the broader analysis of the extensive margin of trade.



Table 2-1. The Composition of Two Margins from Trade Data in Japan

(1) EXPORT

1988 – 1998				
	Value (¥Billion)	Share (%)	HS84– HS92	Share (%)
Total Value of Export	46812.96		34605.00	
Total Value of Extensive Margir	10700.48	22.86%	8553.81	24.72%
Total Value of Intensive Margin	36112.48	77.14%	26051.19	75.28%

1998 – 2007				
	Value (¥Billion)	Share (%)	HS84– HS92	Share (%)
Total Value of Export	77322.55		51823.88	
Total Value of Extensive Margir	31422.78	40.64%	25818.03	49.82%
Total Value of Intensive Margin	45899.76	59.36%	26005.85	50.18%

Source: Trade data is available from *Trade Statistics of Japan* by Ministry Finance of Japan.

Note: Each margin is based on author's calculation.

(2) IMPORT

1988 – 1998				
	Value (¥Billion)	Share (%)	HS84– HS92	Share (%)
Total Value of Import	32522.25		11354.84	
Total Value of Extensive Margir	9067.21	27.88%	4318.51	38.03%
Total Value of Intensive Margin	23455.04	72.12%	7036.33	61.97%

1998 – 2007				
	Value (¥Billion)	Share (%)	HS84– HS92	Share (%)
Total Value of Import	57394.28		20327.49	
Total Value of Extensive Margir	17232.70	30.03%	8382.99	41.24%
Total Value of Intensive Margin	40161.58	69.97%	11944.50	58.76%

Source: Trade data is available from *Trade Statistics of Japan* by Ministry Finance of Japan.

Note: Each margin is based on author's calculation.

### **3. Review of Early Studies**

In this section, we review some of early studies which analyze an important relationship between trade costs and extensive margin of trade. It has long been considered what economic factors can explain a trade pattern among countries or regions. In this study, our focus is not only on the total trade structure but also on the trade structure of the extensive margin of export. When we empirically and theoretically study some determinant of trade, we must not ignore trade costs, and it even becomes more important economic factors to disturb trade between countries. Many early studies have shown trade costs are important in order to explain how much they influence trade volume, but at the same time we argue the question what variables we should take as trade costs. In this section, we review some early studies in line with three kinds of trade costs.

#### **• Distance-related trade costs**

In this section, we review several empirical studies which focus on intensive and extensive margins and some aspects of different types of trade costs such as distance, economic integration, and some other trade costs.

Amurgo-Pacheco & Pierola(2007) have taken distance-related trade costs and analyzed patterns of export diversification among 24 developed and developing countries, adding the geographic diversification into the extensive and intensive margins. They interpret the intensive margin as export growth of old products that have already exported (old products) and the extensive margin as export growth of new products that have newly exported (new products). Also, they pointed out that this lacks geographic dimensions, and add “old destination” which a country has already exported to and “new destination” which a country has not exported to. Thus, in their study, the intensive margin means some products categorized in both old products and old destination, and they spread the extensive margin into geographic extensive (new destination with old products and new products) and product extensive (new products with old destination and new destination). Including the geographic concept, they analyze the export diversification at the intensive and extensive margins. As a result, the growth at the intensive margin can explain the export growth and the geographical diversification shows more dynamism than product diversification. Also, by using the Tobit model, their strong empirical result is that the pattern of export diversification is following “the gravity-like pattern”. They show both geographical factors and market size of destination country can determine the change in probability that countries export more diversified products, and also taking FTA as reducing trade costs they pointed that

trade liberalization induces the export diversification.

Felbermayr & Kohler(2006) have argued that gravity studies of international trade to estimate some relationship between distance and income level has been becoming usual approach, since we should not ignore trade costs in this field at all. Also, they have mentioned that many studies exclude two important features. First one is about an important part of the economic action across time and they call it the time-varying nature of the distance coefficient. Second one is about an interpretation of intensive and extensive margin. To solve these problems, by setting panel data for world trade in manufacturing from 1970 to 1990, they have analyzed some effects of trade costs on intensive and extensive margins. As a result, the importance of distance-related trade costs is falling as time passes, and the effect of WTO membership is statistically significant and economically meaningful on growth of extensive margin. When we consider trade costs, as Felbermayr & Kohler(2006) also have said, technological improvements in transportation and communication have strong impacts on trade activities, and those change of trade costs may give different impact across traded products compared to aggregate trade flows. Thus, we need to analyze some effects of trade costs on the intensive and extensive margin by using disaggregated product data.

#### • **Economic integration and FTA**

In the other case, it can be said that to have a common currency may lower trade costs between currency union members. There are some studies to focus on the common currency effect on trade, especially euro effects (Berthou & Fontagne(2008), Baldwin & Di Nino(2006))<sup>10</sup>. Flam & Nordstrom(2008) is one of them which mentions the euro effects on the intensive and extensive margins. They first find that there is strong impact of euro on export both from currency union member countries to outside countries and from outside countries to currency union member countries. Also, they find that there is significant euro effect on the extensive margin of trade. Specifically, comparing one period (from 2002 to 2005) to other period (from 1995 to 1998), the extensive margin is increased by 6% between currency member countries and also by 4% between currency member countries and outside countries. They also attempt to find some different impacts of euro effect on trade on the margins in different industries and conclude that the euro effects can be observed in some semi and final products in pharmaceuticals and machinery industries.

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<sup>10</sup> For example, Berthou & Fontagne(2008) use French firm level export data in order to clarify the effect of euro on trade and conclude that euro affects the extensive margin rather than the intensive margin.

Next one is a study from aspects of NAFTA. Considering the effect of economic integration, NAFTA is one of the best analytical targets to observe the impact of free trade agreement. Hillberry & McDaniel(2002) show how much NAFTA affects US trade growth by comparing the nature of US trade between NAFTA countries and between non-NAFTA countries<sup>11</sup>. They decompose trade growth into three potential sources of changes in trade volumes such that trade growth is due to trading more units of each type of goods (intensive margin in terms of quantity), changing the unit prices of goods (intensive margin in terms of unit price), and changing the number of traded varieties (extensive margin). They find there are strong variety effects of NAFTA on trade between US and Mexico. This large change in the extensive margin is in import from Mexico, and this suggests facing higher competition from traded varieties from Mexico. Their study tells us that the extensive margin should include in order to analyze the effects of NAFTA.

