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The Impacts of Free Trade Agreements on Trade Flows:

An Application of the Gravity Model Approach

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## I. Introduction

The world has been witnessing a proliferation of regional trade agreements (RTAs), which include free trade agreements (FTAs) and customs unions. The cumulative number of RTAs that had been reported to the GATT (General Agreement on Tariffs and Trade) since its inception in 1948 was 25 in 1990. The number began to increase in the 1990s to record 91 in 2000, and then it has accelerated to reach 194 as of March 1, 2007. Several notable developments should be recognized. First, many RTAs are FTAs, under which trade barriers between FTA members are removed but they maintain their own protection vis-à-vis non-FTA members. The number of customs unions, where members not only remove trade barriers between the members but also establish common external tariff vis-à-vis non-members, is small<sup>1</sup>. Second, many FTAs go beyond the tariff removal to include other elements such as liberalization of foreign direct investment (FDI) policies, facilitation of trade and FDI, and economic development. As such, the impacts of FTAs As such, the economic impacts of FTAs on FTA members and non-member are likely to be substantially larger compared to traditional FTAs. Third, FTAs were actively established in Europe, Africa and North and South America through the 1990s, but starting in the 21<sup>st</sup> century the East Asian region joined other regions in establishing FTAs. In the East Asian region, the Association of Southeast Asian Nations (ASEAN) has been playing a key role in establishing FTAs with other countries in East Asia.

The rapid expansion of RTAs is attributable to various factors. One important reason is stalemate in the Doha Development Agenda, the on-going multilateral trade negotiation under the World Trade Organization (WTO). Faced with this situation, countries interested in promotion of trade liberalization have pursued bilateral or plurilateral trade liberalization under FTAs with the like-minded countries. Being concerned with possible exclusion from FTAs, an increasing number of countries began showing a strong interest in FTAs.

The proliferation of FTAs appear to have affected economic conditions in many countries, not only FTA members but also non-members, through foreign trade. Two

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<sup>1</sup> As of March 1, 2007, out of 194 RTAs reported to the GATT/WTO, as many as 190 RTAs, or 93 percent of total, are FTAs, while the remaining 14 RTAs, or 7 percent of total, are customs unions. (WTO website). Because of the large number of FTAs among RTAs, we use the term FTAs to indicate RTAs, unless otherwise noted.

possible impacts, trade creation and trade diversion, may be realized as a result of FTAs. Trade creation effect means that FTA eliminates trade barriers on trade among FTA members and, therefore, creates trade among them, while trade diversion effect means that FTA would replace imports of highly efficient non-member countries by imports from less efficient FTA members. Trade creation results in an improvement in resource allocation and economic welfare, while trade diversion worsens efficiency in resource allocation the world. Besides, trade diversion has negative impacts on non-members, as they lose an exporting opportunity. While consumers in FTA members may increase welfare as FTA enables them to buy imports at lower prices, an FTA member country as a whole may suffer from loss in government's tariff revenue.

To discern the impacts of FTAs on foreign trade, we undertake the analysis by using two approaches. One approach is to examine the changes in trade patterns before and after an FTA. Specifically, we measure the extent of dependency in foreign trade between and among FTA members. This approach is admittedly too simplistic, but it provides useful information on the extent of trade dependency for different FTAs and its changes over time. The second approach is a more vigorous one, namely, the estimation of a gravity model to discern the impact of FTAs on bilateral trade flows. The gravity model, which is built on the assumption that bilateral trade flows depend on the economic size of the two countries and the distance between them, has been used to assess the impacts of FTAs on bilateral trade flows. We extend the previous studies by enlarging the sample size both in terms of the number of countries and in terms of the time-period. We also undertake the analysis by disaggregating the trade data into five sub-sectors with an presumption that the impacts of FTAs would be different among different sectors, mainly because the removal of trade barriers under FTAs is different for different sectors. Specifically, agricultural products are prone to be excluded from the free trade list. Furthermore, we examine explicitly the impacts of trade-diversion of FTAs by taking account of trade between FTA members and non-members.

The structure of the paper is as follows. Section II examines the changing patterns of international trade among FTA member countries over time, in order to see if any discernable changes such as the increase in intra-FTA member trade can be identified. The analysis in this section, which uses rather crude indicators, also provides some basic information on the international trade for different FTAs. Section III undertakes a rigorous analysis by applying a gravity model to assess the impacts of FTAs on international trade involving FTA members and non-members. In section III a

brief survey of the literature is presented before proceeding to the main analysis. Section IV presents some concluding remarks.

## II. Intra-FTA Trade Dependency for Selected FTAs

FTAs are expected to promote trade among FTA members, possibly at the expense of trade with non-FTA members. This section examines if these expected impacts are observed for a selected number of FTAs by using a rather crude methodology, before undertaking a more rigorous approach in the next section. As such, the analysis in this section may be considered to set the stage for a more detailed analysis in the next section.

We use two indicators to examine the extent of intra-FTA interdependence<sup>2</sup>. One is the share of intra-FTA members' trade in FTA members' overall trade (relative share) and the other is trade-intensity. The definitions of these two indicators are shown below.

Relative share:  $X_{ii} / X_{iw}$

Trade intensity index:  $(X_{ii} / X_{iw}) / (X_{iw} / X_{ww})$

where  $X_{ii}$  represents intra-region (FTA) trade,  $X_{iw}$  region  $i$ 's trade with the rest of the world, and  $X_{ww}$  world trade.

Let us examine the impacts of FTAs on the intra-regional dependence in foreign trade for a selected number of FTAs (Table 1). To begin with the relative share indicator, one observes that the relative share has risen in many FTAs with the exceptions of the EU, Japan-Singapore FTA, Singapore-USA FTA and Mexico-EU FTA after the enactment of FTAs. For example, for the AFTA the relative share increased from around 17 percent in the pre-AFTA years to 22-25 percent in the post-AFTA years. Similar patterns are observed for many other FTAs, although the increase in the relative share is less pronounced compared to the case for the AFTA. This finding indicates the possible trade creation for many FTAs.

The relative shares show the importance of trade with FTA members for a country or a region under study. According to the computed figures for 2005, one finds that intra-FTA trade accounts for a large part of trade for the EU and the NAFTA, as the relative percentage shares of intra-FTA trade in overall trade for these two groups were 58.4 and 43 percent, respectively. Despite the smaller magnitude, the intra-FTA trade is very important for the AFTA members, as the relative percentage share was recorded at

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<sup>2</sup> Schiff and Winters (2003) analyzes the impacts of FTAs (they use the term "regional integration agreements) by using various indicators including those used in this paper.

25.5 percent. The relative shares for Mercosur and China-ASEAN were of some significance with the figures exceeding 10 percent. Indeed, the relative share for the China-ASEAN increased notably over time. For the remaining FTAs, the relative shares are very small, reflecting the limited importance of intra-FTA trade for the countries involved.

The second indicator we examine is trade intensity index, which measures the “pure” intensification of trading relationship. An increase in trade with a country may be attributable to two factors. One is the expansion of trade by a trading partner and the other is “pure” intensification of the trade relationship. Specifically, trade relationship of a country with (or dependency on) a trading partner country can increase when the trading partner’s trade expands faster than other countries. Taking into account of this factor, we compute trade intensity index and its changes over time. Trade intensity index captures the “bias” in bilateral trade relationship by considering the trade volume of the trading partner. Trade relationship is more (less) intensive (or biased) than normal if the value of trade intensity is greater (less) than unity.

According to the computed results shown in Table 1, it appears that trade intensity increased after the establishment of FTAs for the NAFTA, the Mercosur, CER, and the AFTA (recent years). It may be pointed out that trade intensity for Japan-Mexico increased rather noticeably in 2005 after the enactment of Japan-Mexico FTA, although its magnitude is very small at 0.217.

An examination of the trade intensity figures reveals wide variations in the intensity of intra-FTA relationships among different FTAs. In 2005 the Mercosur was found to show the strongest intra-FTA trade relationship, as the trade intensity figure was recorded at 7.8. The Mercosur was followed by the CER (5.6) and the AFTA (4.5). In addition to these FTAs, the EU and the NAFTA recorded the value greater than unity. These findings indicate that trade relationships among FTA members are quite strong, or above average, for the EU, the NAFTA, the AFTA, the Mercosur and the CER. By contrast, trade relationships among FTA members are rather weak, or below average, for the remaining FTAs, Japan-Singapore, Japan-Mexico, China-ASEAN, Korea-Chile, Singapore-USA, and Mexico-EU.

In this section we examined the impacts of FTAs on trade relationship between and among FTA members. We found that some FTAs including the NAFTA, AFTA, Mercosur and the CER appeared to have produced trade-creation effect, while for other FTAs such effect was not observed. We further found that intra-FTA trade relationship is

important and intense for the EU, the NAFTA, the AFTA, the Mercosur and the CER, while it is not so for other FTAs. The analysis in this section has provided useful information on the impacts of FTAs on international trade for the FTA members, but the analysis was rather crude, as it could not isolate the impacts of FTAs from other factors that influence international trade such as economic size of the countries involved. Furthermore, the analysis in this section was not precise in that no statistical assessment was made. To remedy these problems and to discern the impacts of FTAs on international trade for the FTA members and non-members, we undertake an analysis by applying the gravity model in the next section.