Kehoe & Ruhl(2002) have implied that there are very few studies which have incorporated some effects of extensive margin into an analysis of trade models. By using the data set, SITC, they have studied the effects of trade liberalization on extensive margin mainly among countries with NAFTA and among countries with single market area in EU. In consequence, they have shown decrease in tariff has strong impact on extensive margin of trade. They also have mentioned that one of big issues in the field of international trade literature is there is difficulty to have suitable models to explain economic phenomena of larger growth of trade in comparison with relatively smaller reduction of tariff. In Kehoe & Ruhl(2002), although they have taken tariffs as main trade costs and have accounted for the growth of extensive margin not from product cycle theory but trade liberalization, we cannot interpret recent trade expansions in the world only from decrease in tariffs<sup>12</sup>. As fragmentation theory says, we need to focus on many kinds of trade costs to account for globally increases in trade<sup>13</sup>. Besides economic institutional coordination like reduction of tariffs between countries, some other kinds of factors such as technological innovation, improvement of transport technology, firm's FDI activities and mutual cultural and social understanding can also become important to explain the growth of trade.

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<sup>11</sup> Debaere & Mostashari(2008) shows changes in the extensive margin related to tariff reduction.

<sup>12</sup> Kehoe & Ruhl(2002) have emphasized the necessity of extensions of trade model in order to explain the growth of extensive margin and also have modified the model of Dornbusch, Fischer and Samuelson(1977).

<sup>13</sup> In Jones & Kierzkowski (1990) have used the term, *service link costs*, as broad term for trade costs in fragmentation theory.

#### • Other trade costs

Some studies focus on other specific trade costs. Persson (2008) takes the number of days needed for trade procedures as trade transaction costs, and analyzes the impact of change in trade cost on the extensive margin and the intensive margin of differentiated products and homogeneous products<sup>14</sup>. He uses import data of EU 25 countries from developing countries. The finding of this study is the same result as the model by Chaney (2008) and, thus, the extensive margin of differentiated products and the intensive margin of homogeneous products are more negatively affected by trade transaction costs respectively. Using Portuguese firm level data, Bastos and Silva (2008) investigate whether cultural links increase extensive and intensive margins of trade with the concept of firm heterogeneity. They, interestingly, take conical ties, common language and migrant communities for the variables for cultural links, and find the positive relations for both intensive margin and extensive margin. This sort of study with cultural links should be analyzed widely and deeply and become important benchmark for policy study. Since study in the field of international trade is more relevant to trade costs, it is necessary to analyze several kinds of variables as trade costs. Distance is commonly used for many researchers, but to use only distance is not enough to calculate and investigate trade costs, although we have strong data limitations.

#### • Theoretical study

Compared to the empirical studies mentioned above, there are not many theoretical studies for relations between trade and extensive and intensive margin, but Chaney (2008) take firm heterogeneity into the gravity model. Chaney (2008) has analyzed that the asymmetric trade barriers affect extensive margin and intensive margin. In the new trade theories, we assume firms are identical and consumers prefer to consume many varieties and products are highly differentiated. Therefore, intra-industry trade can occur even if trade costs are high, and, due to a high degree of product differentiation, trade costs do make a small impact on trade flows. In the “new” new trade theories, Melitz (2003) has extended the new trade theory to add firm heterogeneity into the trade model, and assume that firms are not identical, differ in the level of productivity,

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<sup>14</sup> There are some other studies which take trade transaction cost as trade costs. For example, Dennis & Shepherd(2007) use the official fees levied on a 20-foot container leaving the exporting country and Martinez-Zarzoso & Marquez-Ramos(2007) take the costs and time involved in exporting and importing as trade costs. However, those studies focus on the relationship between trade transaction cost and export, but not distinguish the intensive and extensive margins.

and only more productive firms export. Chaney (2008) has introduced Melitz (2003) model into trade gravity framework in order to explain entry and exit for heterogeneous firms by change of trade costs and its impact on trade flow.

Allowing for many asymmetric countries by asymmetric trade costs in Chaney (2008), and assuming there are fixed and variable trade costs, it is more profitable to export to a country with lower trade costs and higher demand. Also, there is a threshold level of firm heterogeneity and only firms with higher level of productivity than this threshold can make profits from exporting. Chaney (2008) has defined the intensive margin as the size of exports by existing firms and the extensive margin as the set of exporters. Decrease in variable trade costs can lead to lower the threshold productivity level, so both margins can be affected positively by exporting more for existing firms(intensive margin) and by increasing the number of firms(extensive margin). In contrast, decrease in fixed trade costs may not affect the intensive margin since existing firms have already paid when they enter foreign market. This reduction can only affect new firms to enter the market.

As review above, the profitability of export depends on destination and, in addition, Chaney (2008) has shown that the sensitivity of the extensive margin and the intensive margin by the elasticity of substitution (a degree of product differentiation). When trade costs decrease and the elasticity of substitution is high (lower product differentiation), lower productive firms can become entering the market, but they can capture a small market share since market is more competitive. However, when the elasticity of substitution is low (higher product differentiation), firms are more away from competition. New entrants that can newly enter due to decrease in trade costs are able to face large market potential. This impact of extensive margin is larger than intensive margin on aggregate trade flow. Chaney (2008) has concluded that the effect on change of extensive and intensive margins by reduction in trade costs can depend on the heterogeneity and the degree of product differentiation. His theoretical contribution has mentioned that the effects of trade costs on the extensive margin can be larger and the extensive margin is quantitatively important. Many early studies use firm level data to observe both margins. It would be more practical if we could use firm level data, but due to statistical constraint, we use disaggregated trade data.

#### **4. Measurement of Extensive and intensive margin**

We will first describe trade data for here, and then analyze the characteristics of the extensive margin of trade in Japan. And also, we provide empirical evidences to clarify whether trade in Japan tends to meet product diversification or product specialization.

Finally, we estimate a relation between the extensive margin of export and some factors by the trade gravity model.

#### **4-1 Trade Data**

To analyze the structure of extensive and intensive margins, it is necessary to use highly disaggregated trade data in order to avoid miscalculation. We use Trade Statistics of Japan by Ministry Finance of Japan that is highly disaggregated. The HS (Harmonized System) classification by UN is globally integrated at the 6 digits level, but it is not disaggregated enough to consider the extensive and intensive margins of trade<sup>15</sup>.

Trade data we use is the HS 9-digits data between Japan and 63 countries from 1988 to 2007. Trade between these 63 countries for Japan has about 95% of total export<sup>16</sup>. Trade products we analyze here are categorized in four groups such as general machinery (HS84), electric machinery (HS85), transport equipment (HS86-HS89), and precision machinery (HS90-HS92) at the 2-digits level. The number of product at 9-digits in each group for export and import is as follows. Total export has 8553 products for export and 12058 products for import, general machinery (HS84) has 821 products for export and 795 products for import, electric machinery (HS85) has 683 products for export and 562 products for import, transport equipment (HS86-HS89) has 272 products for export and 197 products for import, and finally, precision machinery (HS90-HS92) has 394 products for export and 409 products for import.

#### **4-2 Characteristics of the extensive margin of trade in Japan**

We focus on the four sectors to observe the extensive margin of trade since we can expect that fragmentation may occur in mainly manufactured sectors, especially in the sector with many trade commodities. When we consider which share of margins is higher or lower, it might be dependent on several economic conditions such as the level of production technology and the consumption level. However, in our study, here we take

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<sup>15</sup> Baldwin & Di Nino (2006) state that the HS 6-digits is too aggregated to see the nature of individual varieties.

<sup>16</sup> 63 countries are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Korea, Luxembourg, Netherland, New Zealand, Norway, Portugal, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom, United States, Brunei Darussalam, Hong Kong, Singapore, Taiwan, Argentina, Brazil, Bulgaria, Chile, Croatia, Malaysia, Mexico, Poland, Romania, Russia, Turkey, Uruguay, Venezuela, Bolivia, China, Colombia, Ecuador, India, Indonesia, Maldives, Mongolia, Paraguay, Peru, Philippines, Sri Lanka, Thailand, Ukraine, Bangladesh, Cambodia, Lao, Myanmar, Pakistan, Vietnam.

only GDP per capita as one of economic factors. Following and extending Imbs & Warziarg (2003), we believe that a country with the lower income level has the lower level of production technology and so the industry structure is not highly developed yet. Thus, those countries should rely on importing the wider range of products from other countries, and the structure of export from Japan to lower income countries may accounts for large share of extensive margin. On the other hand, for higher income countries, Japan export relatively higher quality products in addition to having already exported wider range of products since destination countries have high enough income to consume large variety of products. We can say that the intensive margin can become larger than the extensive margin in this case.

Figure 4.1 is a diagram of extensive and intensive margins to show the relations we mentioned above. From this figure, we can see a distribution of the share of extensive margin and intensive margin and it also give us some interpretation of a group of traded products through decomposed trade in a product into two margins. If trade in products in a group has the higher share of extensive margin, this group tends to have product diversification. Conversely, if the share of intensive margin is larger, specialization may tend to occur in a group. Thus, from the interpretation of this figure, we can say that a group in lower income countries is distributed above the Ext. / Int. line and it is below this line for higher income countries.

Figure 4.1 Diagram of Extensive Margin and Intensive Margin

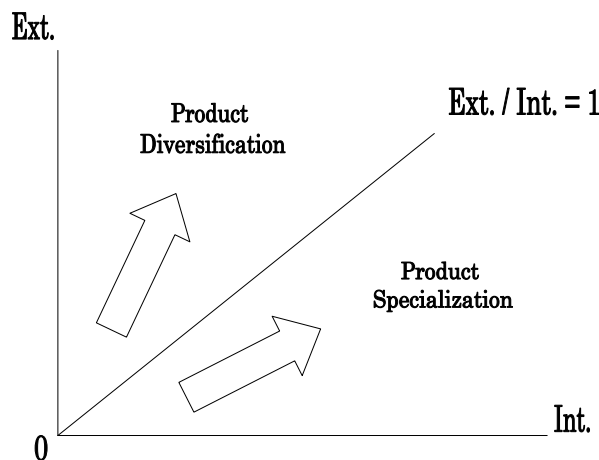




Figure 4-2 shows the result of the relationship the share of the extensive and intensive margins to GDP per capita for 1998 and 2007<sup>17</sup>. We take 10 year and 5 year time lag to calculate both margins for 1998 and 2007. It means that the extensive margin of export for 1998 with 10 year time lag is to be by comparison with 1988, and with 5 year time lag is with 1993. We use the HS 9-digits and aggregate them at the HS 2-digits. From the results of total trade for 10 year time lag, it provides the share increase from the bottom left to the top right, and it describes the growth of both the extensive margin and the intensive margin with income level. Also we can interpret that Japan exports amounts of products with higher intensive margin to the countries with higher income level and exports some range of products with higher extensive margin to the countries with comparatively lower income level.

For four groups of manufactured industries, first, the extensive margin of export for precision machinery (HS90-HS92) increase the intensive margin within 20 years. It indicates that Japan specializes in some range of products and produce relatively higher value added products since this group requires relatively more advanced technology. On the other hand, in the case of import in the group of precision machinery, the share of extensive margin becomes higher. Thus, it can conclude that, within the same product group, Japan has both characteristics within the same product group that exported side is more product specialization and imported side is more product diversification.

The share of extensive margin of export for general machinery (HS84) and electric machinery (HS85) shows significant increase. Those groups have a number of products rather than other three groups, and so, it can have a tendency to occur fragmentation. Unlike precision machinery (HS90-HS92), the range of products has extended for twenty years, and thus, it can conclude that this group has diversified products. Even in the import side, we can observe the higher share of extensive margin and, that is, achieving strong diversification. It can be said that we can interpret that the number of newly traded products has increased in both export and import and this result can give us the strong evidence that the bilateral trade in the different types of products may occur. Finally, for transport equipment (HS86-HS89), the share of intensive margin of both export and import has increased in the case of 5 year time lag, but the different result has appeared in the case of 10 year time lag. It describes the share of extensive margin is higher there. In the long run, we can say the range of products increases and product diversification may occur, but in the short run, we can also observe product