### III. The Impacts of FTAs on Bilateral Trade Flows: An Application of a Gravity Model

Our analysis is based on estimating a gravity model, which tries to explain the volume of trade between the two countries by their market size and geographical distance. The gravity model has been shown to have theoretical foundations in international trade theory, as discussed in Anderson (1979). We begin our analysis by presenting a brief summary of literature survey of the empirical application of the gravity model. We then conduct our analysis first by examining the trade creation effect of FTAs and then the trade creation and trade diversion effects.

#### III.1 A Brief Survey of the Literature

The gravity model has been most instrumental in cross-country analysis of international trade flows for more than four decades. Tinbergen (1962) and Poyhonen (1963) are the first to apply the gravity model to study international trade flows, and since then numerous empirical analyses by applying the model on international trade have been conducted to provide various verifications and implications. Since the mid-1980s theoretical foundations of the gravity model have been provided within the framework of the international trade theory based on imperfect substitutes, increasing return to scale and product differentiation at firm-level. Since the 1990s, the gravity model has attracted a lot of attention in the analysis of international trade as a result of renewed interest in economic geography, which considers geographic and other kinds of distance as an important factor in economic activities.

The gravity equation has been a popular methodology to study the effects on trade of international trading system such as the WTO and regional trading arrangement

such as FTAs and currency unions. Timbergen (1962) was the first attempt to examine the effects of FTA on trade, and he found significant positive effects among members of the British Common Wealth but insignificant for the Benelux FTA. In the 1970s and 1980s several studies analyzed the effects of major regional trade agreements and schemes, such as the EEC, EFTA and LAFTA (Aitken (1973) and Brada and Mendez (1983), etc.). In order to capture the effects of the FTAs on trade flows, they added a dummy variable, which takes the value of unity if country pairs belong to the same FTA, to the standard gravity model. This dummy variable method has been used for many studies on this subject since then.

In light of rapid expansion of FTAs since the 1990s, an increasing number of studies have attempted to examine the impacts of various FTAs by applying the gravity model. Frankel, Stein and Wei (1995), Frankel (1997) examined the effects of major FTAs, such as the EU, the NAFTA, the MECOSUR and the AFTA, and they found significant positive effects in the cases of MERCOSUR and AFTA but not in the cases of the EU and the NAFTA. Solaga and Winters (2000) also attempted to capture the trade creation and two way trade diversion effects of major multilateral FTAs, and they found significantly positive effect on trade creation for the FTAs only in Latin American countries, and they also found significant trade diversion effects for the cases of the EU and the EFTA. Endoh (1999) analyzed the trade creation and trade diversion effects of the EEC, LAFTA and CMEA, and he found both effects for these FTAs, and he also observed that the effects were diminishing in the 1990s. As the results of these studies indicate, the estimated results on the effects of FTAs on trade flows by using the gravity model are not uniform but mixed.

Several attempts have been made to extract effects of FTAs more in detail in recent years. Taking account of the improvement in the estimation method, Baier and Bergstrand (2002) treated FTA dummies as endogenous variables, and they showed the effect of FTAs on trade flows is quadrupled. Carrere (2003) applied Baier and Bergstrand's specification to panel data analyses, and derived the result showing that FTAs generated a significant increase in trade in contrast to previous results. Chen and Tsai (2005) constructed a modified gravity model and compared the results by using panel data. They found that the estimated values are different among different FTAs.

Although the trade creation effects of FTAs are found in many cases, a lot of study suggests that the magnitude of the effects depends on the time period and other circumstances. Based on the notion that the impact of FTAs on trade differs depending

on the products, several studies have conducted analyses at disaggregated sector levels. Gilbert, Scollay and Bora (2004) attempted to find out the effects of major FTAs and natural trading blocs in East Asia by sector, and obtained the results that natural trading blocs in East Asia exist in merchandise and manufacturing sectors. Endoh (2005) investigated the effects of GSTP among developing countries on trade of capital goods, and he found that the trade between GSTP countries increased significantly.<sup>3</sup>

In light of the results from the earlier studies, in this paper, we extend the earlier analyses by using a large up-to-date data sample and a disaggregated dataset, in order to deepen our understanding of the impacts of FTAs on trade flows.

### III.2 The Model and the Estimated Results

We conduct the estimation of the gravity model to assess the impacts of FTAs on international trade flows. We conduct the analysis using two types of datasets, aggregate trade data and disaggregate trade data.

#### III.2.1 The Analysis of Trade Creation Effect

The model

We use a standard gravity equation to estimate trade flow and discern the impacts of FTA on bilateral total merchandise trade. First we estimate the following equation to examine “general FTA effects” for total merchandise trade flow between countries *i* and *j*.

$$\ln(Trade_{ijt}) = \alpha + \beta_1 \ln(Y_{it} * Y_{jt}) + \beta_2 \ln(y_{it} * y_{jt}) + \beta_3 \ln(Distance_{ijt}) + \beta_4 Adjacency_{ijt} + \beta_5 Language_{ijt} + \phi FTA_{ijt} + \sum_t \gamma_t Timedum_t \quad (1)$$

Where,  $Trade_{ijt}$  denotes total export value between country *i* and *j* in year *t*, and it is the sum of the exports of country *i* to *j* and the exports of country *j* to *i*.  $Y$  and  $y$  denote GDP and GDP per capita, respectively.  $Distance$  indicates the distance in km between the largest cities of countries *i* and *j*. These variables take a natural logarithm form.  $Adjacency$  and  $Language$  are dummy variables, for  $Adjacency$  the value of unity is

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<sup>3</sup> Besides, Fukao, Okubo and Stern (2003) provide an econometric analysis on trade diversion effects of NAFTA by using HS 2digit level data, in partial equilibrium framework.



given if countries  $i$  and  $j$  share the common border and for *Language* the value of unity is given when common official languages are shared by countries  $i$  and  $j$ . *FTA* denotes a “comprehensive FTA effects”, and it is binary variable which is unity if country  $i$  belongs to the same FTA with country  $j$ . We construct this variable based on 211 RTAs notified to WTO up to September 2006. *Time dummy* is a nested dummy variable which is used to capture external annual time effect during the sample period.

Among the explanatory variables,  $Y$  and  $y$  are a proxy for economic scale and income level, respectively, and their estimated signs are expected to be positive because the larger economic scale and the higher income level promote trade. The distance variable reflects both tangible and intangible trade costs. The sign is expected to be negative as the longer the distance, the larger the cost. Both dummy variables of *Adjacency* and *Language* also reflect tangible and intangible trade costs such as transportation cost and cultural similarity, so that these estimated coefficients are expected to be positive. The binary variable *FTA* captures a “comprehensive FTA effect” on trade flow, and we expect the estimated relation to be positive, if trade creation effect emerges.

## The Data

The sample for the estimation includes 178 countries over the period 1980-2005 (Appendix Table 2). The sample countries and its largest cities are listed in Appendix Table 2. Although the total number of sample observations are 409,578 ( $((178 \text{ countries} * 177) / 2) * 26$  period), missing values are taken out, and as such the number of samples varies among the estimations.

Trade data are taken from Direction of Trade Statistics (DOT) of IMF. Since the data from DOT are expressed in nominal US dollars, we deflated the value by consumer price Index of USA (2000=1) from International Financial Statistics of the IMF, to construct a pooled-data set. GDP and GDP per capita in the US dollars are taken from World Development Indicators (WDI) of the World Bank. Both GDP and GDP per capita are deflated by GDP deflator (2000=1) for the USA. Distance is a beeline on earth between the largest cities of sample countries and the data are calculated by the latitude and longitude. Adjacency is defined as a common land border.

## The Results

We applied an ordinary least squares method to estimate the gravity equation

indicated in estimation for the pooled data for the three year periods (except for the two-year period for 2004-2005) from 1980 to 2005. The estimated coefficients of the standard set of variables, which are generally used in the gravity model estimation, are shown to have expected signs with statistical significance. That is to say, the magnitude of bilateral trade is promoted by the economic size, income levels, cultural similarities of the countries involved, while it is deterred by their geographical distance. The estimated results of the FTA dummy variable show that FTAs strongly promoted bilateral trade. This relationship is found with statistical significance for all the sub-periods except 1989-1991.

The previous analysis examined the impacts of FTAs in general without considering specific FTAs such as the EU and the NAFTA. We now turn to the analysis of the impacts of specific FTAs on bilateral trade flows. The results of the estimation are shown in Table 3. The standard variables for the gravity model such as GDP, GDP per capita, and distance are generally shown to have expected impacts with statistical significance. The estimated results on the FTA dummies for regional or plurilateral FTAs (the EU, NAFTA, AFTA, MERCOSUR, ASEAN-China, EU-Mexico) are found to be mixed. For example, the estimated coefficients for the EU and the MERCOSUR are mostly positive, while those for the NAFTA, AFTA, ASEAN-China and EU-Mexico are mostly negative. Despite mixed results in the signs of the estimated coefficients, it should be noted that most estimated coefficients are not statistically significant. One exception is the ASEAN-China FTA, for which the negative impact is shown to be statistically significant. These findings, which lead us to make an observation that the trade creation is not detected for major FTAs, are not consistent with our earlier findings from the crude indicators, as they showed the possible presence of trade creation effect for several major FTAs including the NAFTA, the AFTA, and the MERCOSUR.