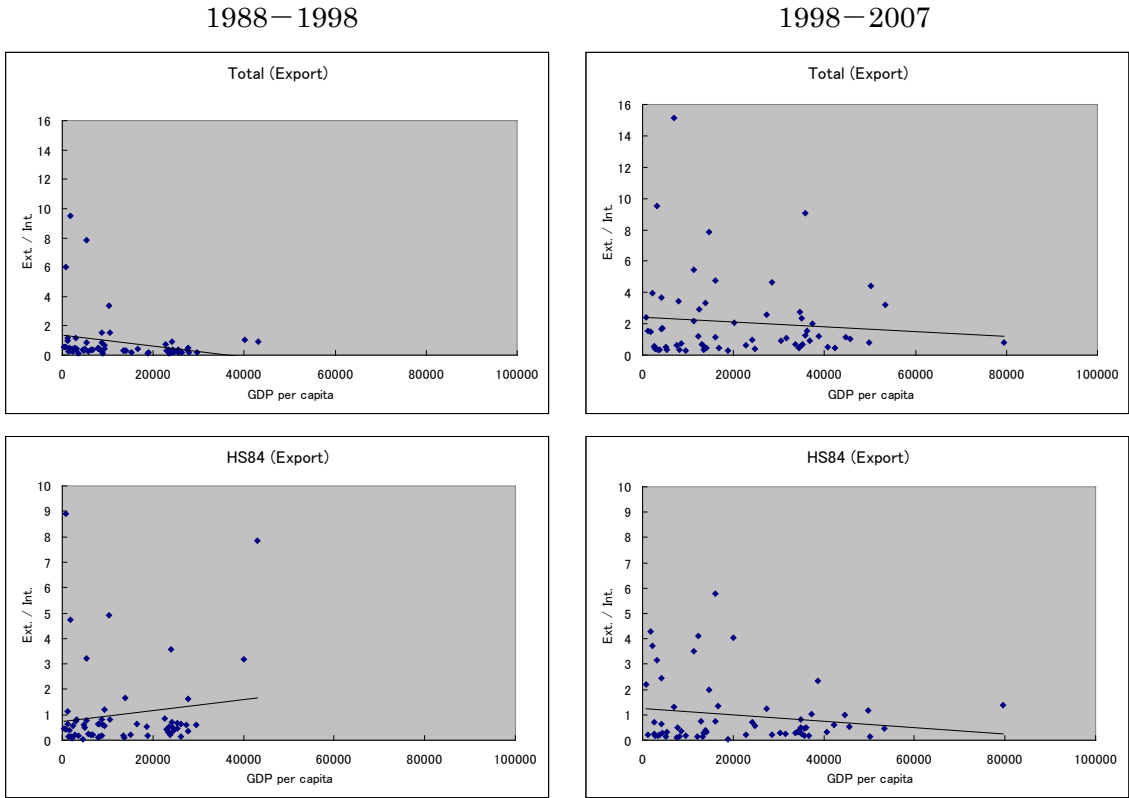
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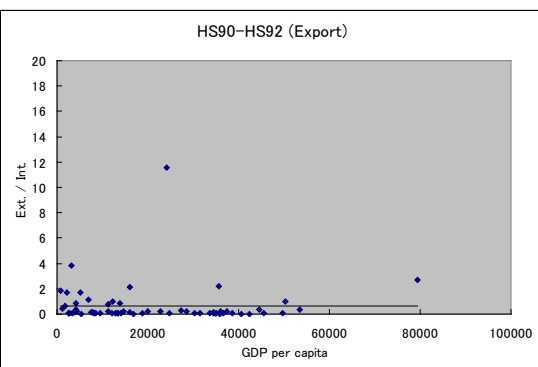
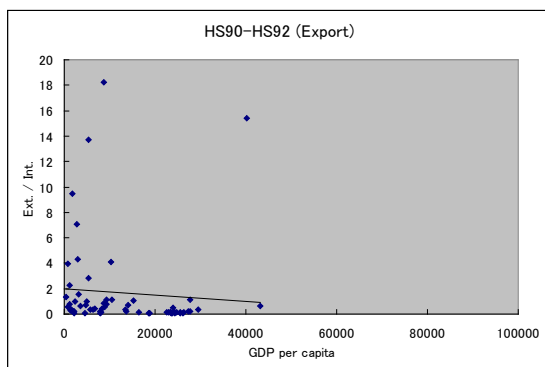
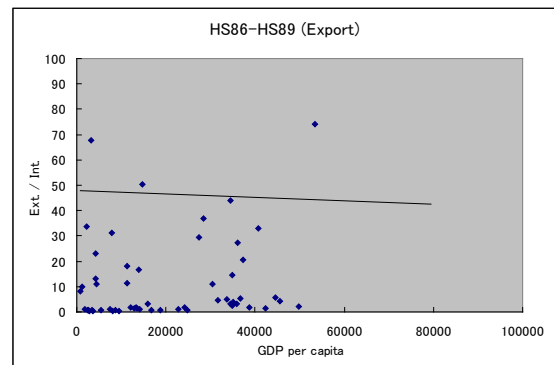
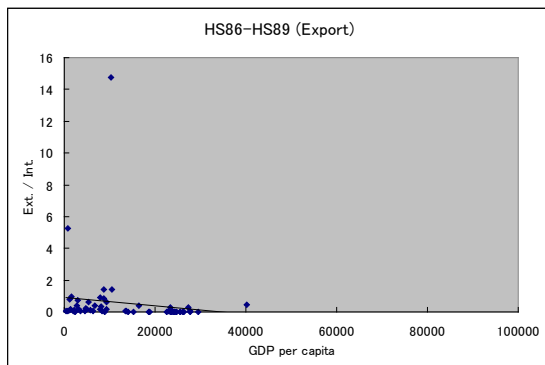
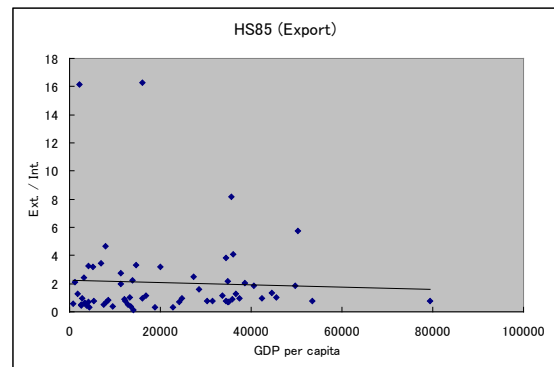
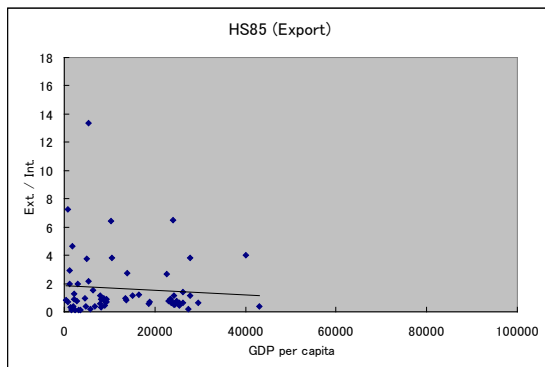
<sup>17</sup> We use trade data from Trade Statistics of Japan by Ministry Finance of Japan and GDP data from World Development Indicator.

specialization.