Contrary to the findings for the major FTAs, some bilateral trade has been shown to be substantially larger than the expected value, which takes account of economic size and geographical distance. Namely, CER, Japan-Singapore, Korea-Chile, and Singapore-USA pairs exhibit substantially larger trade volume compared to the “normal” or “average” levels. Since such relationships are found for the periods, when FTAs were not present, we may argue that these pairs are natural trading partners. If this observation is correct, we would assume the establishment of FTAs involving these

natural trading partners results in beneficial impacts<sup>4</sup>.

### III.2.2 The Analysis of Trade Creation and Trade Diversion Effect

In the previous section we analyzed the trade creation effect of FTAs. In this section we analyze not only the trade creation effect but also the trade diversion effect of FTAs. In order to analyze both trade creation and trade diversion effects, we adopt the following specification of the estimated equation.

$$\begin{aligned}
\ln(Export_{ijt}) = & \alpha + \beta_1 \ln(Y_{it}) + \beta_2 \ln(Y_{jt}) + \beta_3 \ln(y_{it}) + \beta_4 \ln(y_{jt}) \\
& + \beta_5 \ln(Distance_{ijt}) + \beta_6 Adjacency_{ijt} + \beta_7 Language_{ijt} \\
& + \phi_{EU1} EU_{ijt}^1 + \phi_{EU2} EU_{ijt}^2 + \phi_{EU3} EU_{ijt}^3 \\
& + \phi_{NAFTA1} NAFTA_{ijt}^1 + \phi_{NAFTA2} NAFTA_{ijt}^2 + \phi_{NAFTA3} NAFTA_{ijt}^3 \\
& + \phi_{AFTA1} AFTA_{ijt}^1 + \phi_{AFTA2} AFTA_{ijt}^2 + \phi_{AFTA3} AFTA_{ijt}^3 \\
& + \phi_{MRCSR1} MRCSR_{ijt}^1 + \phi_{MRCSR2} MRCSR_{ijt}^2 + \phi_{MRCSR3} MRCSR_{ijt}^3 \\
& + \phi_{ASCH1} ASEANCHN_{ijt}^1 + \phi_{ASCH2} ASEANCHN_{ijt}^2 + \phi_{ASCH3} ASEANCHN_{ijt}^3 \\
& + \phi_{EUMex1} EUMX_{ijt}^1 + \phi_{EUMex2} EUMX_{ijt}^2 + \phi_{EUMex3} EUMX_{ijt}^3 \\
& + \phi_{CER} CER_{ijt} + \phi_{jpsg} JPSG_{ijt} + \phi_{jpmx} JPMX_{ijt} + \phi_{kochl} KRCHL_{ijt} + \phi_{sgusa} SGUSA_{ijt} \\
& + \sum_t \gamma_t Timedum_t
\end{aligned} \tag{3}$$

Where,  $Export_{ijt}$  denotes total export value from countries i to j in year t. As before,  $Y$ , and  $y$ , are GDP and GDP per capita, respectively.  $Distance$ ,  $Adjacency$  and  $Language$  are geographical distance, common border and common official language, respectively. EU(European Union), NAFTA(North American Free Trade Agreement), AFTA (ASEAN Free Trade Area), MRCSR (Mercosur), ASEANCHN(ASEAN-China), EUMEX(EU-Mexico), CER(Australia-New Zealand), JPSG (Japan-Singapore), JPMX (Japan-Mexico), KRCHL (Korea-Chile), SGUSA(Singapore-USA) are FTA dummies representing those groups or countries indicated inside the brackets. An FTA dummy with the upper case letter 1 indicates the trade creation dummy, which is given unity for

<sup>4</sup> See Gilber et.al (2004) on the discussions of natural trading partners.

the countries belonging to the same FTA. FTA dummies with the upper case letters 2 and 3 are trade diversion dummies. The trade diversion dummy variable with the upper case letter 2 is given unity, if exports of an FTA member go to non-members, while the trade diversion dummy variable with the upper case letter 3 is given unity, if exports of a non-FTA member go to FTA member. For the case of trade creation, the estimated sign of the dummy with the upper case letter 1 is positive, while for the case of trade diversion, the estimates signs of the dummies with the upper case letters 2 and/or 3 are negative. We call the first type of trade diversion “type 1 trade diversion” and the second type “type 2 trade diversion” In the standard analysis of FTA, type 1 trade diversion is recognized but not type 2 trade diversion. However, we examine the presence or absence of these two types of trade diversion.

#### The Data

The sample of 63 countries and their main cities used in the empirical analyses is listed in Appendix Table 3. This list is the same as that in Frankel and Wei (1995), Frankel et al. (1995), Frankel (1997) and Rauch (1999), for the convenience of readers. Export values are taken from Commodity Trade Statistics of the United Nations. We use five types of products for the estimation, namely, food and live animals, apparels, iron and steel, electrical machinery and motor vehicle. Details are described in Appendix Tables A4 and A6. We used the pooled dataset containing the export values for 1990, 1995, 2000 and 2005. Regarding the explanatory variables, we use the same dataset used for the estimation of total trade.

#### The Results

The results of the estimation are shown in Table 4. The table shows the results for the five different product groups in addition to those for total exports. To begin with the results for total exports, we find the trade creation effect for the AFTA, the MERCOSUR, the EU-Mexico FTA, the CER and Korea-Chile. The trade diversion effect is observed for the NAFTA, the MERCOSUR and the EU-Mexico FTA. For the EU, the AFTA, ASEAN-China FTA, exports to non-members were found greater than the “average.”

The results for the five different product group show quite different patterns concerning the trade creation and trade diversion effects for the regional and plurilateral FTAs compared to those for total exports. Contrary to the findings for total exports, for

the EU, and the NAFTA, trade creation effect was found for some products. For the EU, trade creation was found for food and live animals, apparel, iron and steel, and motor vehicles, while for the NAFTA trade creation was found for food and live animals, and motor vehicles. Being consistent with the results for total exports, the AFTA and the MERCOSUR observe trade creation effect for many products.

As explained above, two types of trade diversion, type 1 and type 2 trade diversion, were tested in the analysis. Type 1 trade diversion indicates the decline in non-FTA members' exports to FTA members, while type 2 trade diversion indicates the decline in FTA member's exports to non-FTA members. For the EU, type 1 trade diversion was detected for iron and steel, electrical machinery, and motor vehicles. It is interesting to note that for apparel non-EU exports to the EU increased. Coupled with the observation that type 2 trade diversion is detected for apparel, the findings appear to show that consumption, or demand for apparel increased substantially in the EU.

For the NAFTA, type 1 trade diversion was found for food and live animals and motor vehicles, while type 2 trade diversion was found for all the products except food and live animals. Coupled with the estimated results on trade creation, one could argue that the NAFTA market for the automobiles became introverted.

Regarding the AFTA, little evidence is found for the trade diversion. Indeed, only one case of trade diversion with statistical significance was found for the AFTA, that is, type 2 trade diversion. The findings for the MERCOSUR are quite different than those for the AFTA in that many cases of trade diversion were found.

The findings for other FTAs reveal several interesting developments. For ASEAN-China, trade between them as well as trade with others countries increased for apparel and electrical machinery, probably reflecting active international trade in parts and components of these products under the regional production and distribution networks, which have been constructed in East Asia by multinational corporations. Bilateral trade between the EU and Mexico are substantially large in electronics while non-members' exports to the EU-Mexico are shown to be quite large, probably reflecting large amount of trade in auto parts with the US under the NAFTA.

#### IV. Conclusions:

We attempted to examine the impacts of FTAs on trade flows. More specifically, we attempted to discern trade creation and trade diversion effects of FTAs

by using two methodologies. One approach is to compute the importance of intra-FTA trade in overall trade of FTA members, and the other is to estimate a gravity equation by introducing FTA dummies.

The results of the analysis revealed several interesting observations. First, an analysis of the aggregate data, or total trade or total exports, strongly indicate that FTAs bring about trade creation effect. However, the results are mixed when it comes to specific FTAs. For example, trade creation effect was not found for the EU and the NAFTA, while the AFTA and the MERCOSUR tend to have trade creation effect. These findings based on aggregate data have to be modified, as the analyses for different product categories show different patterns. For the EU and the NAFTA, for which trade creation effect was not found from the aggregate data analysis, trade creation effect was found for several products including food and live animals, apparel, iron and steel, and motor vehicles for the case of the EU and food and live animals and motor vehicles for the case of the NAFTA. An analysis of trade diversion tends to show such effect for many products in the case of the EU, the NAFTA, and the MERCOSUR but not for the case of the AFTA.

Our overall assessment of the results on trade creation and trade diversion tends to indicate that the EU and the NAFTA are relatively more closed or introverted than the AFTA, the CER or the MERCOSUR. Other FTAs, which we analyzed, appear to be too recent to show substantial impacts yet.