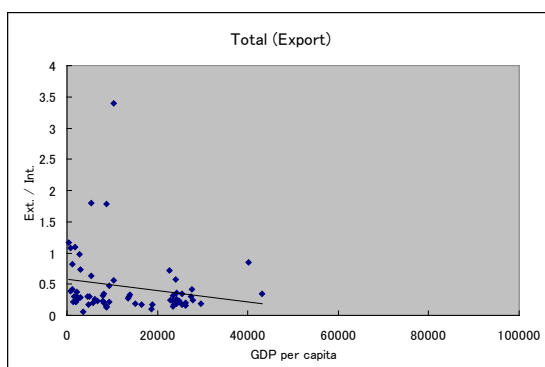
We have discussed the transition of the share of extensive margin and intensive margin for total trade and four manufactured groups. It investigates that a tendency of the share of the margins in each group is different and its difference is dependent on the characteristics of each industry and the length of period. However, for here we can provide that we can see the international production sharing even from the view of the extensive and intensive margins of trade. Since our aim of this study is to see the size of extensive and intensive margin of disaggregated products at the country level, the study for some investigations of the industry characteristics will be future research.

Figure 4-2 The Share of the Extensive Margin and Intensive Margin

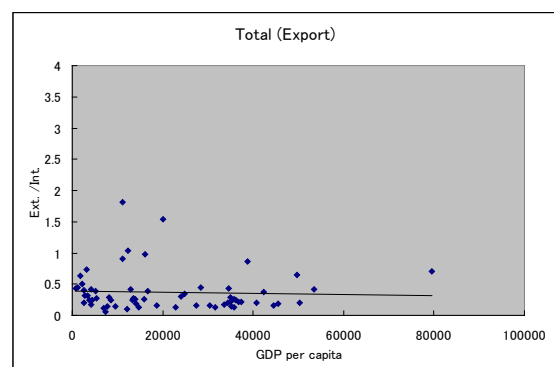


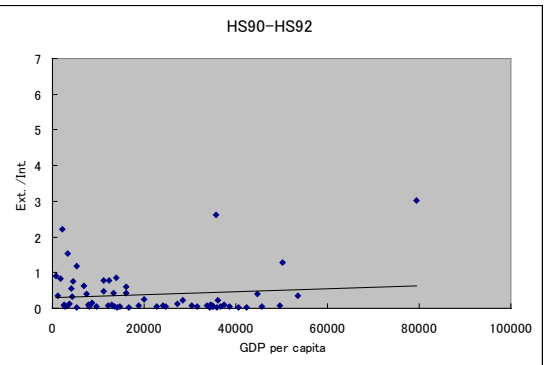
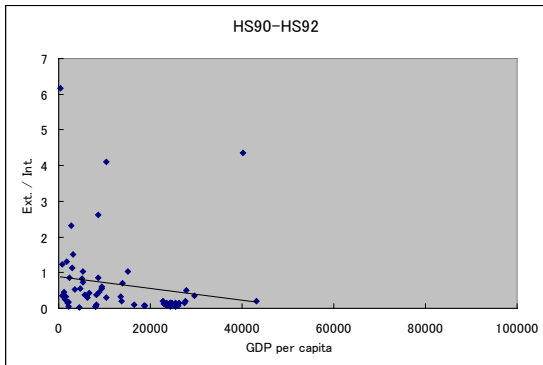
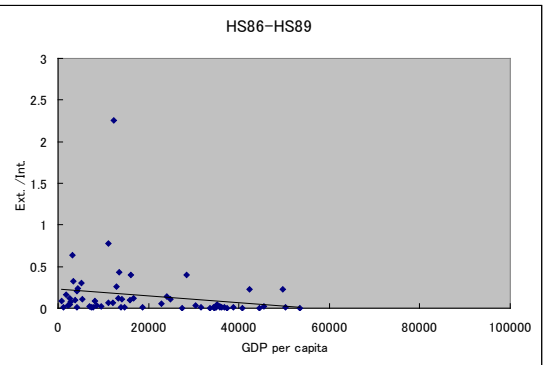
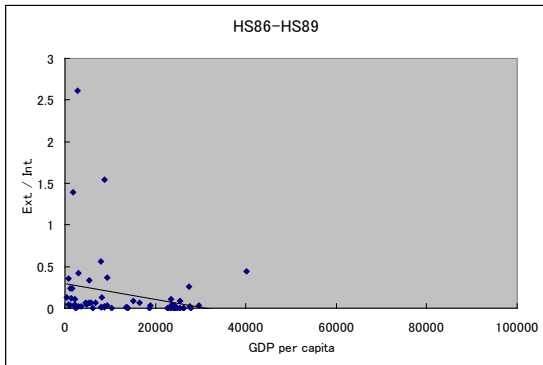
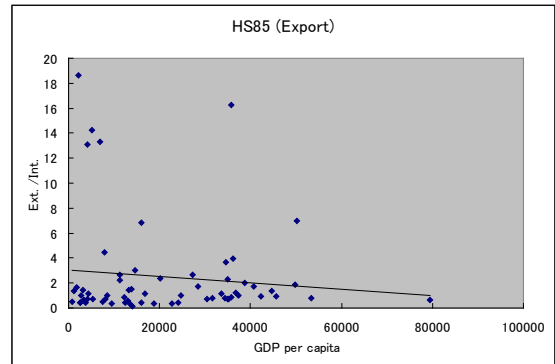
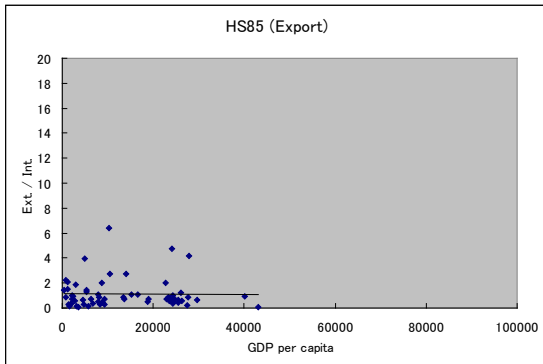
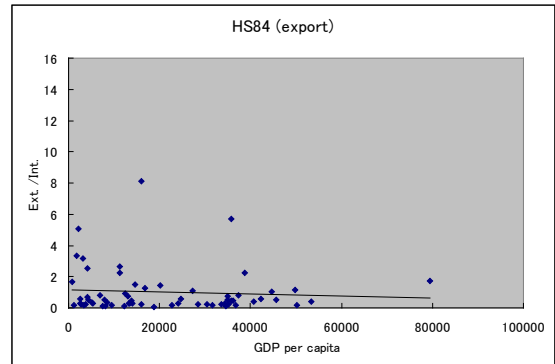
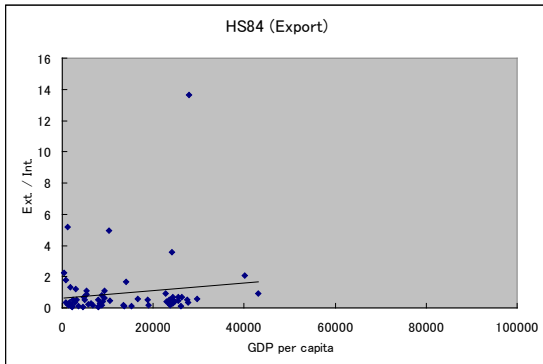


1993—1998



2002—2007

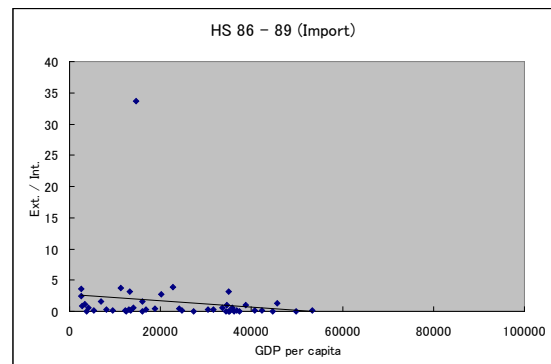
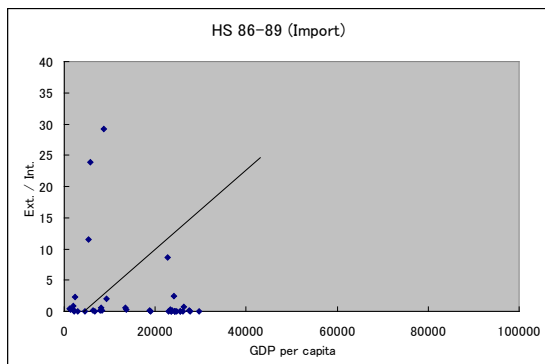
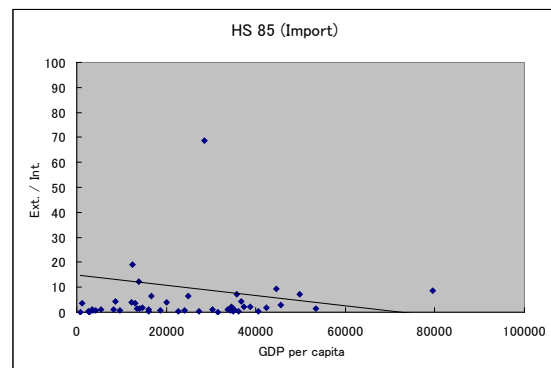
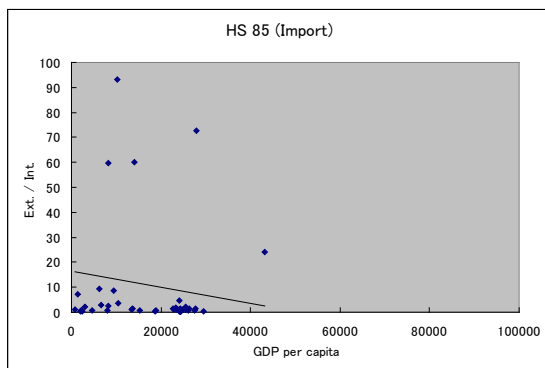
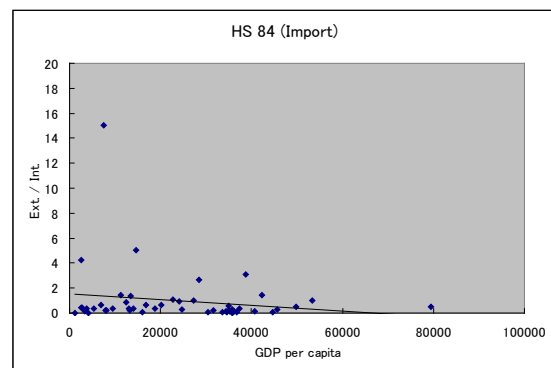
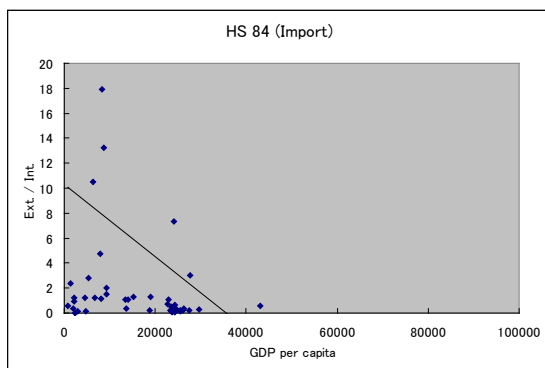
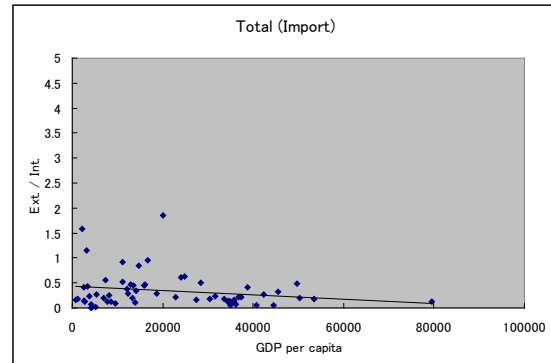
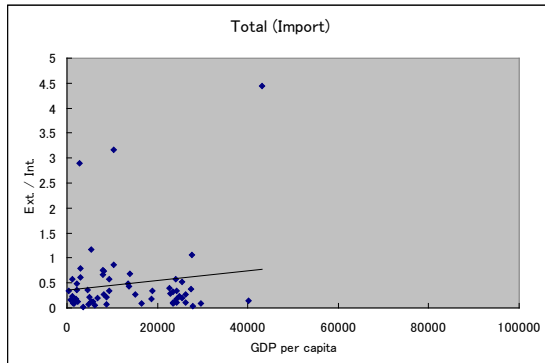