Before ending this paper, we would like to point out the limitations of our study and future research agenda on the impacts of FTA on international trade. To begin with the limitations, we could not include some variables that would have impacts on bilateral international trade. Foreign direct investment (FDI) has been expanding rapidly and FDI is shown to have substantial impacts on foreign trade. Multinational corporations (MNCs), which are major suppliers of FDI, dominate international trade. Indeed, MNCs are actively engaged in intra-firm trade, or trade inside MNCs. These observation attest the importance of FDI in explaining bilateral trade, but a lack of reliable information on bilateral FDI precluded us from including FDI in the analysis. The construction of reliable FDI database is an very important agenda. Another desirable information is economic cost of bilateral foreign trade. We used geographical distance as a proxy for the economic distance. A better indicator is needed.

Finally, we would like to mention several possible extensions of our analysis as future research agenda. One is to undertake a panel data analysis. We have compiled a

large dataset comprised of time-series and cross-country information, which could be used for the panel data analysis. Such an in-depth analysis would prove useful in obtaining reliable results.

Table 1 Changes in Intra-FTA Dependency in Foreign Trade for Selected FTAs

		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
<b>EU15</b>	Relative share	0.58	0.558	0.573	0.584	0.58	0.59	0.622	0.637	0.641	0.638	0.646	0.647	0.653
	Trade intensity	1.577	1.739	1.729	1.773	1.842	1.825	1.652	1.639	1.682	1.69	1.603	1.631	1.678
<b>NAFTA</b>	Relative share	0.332	0.348	0.344	0.37	0.379	0.383	0.359	0.361	0.363	0.367	0.372	0.389	0.397
	Trade intensity	1.922	1.952	1.965	2.02	1.852	1.871	1.849	1.954	1.935	1.936	2.092	2.156	2.192
<b>AFTA</b>	Relative share	0.156	0.158	0.182	0.192	0.178	0.179	0.164	0.171	0.165	0.163	0.166	0.175	0.177
	Trade intensity	4.327	4.269	4.525	4.57	4.388	5.067	5.334	5.212	4.468	4.003	3.804	3.631	3.543
<b>MERCOSUR</b>	Relative share	0.089	0.088	0.093	0.076	0.082	0.068	0.091	0.084	0.086	0.099	0.1	0.119	0.141
	Trade intensity	3.279	3.286	3.776	3.542	3.715	3.334	5.391	5.258	5.261	6.492	6.676	7.686	8.986
<b>CER</b>	Relative share	0.064	0.065	0.063	0.068	0.073	0.067	0.065	0.075	0.074	0.072	0.074	0.074	0.075
	Trade intensity	4.321	4.273	3.825	4.57	4.464	4.307	4.49	5.249	4.888	4.41	5.065	5.158	5.427
<b>Japan-Singapore</b>	Relative share	0.036	0.04	0.042	0.04	0.039	0.034	0.034	0.039	0.044	0.046	0.049	0.052	0.051
	Trade intensity	0.427	0.456	0.482	0.439	0.405	0.367	0.367	0.436	0.465	0.484	0.531	0.542	0.55
<b>Japan-Mexico</b>	Relative share	0.012	0.016	0.016	0.014	0.016	0.016	0.012	0.013	0.012	0.011	0.012	0.012	0.013
	Trade intensity	0.153	0.189	0.186	0.165	0.177	0.175	0.136	0.151	0.136	0.125	0.144	0.131	0.149
<b>China-ASEAN</b>	Relative share	0.046	0.048	0.051	0.054	0.054	0.053	0.049	0.05	0.055	0.059	0.061	0.067	0.072
	Trade intensity	0.542	0.492	0.51	0.389	0.538	0.754	0.726	0.769	0.721	0.644	0.582	0.536	0.479
<b>Korea-Chile</b>	Relative share	0.005	0.005	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.007	0.005	0.006	0.007
	Trade intensity	0.383	0.356	0.274	0.236	0.215	0.268	0.257	0.245	0.223	0.312	0.237	0.262	0.278
<b>Singapore-USA</b>	Relative share	0.021	0.021	0.023	0.029	0.027	0.027	0.027	0.03	0.035	0.037	0.038	0.039	0.041
	Trade intensity	0.149	0.145	0.16	0.195	0.168	0.165	0.171	0.201	0.229	0.239	0.258	0.263	0.275
<b>Mexico-EU</b>	Relative share	0.006	0.008	0.008	0.006	0.007	0.006	0.005	0.006	0.005	0.005	0.006	0.007	0.007
	Trade intensity	0.015	0.024	0.023	0.018	0.02	0.019	0.014	0.014	0.014	0.014	0.015	0.016	0.018



Table 1 Changes in Intra-FTA Dependency in Foreign Trade for Selected FTAs (Continued).

		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<b>EU15</b>	Relative share	0.604	0.61	0.617	0.609	0.548	0.559	0.62	0.6	0.595	0.599	0.606	0.599	0.584
	Trade intensity	1.733	1.753	1.605	1.615	1.499	1.448	1.626	1.701	1.639	1.639	1.612	1.625	1.665
<b>NAFTA</b>	Relative share	0.41	0.424	0.42	0.434	0.444	0.457	0.468	0.468	0.465	0.459	0.448	0.437	0.43
	Trade intensity	2.081	2.169	2.277	2.297	2.202	2.159	2.148	2.089	2.109	2.186	2.339	2.412	2.387
<b>AFTA</b>	Relative share	0.184	0.201	0.204	0.206	0.212	0.209	0.218	0.227	0.222	0.227	0.251	0.251	0.255
	Trade intensity	3.173	3.226	3.054	3.071	3.226	3.756	3.798	3.711	3.835	3.901	4.536	4.475	4.485
<b>MERCOSUR</b>	Relative share	0.166	0.177	0.185	0.193	0.203	0.209	0.184	0.177	0.16	0.128	0.132	0.134	0.136
	Trade intensity	9.373	9.979	10.514	10.199	9.801	10.34	10.797	9.863	9.003	8.602	9.34	8.363	7.792
<b>CER</b>	Relative share	0.081	0.087	0.087	0.089	0.088	0.077	0.085	0.074	0.075	0.078	0.083	0.082	0.076
	Trade intensity	5.584	5.88	6.204	6.055	6.106	5.722	6.336	5.867	5.992	5.976	6.35	6.255	5.618
<b>Japan-Singapore</b>	Relative share	0.058	0.062	0.064	0.061	0.057	0.05	0.051	0.054	0.046	0.043	0.04	0.04	0.038
	Trade intensity	0.573	0.608	0.64	0.642	0.625	0.616	0.613	0.618	0.582	0.563	0.545	0.549	0.529
<b>Japan-Mexico</b>	Relative share	0.013	0.013	0.011	0.012	0.012	0.012	0.012	0.013	0.014	0.015	0.012	0.014	0.016
	Trade intensity	0.134	0.137	0.115	0.131	0.129	0.145	0.137	0.137	0.161	0.182	0.155	0.184	0.217
<b>China-ASEAN</b>	Relative share	0.084	0.09	0.094	0.094	0.095	0.085	0.089	0.098	0.099	0.106	0.111	0.118	0.124
	Trade intensity	0.432	0.422	0.444	0.452	0.495	0.58	0.581	0.599	0.644	0.709	0.757	0.749	0.746
<b>Korea-Chile</b>	Relative share	0.009	0.009	0.01	0.01	0.01	0.009	0.008	0.008	0.007	0.007	0.008	0.01	0.012
	Trade intensity	0.336	0.338	0.354	0.324	0.351	0.357	0.309	0.267	0.275	0.252	0.279	0.333	0.397
<b>Singapore-USA</b>	Relative share	0.044	0.045	0.047	0.048	0.045	0.041	0.039	0.036	0.033	0.031	0.031	0.03	0.027
	Trade intensity	0.268	0.272	0.299	0.304	0.273	0.243	0.226	0.202	0.192	0.192	0.203	0.204	0.191
<b>Mexico-EU</b>	Relative share	0.007	0.007	0.005	0.005	0.006	0.007	0.007	0.008	0.009	0.008	0.008	0.007	0.008
	Trade intensity	0.02	0.02	0.013	0.013	0.016	0.017	0.018	0.021	0.022	0.021	0.02	0.019	0.022