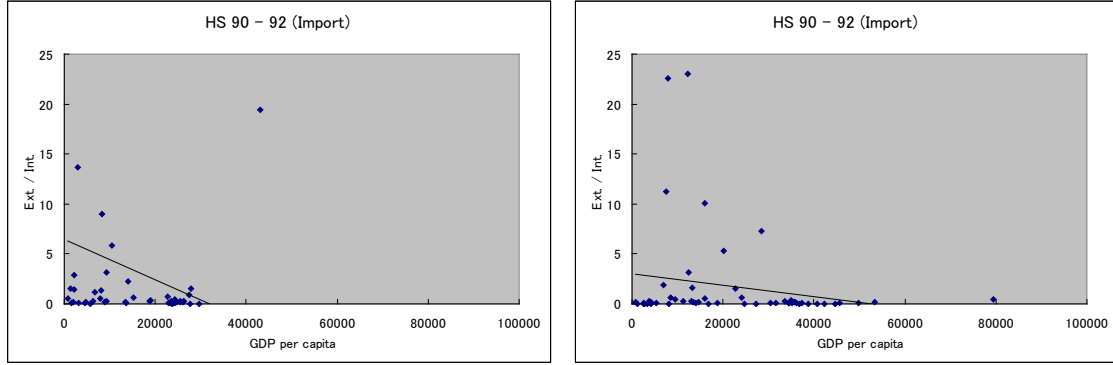


# Import

1993-1998

2002-2007





#### 4-3 Panel Data Analysis

We follow the typical gravity approach to see whether the extensive margin of trade can be determined by market size and trade costs. General trade gravity approach is that the volume of trade between two countries is proportional to the size of market and inversely related to the distance between two countries. However, for here, we will use both the values and the number of the extensive margin of export for total products and manufactured products as the variables of extensive margins from Japan, and see whether the extensive margin can be estimated by standard simple gravity equation. The simple gravity equation for our analysis takes the following form:

$$\begin{aligned} \ln EXTENSIVE_t^i = & \beta_0 + \beta_1 \ln GDP_t^i + \beta_2 \ln GDP_t^j + \beta_3 \ln DISTANCE_t^i \\ & + \beta_4 \ln REMOTENESS_t^i + \beta_5 China_t^i + \beta_6 NIES_t^i \\ & + \beta_7 \ln ASEAN4_t^i + \beta_8 \ln Europe_t^i + \beta_9 \ln SAMERICA_t^i + v_{it} \end{aligned}$$

where  $i$ , and,  $t$  represent partner countries for Japan and time, respectively. We take three dependent variables such as the number of total traded products, manufactured products, and the differentiated products.  $\ln GDP_t^i$  is log of GDP for partner country,

$\ln GDP_t^j$  is log of GDP for Japan,  $\ln DISTANCE_t^i$  is log of geographical distance

between Japan and each partner country,  $\ln REMOTENESS_t^i$  is log of relative distance,

and  $China_t^i$ ,  $NIES_t^i$ ,  $ASEAN4_t^i$ ,  $Europe_t^i$ , and  $SAMERICA_t^i$  are dummy for the

countries, China, NIEs, ASEAN4, Europe, and South America, respectively. Table 4-1 describes the expected sign between the extensive margins and the independent variables. The relationship between them follows.

We expect a positive sign for GDP, since export increases as a country size grows in the general trade gravity model. As we saw already, as the level of production and the income level increase, countries induce their diversification and specialization. Also, fragmentation force accelerates more effective production and trade among countries. Hence, positive relationship expects for GDP.

Following many other studies with gravity estimations, we use distance between the capital cities, and obviously we expect negative sign. Distance is included as a proxy for shipping costs and technological improvement for transportation has still been contributing to reducing this costs. However, geographical distance is still a key factor for the extensive margin of trade. Countries prefer to stay closer if they trade parts and components, and if larger share of the extensive margin of trade accounts for intermediate products, they do not like to trade them to distant countries, because it takes time to build up a final product. So, we expect the negative relation between distance and the extensive margin.

Following Ijiri (2005), we provide remoteness that shows how far a country is away from the rest of the world among 64 countries. In Ijiri (2005), he has estimated remoteness in order to investigate the determinants of FDI for Japanese firms. In this study, we estimate this variable whether it can explain the growth of extensive margins. If this value of remoteness is low for a country, it means that this country locates where many countries with comparatively larger economic size and competition exist. The reverse holds if remoteness is high, and in this case, market is relatively sheltered from competition. That is, as Chaney (2008) has noted in his study, the effect of change in the extensive margin by a reduction of trade costs can be large on trade flows, and thus, we can expect positive sign for the relation between the extensive margin and remoteness. For other trade costs, we use the index of cost of business start-up procedures introduced by the World Bank. We expect to have this data as fixed trade costs. Some studies take a change in new entrants as extensive margin and new entrants need to pay for business start-up when they enter. We, of course, expect the negative relation between this cost and extensive margins.

Besides the independent variables mentioned above, we add some regional dummy variables of China, Asian NIEs, ASEAN5, EU, and South America. We take 1 if partner countries are in one of the regions and 0 otherwise. We expect strongly positive sign for East Asian countries due to observing fragmentation especially among East Asian

countries. On the other hand, a negative sign comes to appear for EU and South America. EU countries are facing many countries with high economic level in the neighborhood and South American countries have relatively lower economic size and higher distance from Japan.