Table 2; Empirical results of regression on total trade, 1980-2005, pooled data

	1980-1982	1983-1985	1986-1988	1989-1991	1992-1994	1995-1997	1998-2000	2001-2003	2004-2005
<b>Constant</b>	-16.80 *** (47.78)	-17.27 *** (51.50)	-18.36 *** (59.02)	-18.78 *** (142.62)	-20.28 *** (75.61)	-20.40 *** (82.82)	-21.49 *** (92.81)	-21.26 *** (94.16)	-18.88 *** (63.94)
<b>GDP</b>	0.9392 *** (101.67)	0.9287 *** (105.94)	0.8719 *** (132.18)	0.8836 *** (142.62)	0.8937 *** (153.65)	0.9247 *** (170.34)	0.9504 *** (188.28)	0.9552 *** (193.85)	0.9126 *** (140.36)
<b>GDP per capita</b>	-0.0297 **** (4.55)	-0.0217 *** (3.51)	0.1451 *** (16.76)	0.1583 *** (19.95)	0.1325 *** (17.82)	0.0996 *** (14.55)	0.0823 *** (13.10)	0.0691 *** (11.19)	0.0536 *** (6.41)
<b>Distance</b>	-1.1868 **** (49.81)	-1.1685 *** (51.49)	-1.1309 *** (52.07)	-1.1828 *** (60.64)	-1.0333 *** (-59.94)	-1.1503 *** (72.80)	-1.1564 *** (77.63)	-1.2097 *** (82.59)	-1.1827 *** (59.48)
<b>Adjacency</b>	-0.0601 (0.53)	0.1051 (0.96)	0.4118 *** (3.96)	0.5620 *** (5.67)	1.0642 *** (11.94)	1.0244 *** (12.28)	0.9197 *** (11.50)	0.7813 *** (9.97)	0.7338 *** (6.81)
<b>Common language</b>	0.5327 **** (11.03)	0.4381 *** (9.38)	0.5433 *** (12.56)	0.5848 *** (14.62)	0.7181 *** (18.48)	0.6694 *** (18.08)	0.7123 *** (20.54)	0.7293 *** (21.57)	0.7135 *** (15.83)
<b>FTA</b>	0.3498 **** (3.77)	0.3967 *** (4.70)	0.1456 * (1.85)	-0.0279 (0.64)	0.2625 *** (6.28)	0.3436 *** (8.94)	0.3109 *** (8.72)	0.2740 *** (8.23)	0.2819 *** (6.45)
<b>year dummy D1</b>	-0.1027 **** (2.41)	-0.0423 (1.05)	-0.0154 (0.41)	-0.0033 (0.10)	-0.1973 *** (5.91)	-0.0425 *** (1.40)	-0.1309 *** (6.20)	0.0068 (0.25)	-0.1140 *** (3.82)
<b>year dummy D2</b>	-0.2965 **** (6.95)	-0.0878 ** (2.20)	-0.0282 (0.75)	-0.0182 (0.52)	-0.2130 *** (6.47)	-0.1372 *** (4.56)	-0.1737 *** (92.81)	0.0675 *** (2.48)	
Adjusted R <sup>2</sup>	0.6417	0.6436	0.6665	0.6891	0.6799	0.6829	0.697	0.7072	0.659
Observations	12596	13473	14624	16053	19406	23390	26214	26820	18158

Notes: T-values are in parentheses. \*, \*\* and \*\*\* denotes 1%, 5% and 10% significance level respectively. All variables except dummies are in natural logs.

Table 3; Empirical results of regression on total trade, 1980-2005, pooled data

	1980-1982	1983-1985	1986-1988	1989-1991	1992-1994	1995-1997	1998-2000	2001-2003	2004-2005
<b>Constant</b>	-15.21 *** (31.17)	-15.92 *** (34.53)	-17.04 *** (39.88)	-17.57 *** (43.65)	-18.66 *** (48.75)	-18.95 *** (51.61)	-20.04 *** (56.69)	-19.76 *** (56.97)	-17.35 *** (37.53)
<b>GDP</b>	0.9499 *** (101.13)	0.9383 *** (105.11)	0.8736 *** (129.86)	0.8828 *** (142.06)	0.8951 *** (154.03)	0.9300 *** (171.77)	0.9558 *** (190.33)	0.9606 *** (196.56)	0.9176 *** (142.78)
<b>GDP per capita</b>	-0.0308 *** (4.72)	-0.0228 *** (3.68)	0.1548 *** (17.92)	0.1654 *** (20.95)	0.1298 *** (17.48)	0.0965 *** (14.09)	0.0810 *** (12.84)	0.0685 *** (11.04)	0.0528 *** (6.26)
<b>Distance</b>	-1.2380 *** (51.59)	-1.2165 *** (52.96)	-1.1475 *** (52.69)	-1.1845 *** (58.36)	-1.0249 *** (57.97)	-1.1566 *** (71.89)	-1.1676 *** (77.21)	-1.2232 *** (82.57)	-1.1973 *** (59.83)
<b>Adjacency</b>	0.5396 *** (11.21)	0.4576 *** (9.84)	0.5565 *** (12.91)	0.5870 *** (14.65)	0.7420 *** (19.10)	0.6983 *** (18.87)	0.7379 *** (21.29)	0.7538 *** (22.31)	0.7349 *** (16.29)
<b>Common language</b>	-0.0878 (0.76)	0.1172 (1.06)	0.4419 *** (4.21)	0.5527 *** (5.52)	1.0311 *** (11.48)	1.0036 *** (11.94)	0.9058 *** (11.25)	0.7694 *** (9.75)	0.7170 *** (6.60)
<b>EU</b>	-0.1573 (0.52)	0.05 (0.16)	0.40 (1.35)	0.17 (0.59)	0.32 (1.10)	0.35 (1.19)	0.03 (0.12)	-0.14 (0.54)	-0.01 (0.03)
<b>NAFTA</b>	-0.6868 (1.07)	-0.6191 (0.97)	-1.0087 (1.63)	-0.9915 * (1.63)	-0.6437 (1.04)	-0.6807 (1.08)	-0.6472 (1.05)	-0.6149 (-1.01)	-0.0997 (-0.12)
<b>AFTA</b>	0.2193 (0.45)	-0.7334 * (1.77)	-0.5689 (1.51)	-0.2662 (0.74)	-0.0088 (0.03)	0.1666 (0.50)	0.1489 (0.45)	-0.1250 (0.39)	-0.2069 (0.47)
<b>MERCOSUR</b>	-0.2097 (0.59)	-0.4078 (1.17)	-0.8601 (2.53)	-0.3772 (1.13)	-0.0836 (0.25)	0.1664 (0.48)	0.2081 (0.61)	0.0699 (0.21)	0.0638 (0.14)
<b>ASEAN-China</b>	-1.5913 *** (4.75)	-1.3143 *** (4.20)	-1.4063 *** (4.86)	-1.2820 *** (4.72)	-1.7043 *** (6.42)	-1.5725 *** (5.96)	-1.5633 *** (6.02)	-1.6042 *** (6.27)	-1.6047 *** (4.64)
<b>EU-Mexico</b>	-0.4620 * (1.66)	-0.5223 * (1.90)	-0.7091 *** (2.65)	-0.4654 * (1.77)	-0.2011 (0.75)	-0.4081 (1.53)	-0.2049 (0.81)	-0.0442 (-0.18)	-0.0070 (0.02)
<b>CER</b>	1.6124 (1.46)	1.84 * (1.68)	1.59 (1.50)	1.74 * (1.67)	2.07 ** (1.94)	2.14 ** (1.98)	1.93 * (1.81)	1.82 * (1.73)	2.01 (1.41)
<b>Japan-Singapore</b>	2.3164 (2.10)	2.3384 ** (2.14)	2.1649 ** (2.03)	2.1612 ** (2.07)	2.4687 ** (2.31)	2.4122 ** (2.23)	2.1396 ** (2.01)	1.9740 * (1.88)	2.0755 (1.46)
<b>Japan-Mexico</b>	-0.1357 (0.12)	0.0511 (0.05)	-0.1475 (0.14)	-0.1672 (0.16)	-0.0047 (0.00)	-0.1702 (0.16)	-0.2258 (0.21)	-0.4372 (0.42)	0.0682 (0.05)
<b>Korea-Chile</b>	2.7716 *** (2.51)	2.6984 ** (2.47)	2.8253 *** (2.65)	3.0589 *** (2.93)	3.0700 *** (2.88)	3.4123 *** (3.15)	3.0364 *** (2.85)	2.9213 *** (2.78)	3.3939 ** (2.39)
<b>Singapore-USA</b>	2.4420 * (2.21)	2.8388 ** (2.59)	2.5688 ** (2.41)	2.6188 *** (2.51)	2.5474 ** (2.38)	2.6441 ** (2.44)	2.3953 ** (2.25)	2.2205 ** (2.11)	2.2565 (1.59)
<b>year dummy D1</b>	-0.0964 ** (2.27)	-0.0450 (1.12)	-0.0162 (0.43)	-0.0030 (0.09)	-0.1989 *** (5.97)	-0.0425 (1.40)	-0.1293 *** (4.61)	0.0079 (0.29)	-0.1137 *** (3.81)
<b>year dummy D2</b>	-0.2908 *** (6.84)	-0.0909 ** (2.28)	-0.0292 (0.78)	-0.0178 (0.51)	-0.2129 *** (6.48)	-0.1372 *** (4.56)	-0.1698 *** (6.06)	0.0703 *** (2.59)	
Adjusted R <sup>2</sup>	12596	13473	14624	16053	19406	23390	26214	26820	18158
Observations	0.6436	0.6442	0.668	0.6904	0.6812	0.6835	0.6976	0.7076	0.659

Notes: T-values are in parentheses. \*, \*\* and \*\*\* denotes 1%, 5% and 10% significance level respectively. All variables except dummies are in natural logs

Table 4; Empirical results of regression by disaggregated and aggregated data.

	Food and live animals	Apparels	Iron & Steel	Electrical machinery	Motor vehicles	Total Exports	
Constant	-17.7182 *** (29.05)	-17.8610 *** (20.01)	-24.9681 *** (-28.73)	-41.3743 *** (60.42)	-38.4149 *** (36.99)	Constant	-19.6412 *** (83.49)
GDP i	0.7081 *** (42.89)	1.0738 *** (45.06)	1.1097 *** (47.80)	1.4734 *** (80.23)	1.5746 *** (56.16)	GDP	0.9317 *** (192.58)
GDP j	0.8073 *** (48.53)	0.4795 *** (20.40)	0.8923 *** (38.56)	0.8021 *** (44.26)	0.4584 *** (16.81)	GDP per capita	0.0900 *** (14.47)
GDP per capita i	-0.0342 * (1.88)	-0.4598 *** (16.88)	-0.1212 *** (4.56)	0.6583 *** (31.18)	0.2840 *** (8.34)	Distance	-1.2446 *** (-85.93)
GDP per capita j	0.1446 *** (8.19)	0.4713 *** (18.08)	-0.1284 *** (5.26)	0.1093 *** (5.66)	0.2547 *** (8.47)	Adjacency	0.8951 *** (12.09)
Distance	-0.8249 *** (27.63)	-1.2014 *** (28.71)	-1.2127 *** (30.31)	-1.1409 *** (34.95)	-0.7327 *** (15.62)	Common language	0.8390 *** (26.39)
Adjacency	0.7175 *** (5.90)	0.3460 ** (2.10)	0.6313 *** (4.15)	0.1680 (1.26)	0.7948 *** (4.60)		
Common language	0.9309 *** (13.24)	0.4001 *** (4.00)	0.3745 *** (3.91)	0.6472 *** (8.26)	0.6635 *** (6.09)		
EU	0.9544 *** (7.59)	0.8849 *** (5.41)	0.6419 *** (4.18)	-0.1474 (1.11)	1.2415 *** (7.04)	EU	-0.1519 (1.26)
EU to non-EU	0.6442 *** (8.74)	-0.2131 ** (2.03)	0.2812 *** (2.97)	-0.0940 (1.23)	0.0998 (0.89)	EU - non member	0.4290 *** (14.06)
non-EU to EU	-0.0103 (-0.14)	0.4701 *** (4.42)	-0.4365 *** (4.05)	-0.1795 ** (2.10)	-0.6836 *** (5.12)		
NAFTA	0.8790 * (1.93)	-0.1515 (-0.27)	-0.1572 (0.30)	-0.4143 (0.88)	1.6968 *** (3.05)	NAFTA	-0.3327 (0.54)
NAFTA to non members	0.5818 *** (5.73)	-1.7399 *** (-12.16)	-1.3501 *** (10.40)	-1.5952 *** (15.26)	-1.8694 *** (-12.99)	NAFTA - non member	-0.3935 *** (6.84)
non members to NAFTA	-0.4588 *** (-4.31)	1.1254 *** (7.83)	-0.0129 (-0.09)	-0.0849 (0.73)	-0.9205 *** (-5.28)		
AFTA	2.2477 *** (7.80)	0.2449 (0.66)	1.3500 *** (3.95)	4.2004 *** (13.53)	1.2408 *** (3.23)	AFTA	1.7098 *** (6.73)
AFTA to non members	1.0127 *** (11.43)	1.2086 *** (9.96)	-0.3860 *** (2.79)	2.9679 *** (30.63)	0.0971 (0.54)	AFTA - non member	0.9993 *** (22.30)
non members to AFTA	0.7581 *** (7.92)	-0.0849 (-0.58)	1.2099 *** (9.63)	1.2491 *** (11.90)	0.0573 (0.35)		
MERCOSUR	0.8300 *** (3.16)	-0.4137 (1.17)	-0.3301 (0.97)	-0.4360 (1.46)	0.9714 ** (2.46)	MERCOSUR	0.2878 (0.85)
MERCOSUR to non member	1.1037 *** (13.29)	-1.5514 *** (10.99)	1.1157 *** (8.66)	-1.9732 *** (19.37)	-0.9890 *** (5.64)	MERCOSUR - non member	-0.2486 *** (5.23)
non members to MERCOSUR	-1.0783 *** (11.20)	-0.5362 *** (3.80)	-0.6953 *** (4.92)	0.0008 (0.01)	-0.5671 *** (3.30)		
ASEAN-China	0.4014 (1.42)	1.3571 *** (3.49)	0.3542 (0.99)	1.0597 *** (3.25)	-0.0099 (0.02)	ASEAN-China	-0.2073 (0.65)
ASEAN-China to non members	-0.3066 *** (2.72)	1.8733 *** (11.72)	-0.3663 ** (2.09)	0.6141 *** (4.79)	-0.7412 *** (3.45)	ASEAN*China - non member	0.3737 *** (5.72)
non members to ASEAN-China	-0.1376 (1.12)	0.3466 * (1.85)	0.4692 *** (2.82)	0.3620 *** (2.60)	-0.3685 * (1.66)		
EU-Mexico	-0.0712 (0.48)	0.1087 (0.54)	0.2646 (1.40)	0.3199 ** (1.95)	0.2045 (0.93)	EU-Mexico	-0.1802 (0.91)
EU-Mexico to non members	-0.5093 *** (5.30)	0.2982 ** (2.03)	-0.0122 (0.09)	0.0943 (0.89)	-0.1339 (-0.83)	EU*Mexico - non member	-0.3126 *** (5.99)
non members to EU-Mexico	0.0632 (0.64)	-0.3258 ** (-2.23)	0.0019 (0.01)	0.1650 (1.41)	0.3659 ** (2.00)		
CER	3.0587 *** (2.81)	-0.3714 (0.29)	3.0332 *** (2.56)	2.5025 ** (2.32)	2.0690 (1.42)	CER	1.9106 ** (2.06)
Japan-Singapore	0.6490 (0.60)	-1.1123 (0.86)	1.4384 (1.21)	0.5364 (0.50)	1.3506 (1.07)	Japan-Singapore	0.6002 (0.32)
Japan-Mexico	-1.5628 (1.44)	-2.0460 (1.59)	0.4352 (0.37)	0.2025 (0.19)	0.7756 (0.61)	Japan-Mexico	0.8025 (0.43)
Korea-Chile	0.3657 (0.34)	3.1032 * (1.71)	1.7471 (1.48)	0.7548 (0.70)	3.7390 ** (2.10)	Korea-Chile	3.6046 *** (1.95)
Singapore-USA	0.2398 (0.22)	-0.7523 (0.51)	0.2177 (0.16)	1.3840 (1.11)	-1.5976 (1.09)	Singapore-USA	1.1031 (0.60)
Adjusted R2	0.4579	0.4476	0.4601	0.638	0.5189		0.7014
Observations	115535	7801	7271	9350	5671		30700

Notes: T-values are in parentheses. \*, \*\* and \*\*\* denotes 1%, 5% and 10% significance level respectively. All variables except dummies are in natural logs.

Table A1. Empirical studies on FTA effects by gravity equation.

Reference	Period	Sector	#countries	Dependant Var.	Explanatory variables and Results
Frankel, Stein & Wei (1995)	1965-1990	Overall	63	Exports + Imports	EastAsia(+,***), EC(+), NAFTA(+) MERCOSUR(+,**), AndeanPact(+,**)
Frankel (1997)	1965-1994	Total merchandise	63	Exports + Imports	EU15(+), NAFTA(+), MERCOSUR(+,*), Andean(-,**,+) ASEAN(+**), AUS-NZ(+**)
Endoh (1999)	1960-1994	Overall	80	Exports	EEC1(+,***), EEC2(+,*), EEC3(+,***) LAFTA1(-,*), LAFTA2(-,*), LAFTA3(-,*) CMEA1(-,***), CMEA2(+,***), CMEA3(-,***)
Soloaga & Winters (2000)	1980-1996	Overall	58	Imports	EU(-***), EU-import(+***), EU-Export(+***) EFTA(-), EFTA-import(+***), EFTA-Export(+***) ASEAN(+), ASEAN-Import(+), ASEAN-Export(+***) GULFCOOP(+), GULF-Imp(+), GULF-exp(-***) NAFTA(+), NAFTA-imp(+**), NAFTA-exp(+*) CACM(+***), CACM-imp(-***), CACM-exp(-***) LAIA(+***), LAIA-imp(-***), LAIA-exp(-***) ANDEAN(+***), ANDEAN-imp(-***), ANDEAN-exp(-***) MERCOSUR(+***), MERCOSUR-imp(-***), MERCOSUR(-), MERCOSUR-exp(-**)
Endoh (2000)	1960-1995	Overall	80	Exports	ASEAN1(+,***), ASEAN2(+,*), ASEAN3(+**,-) APEC89-1(+), APEC89-2(+,***,-), APEC89-3(+) EAEC1(+***), EAEC2(+***), EAEC3(+***) APEC951(+**,-), APEC952(+,***), APEC95-3(+,***,-)
Baier & Bergstrand (2002)	1996	Overall	53	Exports + Imports	FTA*GDP(-,*), FTA*Pop(+,*), FTA*Distance(-) FTA*Border(+), FTA*Hazard(-), NFTA*Hazard(-,**)
Carrer (2003)	1962-1996	Overall	130	Imports	EU(+,***), EU-im(+,*), EU-ex(+,***) ANDEAN(+,*), ANDEAN-im(-,***), ANDEAN-ex(-,***) CACM(+,***), CACM-im(-,***), CACM-ex(+) LAFTA(+,***), LAFTA-im(-,***), LAFTA-ex(-,*) MERCOSUR(-), MERCOS-im(-,***), MERCOS-ex(-) NAFTA(+), NAFTA-im(-,***), NAFTA-ex(+,*) ASEAN(+,***), ASEAN-im(-,***), ASEAN-ex(+,***)
Martinez-Zarzoso & Nowak-Lehmann (2003)	1988-1996	Overall	20	Exports + Imports	EU(+,*), MERCOSUR(+,*)
Elliot & Ikemoto (2004)	1982-1999	Overall	35	Imports	ASEAN(+,***), imASEAN(+,***), exASEAN(+,***) EEC(+,*), imEEC(+,***), exEEC(+,***) NAFTA(+,***), imNAFTA(-,***), exNAFTA(-,***)