Table 4-1 The expected sign

Independent Variables	Expected sign
GDP	+
GDP (Japan)	+
Distance	-
Remoteness	+
China	+
NIES	+
ASEAN4	+
Europe	-
South America	-

#### 4-4 Estimation Results

As discussed above, one of the main purposes of this study is to investigate the importance of the extensive margin and to test the simple gravity estimation can explain the extensive margin of trade. Then, we have similar evidence for both the values and the number of products. Table 4-2 shows the results for values of the extensive margin of total products from (1) to (3) and for values of the extensive margin of export for manufactured products from (4) to (6). Table 4-3, also, shows the results for the number of products in terms of total products and manufactured products. Most variables enter with the expected signs. With all the number of total traded products, manufactured products and differentiated products equations, the estimated coefficients for the GDPs have the expected signs and are statistically significant. It can conclude from our gravity estimation that the extensive margins of export are positively correlated with the market size of countries. Also, geographic distance negatively affects the extensive margin of export in the simple regressions, except when it includes regional dummies.

For remoteness, if it is positive, it can show that the extensive margin of export can be greater for the countries that are far from rest of the world. However, our result for remoteness does not have significance for coefficients, although it provides positive sign. As Chaney (2008) says, the extensive margin of trade is sensitive to change of trade costs when market is sheltered from competition. The sign of coefficients for remoteness is positive and statistically significant for the extensive margin. We can consider that the extensive margin of export from Japan is



It is worth noting for our findings that regional characteristics strongly appeared. The result of regional dummies provides a distinctly difference between regions. The coefficients for dummy variables for China, NIEs, and ASEAN are positive for three regressions. On the other hand, the coefficients for the Europe and South America dummy variables in the regressions are negative and mostly significantly. Those differences of the results of regional dummy give us the distinct characteristics of regions where Japan exports. The extensive margin of trade in East Asia can be affected international fragmentation forces. It explains that the extensive margin of trade is induced by international production sharing among Asian countries, but not between Japan and EU and South American countries which locate quite far from Japan. It is almost the same interpretation as we use intermediate products. However, we should not just simply conclude that fragmentation may occur due to increase only in intermediate trade. Thus, to analyze the growth of extensive margin may complement to observe recent production sharing.

Figure 4-2 Regression estimation ( Values of the extensive margin)

	Value of the extensive margin of export for total products			Value of the extensive margin of export for manufactured		
	(1)	(2)	(3)	(1)	(2)	(3)
GDP	0.893 (14.14)**	0.925 (14.25)**	0.824 (14.12)**	0.912 (13.24)**	0.936 (13.10)**	0.827 (13.00)**
GDPjapan	1.597 (7.96)**	1.532 (7.55)**	1.717 (8.77)**	1.875 (7.91)**	1.827 (7.62)**	2.023 (8.72)**
Distnace	-1.164 (5.97)**	-1.158 (5.97)**	0.271 (0.76)	-1.091 (5.16)**	-1.087 (5.12)**	0.463 (1.20)
Remoteness		0.778 (1.98)*			0.581 (1.34)	
DChina			0.74 (0.84)			0.726 (0.76)
DNIES			2.459 (4.66)**			2.66 (4.65)**
Asean4			1.279 (3.03)**			1.326 (2.90)**
Deurope			-0.606 (2.32)*			-0.555 (1.96)
Samerica			-1.407 (3.11)**			-1.613 (3.29)**
Constant	-41.705 (7.79)**	-44.437 (8.05)**	-55.985 (9.12)**	-51.193 (8.00)**	-53.249 (8.09)**	-66.932 (9.33)**
R-squared	0.31	0.31	0.30	0.27	0.27	0.30
Observations	923	923	923	923	923	923
Number of ID	63	63	63	63	63	63

Absolute value of z statistics in parentheses

\* significant at 5%; \*\* significant at 1%

Figure 4-2 Regression estimation (Number of the extensive margin)

	The total number of products in the extensive margin of export			The number of manufactured products in the extensive margin of export		
	(1)	(2)	(3)	(1)	(2)	(3)
GDP	0.122 (6.65)**	0.129 (7.08)**	0.128 (7.11)**	0.093 (5.67)**	0.108 (6.66)**	0.093 (5.69)**
Distnace	-0.58 (4.65)**	0.007 -0.05	0.563 (2.51)*	-0.34 (3.50)**	-0.34 (3.82)**	0.439 (2.36)*
Remoteness		-0.211 (1.06)			0.145 (0.90)	
DChina		1.26 (2.39)*	1.634 (3.01)**			1.10 (2.44)*
DNIES		1.552 (4.89)**	1.8 (5.44)**			1.238 (4.50)**
Asean4		1.342 (4.87)**	1.228 (4.57)**			0.876 (3.92)**
Deurope			-0.473 (2.78)**			-0.303 (2.15)*
Samérica			-0.995 (3.43)**			-0.674 (2.80)**
Constant	9.117 (7.55)**	4.48 (2.88)**	-1.148 (0.59)	7.001 (7.27)**	5.902 (4.80)**	0.106 (0.07)
Observations	941	941	941	941	941	941
Number of ID	63	63	63	63	63	63
R-squared	0.01	0.01				
Absolute value of z statistics in parentheses						
* significant at 5%; ** significant at 1%						

## 5. Conclusion

We have seen how the extensive margin of trade increases by using at the HS 9-digits trade data. First, we saw the pattern of extensive margin which is affected by a country's characteristics. Following, Imbs & Warziarg (2003) and other studies, we assumed that income level matters to it whether a country achieve diversification and specialization. Then, empirical evidence shows that trade in precision machinery (HS90-HS92) tends to make specialization for export and diversification for import. However, there is also clear evidence that the extensive margin of export in Japan is expanding for general machinery (HS84) and electric machinery (HS85). It can observe both patterns but overall the extensive margin of trade is strongly supported by gravity equations. It helps to explain international production sharing due to increase in the extensive margin of export with some East Asian countries. Except China, we have

strong evidence that increase in trade in new products rapidly induces between East Asian countries. On the other hand, it results to a negative relationship to European countries and South American countries. Although some effect of distance is lower due to improvements of transport technology, it seems that distance still matters and it influences not only geographical distance but communication costs or cultural difference as a country locates far. So, although countries in East Asia still have relatively lower income level, Japan exports more new products. The regional characteristics appeared here like other early studies for fragmentation. Although, from our research, we can only provide the results from the view of Japanese trade pattern, trade in new products gives suppliers to access more input effectively to be able to produce a final products and consumers to have wider choices to purchase. For further studies, we should decompose products which belong to the extensive margin into intermediate and final products to consider whether trade in parts and components supports the growth of extensive margin. Also, we have analyzed only for Japanese extensive margin of trade, and thus, we need to research whether other developed countries.

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