Table A1. Empirical studies on FTA effects by gravity equation. (continued)

Reference	Period	Sector	countries	Dependant Var	Explanatory variables and Results
Nguyen & Hashimoto (2005)	1988-2002	Overall	39	Exports	AFTA(+***), imAFTA(+***), exAFTA(+***) EU(-***), imEU(-***), exEU(-***), MERC(+***),imMERC(+***),exMERC(-***) NAFTA(+**), imNAFTA(+***), exNAFTA(-***)
Cheng & Tsai (2005)	1981-1997	Overall	44 + 57	Exports	EEC(+, **), EFTA(+, **), EU(+, **), CUSFTA(+, **), NAFTA(+***) EEC-exp & imp (+, **), EFTA-exp & imp (+, **), EU-exp & imp (-**), CUSFTA-exp & imp(-, **), NAFTA-exp & imp(+, **), LAFTA-exp & imp(+, **) MERCOSUR-exp & imp(+, **)
Rose (2005)	1948-1999	Overall	175	Exports + Imports	FTA(+, ***), GSP(+, ***) WTO1(-, *), WTO2(-, *) IMF1(-, ***), IMF2(-, **) OECD1(+, ***), OECD2(+, ***)
Gilbert, Scollay & Bora (2004)	1984-1998	4 sectors	38	Exports + Imports	EU(-, agriculture+**),NAFTA(-), AFTA(+**), CER(+), MERCOSUR(+),Andean Pact(+**, agriculture+) APEC(+***) ----- EU(+), NAFTA(-***), AFTA(+**), CER(-***, agri+**), MERCOSURopen(-, agri+***), Andean Pact open (-***, agri+), APEC open(+)
Jayasinghe & Sarker (2004)	1985-2000	6 agrifood sectors	59	Exports + Imports	NAFTA bloc effects are significant on vegetable and meat. NAFTA trade diversion are on meat, vegetable, fruits, sugar, but diminishing over time.
Endoh (2005)	1970-1995	3 sectors;	63	Exports + Imports	GATT(+, ***), GSTPbase(-, ***), GSTP859095(+, ***) GSTP9095(+, ***), GSTP95(+) Africa(-, ***), Americas(+, ***), Asia(+, ***) Europe(-, *), Oceania(+, *)

**Table A2: Sample economies; Estimation 1**

Country or region	The largest city	Country or region	The largest city	Country or region	The largest city	Country or region	The largest city
UNITED KINGDOM	London	UNITED STATES	New York	BAHRAIN, KINGDOM OF	Manama	DJIBOUTI	Djinouti
AUSTRIA	Vienna	CANADA	Toronto	CYPRUS	Cyprus	ALGERIA	Alger
BELGIUM	Brussels	MEXICO	Mexico City	IRAN, I.R. OF	Teheran	ANGOLA	Luanda
BELGIUM-LUXEMBOURG	Brussels	ARGENTINA	Buenos Aires	IRAQ	Baghdad	BOTSWANA	Baborone
DENMARK	Copenhagen	BOLIVIA	La Paz	ISRAEL	Tel Aviv	BURUNDI	Bujumbura
FRANCE	Paris	BRAZIL	Sao Paulo	JORDAN	Amman	CAMEROON	Duala
GERMANY	Essen	CHILE	Santiago	KUWAIT	Kuwait	CAPE VERDE	Praia
ITALY	Rome	COLOMBIA	Bogota	LEBANON	Beirut	CENTRAL AFRICAN REP.	Bangi
LUXEMBURG	Luxembourg	COSTA RICA	San Jose	OMAN	Muscat	CHAD	N'Djamena
NETHERLANDS	Amsterdam	DOMINICAN REPUBLIC	Santo Domingo	SAUDI ARABIA	Riyad	COMOROS	Moroni
NORWAY	Oslo	ECUADOR	Guayaquil	SYRIAN ARAB REPUBLIC	Damascus	CONGO, REPUBLIC OF	Brazzaville
SWEDEN	Stockholm	EL SALVADOR	San Salvador	UNITED ARAB EMIRATES	Dubayy	CONGO, DEM. REP. OF	Kinshasa
SWITZERLAND	Zurich	GUATEMALA	GUATEMALA	EGYPT	Cairo	BENIN	Porto-Novo
FINLAND	Helsinki	HAITI	Port France	YEMEN ARAB REP.	Sanua	EQUATORIAL GUINEA	Malabo
GREECE	Athens	HONDURAS	Tegucigalpa	BANGLADESH	Dacca	ERITREA	Asmara
ICELAND	Reykjavik	NICARAGUA	Managua	BHUTAN	Thimphu	ETHIOPIA	Addis Ababa
IRELAND	Dublin	PANAMA	Panama	CAMBODIA	Phnom Penh	GABON	Libreville
MALTA	Valletta	PARAGUAY	Asuncion	SRI LANKA	Colombo	GAMBIA, THE	Serrekunda
PORTUGAL	Lisbon	PERU	Lima	CHINA, P.R.: MAINLAND	Shanghai	GHANA	Accra
SPAIN	Madrid	URUGUAY	Montevideo	CHINA, P.R.: HONG KONG	Hong Kong	GUINEA-BISSAU	Bissau
TURKEY	Istanbul	VENEZUELA, REP. BOL.	Caracas	INDIA	Mumbai	GUINEA	Konakry
		ANTIGUA AND BARBUDA	St. Johns	INDONESIA	Jakarta	COTE D IVOIRE	Abidjan
		BAHAMAS, THE	Nassau	JAPAN	Tokyo	KENYA	Nairobi
		DOMINICA	Roseau	KOREA	Seoul	LESOTHO	Maseru
		GRENADA	St. Johns	LAO PEOPLE S DEM.REP	Vientiane	LIBERIA	Monrovia
		GUYANA	Georgetown	MALAYSIA	Kuala Lumpur	LIBYA	Tripoli
		BELIZE	Belmopan	MALDIVES	Male	MADAGASCAR	Antananarivo
		JAMAICA	Kingston	NEPAL	Kathmandu	MALAWI	Lilongwe
		ST. KITTS AND NEVIS	Basse-Terre	PAKISTAN	Karachi	MALI	Bamako
		ST. LUCIA	Castries	PHILIPPINES	Manila	MAURITANIA	Nouakchott
		ST. VINCENT & GREN.S.	Kingston	SINGAPORE	Singapore	MAURITIUS	Port Louis
		SURINAME	Paramaribo	THAILAND	Bangkok	MOROCCO	Casablanca
		TRINIDAD AND TOBAGO	Port of Spain	VIETNAM	Hochiminh	MOZAMBIQUE	Maputo
						NIGER	Niamey
						NIGERIA	Lagos
						ZIMBABWE	Harare
						RWANDA	Kigali
						SOUTH AFRICA	Cape Town
						SAO TOME & PRINCIPE	Sao Tome
						SEYCHELLES	Victoria
						SENEGAL	Dakar
						SIERRA LEONE	Freetown
						NAMIBIA	Windhoek
						SUDAN	Al Khatum
						SWAZILAND	Mbabane
						TANZANIA	Dar es Salaam
						TOGO	Lome
						TUNISIA	Tunis
						UGANDA	Kampala
						BURKINA FASO	Ouagadougou
						ZAMBIA	Lusaka

**Table A3: Sample economies; Estimation 2, the largest city are the same as table X**

Austria	Spain	Iran	Pakistan
Belgium	Sweden	Israel	Australia
Luxemburg	Switzerland	Kuwait	New Zealand
Bulgaria	United Kingdom	Saudi Arabia	United States
Denmark	Germany	Turkey	Canada
Finland	Algeria	United Arab Emirates	Mexico
France	Egypt	China	Argentina
Greece	Ethiopia	Hong Kong	Bolivia
Hungary	Ghana	Korea	Brazil
Iceland	Kenya	Japan	Chile
Ireland	Libya	Indonesia	Colombia
Italy	Morocco	Malaysia	Ecuador
Netherlands	Nigeria	Philippines	Paraguay
Norway	South Africa	Singapore	Peru
Portugal	Sudan	Thailand	Uruguay
Romania	Tunisia	India	Venezuela



Table A4: List of Variables

Variables	Definition	Expected signs	Source
Trade	Sum of Export value of country i to j and j to i		IMF, Direction of Trade Statistics
Export	Export value of country i to j		UN, COMTRADE
	-Food and Live animals		- SITC code 0
	-Apparels		- HS code 61
	-Iron and steel		- HS code 72
	-Electrical machinery		- HS code 85
	-Motor vehicles for transport of persons		- HS code 8703
GDP	log og GDP, constant 2000 US\$	+	World Bank, World Development Indicatc
per capita GDP	log of per capita GDP, GDP constant 2000 US\$ divide by total population	+	World Bank, World Development Indicatc
Distance	log of distance in kn between the largest city of country i and j	-	
Adjacency	Dummy variable if a country pair has the same common languages.	+	
Language	Dummy variable if a country pair shares a land border	+	
FTA	Dummy variable if a country pair belongs to the same FTA.		
EU1	Dummy variable if a country pair both belongs to EU		
EU2	Dummy variable if country i is a member of EU and country j is not a member.		
EU3	Dummy variable if country i is not a member of EU and country j is a member.		
NAFTA1	Dummy variable if a country pair both belongs to NAFTA		
NAFTA2	Dummy variable if country i is a member of NAFTA and country j is not a member.		
NAFTA3	Dummy variable if country i is not a member of NAFTA and country j is a member.		
AFTA1	Dummy variable if a country pair both belongs to AFTA		
AFTA2	Dummy variable if country i is a member of AFTA and country j is not a member.		
AFTA3	Dummy variable if country i is not a member of AFTA and country j is a member.		
MERCOSUR1	Dummy variable if a country pair both belongs to MERCOSUR		
MERCOSUR2	Dummy variable if country i is a member of MERCOSUR and country j is not a member.		
MERCOSUR3	Dummy variable if country i is not a member of MERCOSUR and country j is a member.		
ASEAN-China 1	Dummy variable if a country pair both belongs to ASEAN-China FTA		
ASEAN-China 2	Dummy variable if country i is a member of ASEAN-China FTA and country j is not a member.		
ASEAN-China 3	Dummy variable if country i is not a member of ASEAN-China FTA and country j is a member.		
EU-Mexico 1	Dummy variable if a country pair both belongs to EU-Mexico FTA		
EU-Mexico 2	Dummy variable if country i is a member of EU-Mexico FTA and country j is not a member.		
EU-Mexico 3	Dummy variable if country i is not a member of EU-Mexico FTA and country j is a member.		
CER	Dummy variable if a country pair both belongs to CER		
Japan-Singapore FTA	Dummy variable if a country pair both belongs to Japan-Singapore FTA		
Japan-Mexico FTA	Dummy variable if a country pair both belongs to Japan-Mexico FTA		
Korea-Chile FTA	Dummy variable if a country pair both belongs to Korea-Chile FTA		
Singapore-USA FTA	Dummy variable if a country pair both belongs to Singapore-USA FTA		

Table A5. Basic statistics of variable of equation 1

Variables	<i>N</i>	Mean	Std. Dev.
ln Trade	179493	15.8509	3.3066
ln GDP	353001	46.0031	3.3944
ln GDP per capita	350713	14.9873	2.1952
ln Distance	409578	8.7356	0.7878
Adjacency	409578	0.0160	0.1255
Language	409578	0.1301	0.3365
FTA	409578	0.0612	0.2396
EU	409578	0.0056	0.0746
NAFTA	409578	0.0001	0.0094
AFTA	409578	0.0007	0.0265
MERCOSUR	409578	0.0004	0.0191
ASEAN-China	409578	0.1153	0.3194
EU-Mexico	409578	0.0017	0.0409
CER	409578	5.62E-05	0.0075
Japan-Singapore	409578	9.77E-06	0.0031
Japan-Mexico	409578	2.44E-06	0.0016
Korea-Chile	409578	4.88E-06	0.0022
Singapore-USA	409578	4.88E-06	0.0022

Table A6. Basic statistics of variable of equation 2

Variables	<i>N</i>	Mean	Std. Dev.
ln Export			
-Food and Live animals	11686	15.3921	2.9395
-Apparels	7879	12.8962	3.4430
-Iron and steel	7345	14.5908	3.2123
-Electrical machinery	9450	15.5264	3.5669
-Motor vehicles	5737	14.1710	3.6134
ln GDPi	15689	25.4445	1.5942
ln GDPj	15689	25.4445	1.5942
ln GDP per capita i	15689	8.5393	1.5164
ln GDP per capita j	15689	8.5393	1.5164
ln Distance	15876	8.6719	0.8778
Adjacency	15876	0.0340	0.1813
Language	15876	0.1051	0.3066
EU	15876	0.0453	0.2079
NAFTA	15876	0.0015	0.0389
AFTA	15876	0.0050	0.0708
MERCOSUR	15876	0.0050	0.0708
ASEAN-China	15876	0.0053	0.0725
EU-Mexico	15876	0.0265	0.1607
CER	15876	2.5E-04	1.6E-02
Japan-Singapore	15876	2.5E-04	1.6E-02
Japan-Mexico	15876	2.5E-04	1.6E-02
Korea-Chile	15876	2.5E-04	1.6E-02
Singapore-USA	15876	2.5E-04	1.6E-02

Table A7: Correlation matrix of explanatory variables of equation 1, pooled data

	ln GDP	ln GDP per capita	ln Distance	Adjacency	Language	FTA	EU	NAFTA	AFTA	MERCOSUR	ASEAN-China	EU-MEX	CER	JPN-SGP	JPN-MEX	KOR-CHL	SGP-USA
ln GDP	1																
ln GDP per capita	0.5281	1															
ln Distance	0.1273	0.0407	1														
Adjacency	-0.023	-0.089	-0.383	1													
Language	-0.201	-0.134	-0.174	0.1484	1												
FTA	0.1085	-0.008	-0.182	0.1134	0.0731	1											
EU	0.1731	0.1826	-0.207	0.0816	-0.017	0.2646	1										
NAFTA	0.0419	0.0241	-0.019	0.0586	0.0076	0.0411	-0.002	1									
AFTA	0.0145	-0.025	-0.072	0.0634	-0.012	0.1164	-0.004	-6E-04	1								
MERCOSUR	0.0218	0.0106	-0.04	0.0885	0.0379	0.084	-0.003	-4E-04	-0.001	1							
ASEAN-China	0.0218	0.0125	-0.004	-0.007	-0.016	0.0514	0.0036	0.0036	0.004	0.0033	1						
EU-Mexico	0.1027	0.1123	-0.095	0.0339	-0.009	0.1555	0.4906	-9E-04	-0.002	-0.002	0.0717	1					
CER	0.0123	0.0185	-0.013	-0.002	0.0279	0.0329	-0.001	-2E-04	-5E-04	-3E-04	-9E-04	-7E-04	1				
Japan-Singapore	0.0113	0.0109	-3E-04	-8E-04	-0.002	0.0137	-5E-04	-1E-04	-2E-04	-1E-04	0.0078	-3E-04	-1E-04	1			
Japan-Mexico	0.0073	0.004	0.002	-4E-04	-0.001	0.0069	-2E-04	0	-1E-04	-1E-04	0.0056	-1E-04	0	0	1		
Korea-Chile	0.0053	0.0037	0.0049	-6E-04	-0.001	0.0097	-4E-04	0	-1E-04	-1E-04	0.0079	-2E-04	0	0	0	1	
Singapore-USA	0.0091	0.0077	0.0041	-6E-04	0.0082	0.0097	-4E-04	0	-1E-04	-1E-04	0.0079	-2E-04	0	0	0	0	1

## Appendix: The Description of the data

Export values at aggregated level are taken from Direction of Trade Statistics (DOT) of IMF. These values denote nominal US\$, thus we deflated by consumer price index (CPI) of USA (2000=1) from International Financial Statistics of IMF for pooling the data.

Export values at commodity level are from the UN's Commodity Trade Statistics database (COMTRADE, available from <http://comtrade.un.org/db/>). We used five commodity data, namely 'food and live animals' of SITC code 0, 'articles of apparel, accessories, knit or crochet' of HS code 61, 'iron and steel' of HS code 72, 'electrical, electronic equipment' of HS code 85 and 'Motor vehicles for transport of persons' of HS code 8703. We also deflated these export value by CPI of USA.

Real GDP and population data are taken from the World Bank's World Development Indicators (WDI). Real GDP are deflated by GDP deflator (2000=1) and denote US\$. Real per capita GDP is real GDP divided by population. Distance is a beeline on earth between the largest cities of sample countries, calculated by the latitude and longitude by using free soft ware (<http://www.vector.co.jp/soft/win95/home/se229987.html>). We define 'Adjacency' as a case where countries share common land border, and 'common language' as a case where two countries have the same official language. The information on these two variables is obtained from 'regional basic data' provided by website of Ministry of Foreign Affairs of Japan.

'Comprehensive FTA' dummy variable is based on the date in force of the notified RTAs to WTO. Regarding the EU and the AFTA, the number of signatory countries has increased during the sample periods, thus EU dummy and AFTA dummy reflects this enlargement.

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