Does Trade Among ASEAN Members Promote Efficiency? Sectoral Evidence from the Gravity Model*

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Abstract

This study investigates whether intra-ASEAN trade represents higher trade with efficient members (trade creating) or with inefficient members (trade diverting). Since ASEAN integration efforts are geared toward "open regionalism", factors affecting both inter-industry and intra-industry trade at the disaggregated level are also identified. Using the extended gravity model, intra-ASEAN trade with efficient members is found for total exports, mainly contributed by five sectors: beverages & tobacco, minerals & fuels, chemicals & materials, machinery & transport equipment, and miscellaneous manufactures. Thus, this study finds that only 'good', i.e., efficient intra-regional trade is taking place within ASEAN, which is in line with the objective of establishing the ASEAN Economic Community. Income levels, transportation costs as well as level of development are shown to have a significant effect on total trade as well as on most sectors. Based on the findings, the study provides policy recommendations to promote higher trade for ASEAN members.

Keywords: Economic integration, Gravity model, ASEAN, Efficiency, Sectoral analysis

JEL Classifications: F13, F14, F15, F42, F53, O19, O24, O53

Introduction

Over the past few decades, efforts at regional integration have increasingly become the central focus of various groups of countries. Economic integration, in particular, can lead to trade creation and other benefits in the form of a more competitive trade environment from the removal of trade barriers and the possibility of realizing economies of scale and higher economic growth. In addition, forming economic groupings can also stimulate investment in the member countries from both internal and foreign sources. It has been argued that integration can stimulate investment by reducing risk and uncertainty due to the larger market that producers become open to. Furthermore, foreign investors may wish to invest in productive capacity in a member country to avoid being excluded by trade restrictions and a high common external tariff (Appleyard, 1995). In January 1992, six members[1] of ASEAN agreed to establish the ASEAN Free Trade Area (AFTA) which among others, sought to reduce the level of its tariffs on imports of highly protected agricultural products and manufactures and to eliminate non-tariff barriers within ASEAN. In addition, the members agreed that the ASEAN Economic Community be established in 2020 with the aim of establishing ASEAN as a single market place and production base.

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In order to achieve this goal, ASEAN will have to ensure that member countries develop their capacities and enhance the efficiency of their production as a means to create comparative advantage in eleven priority areas.[2] Hence, in the case of ASEAN that has a higher trade share with the rest of the World compared to intra-ASEAN trade, the issue is no longer merely to get higher intra-trade activities in the region but to have intra-ASEAN trade that are trade creating (higher trade with efficient members) rather than trade diverting (higher trade with inefficient members). Therefore, based on the discussion above, this study aims at investigating whether intra-trade in general has caused a shift in the product origin from a domestic producer who faces higher costs to a member producer with lower resource costs, leading to higher efficiency (trade creation) or whether it has caused the product origin to shift from a non-member producer who faces lower costs to a member producer whose resource costs are higher, leading to a fall in efficiency and welfare (trade diversion).

This study also attempts to determine the factors that affect trade, both inter-industry as well as intra-industry trade. Particularly, it investigates whether economic sizes, level of development, relative development, trade policy, geographical factors, exchange rate risk, factor endowments, membership in ASEAN, and transportation costs (as proxied by geographical distance), are important determinants of both inter-industry as well as intra-industry trade. This study adopts the extended gravity model at the total trade of ASEAN countries. From the findings, some general policy recommendations are later provided so as to enable member countries to align their policies, not only for enhancing regional economic integration *per se*, but more importantly to develop the ability to compete with the rest of the World as a single regional market and production base. The next section provides a survey of previous works on ASEAN economic integration and applications of the gravity model. Section 3 explains the extended gravity model adopted in this study and provides the description of the data. The analysis of results for each model estimated is provided in section 4. The last section concludes.

2. Literature Review

Since first pioneered by Viner (1950), there has been a vast growth of literature on economic integration of various regional groupings including ASEAN. Studies range from analyzing the economic effects of the grouping *per se* and in comparison with other regional groupings (Kreinin and Plummer, 1992, Plummer, 1997, Clarete, Edmonds and Wallack, 2003), to analyzing the effects of ASEAN free trade arrangements (FTAs) with other countries and at the sectoral level (Naya and Plummer, 2006). In addition, the study by Naya and Plummer (2006) also examines whether the ASEAN regional grouping can be described as a 'natural economic bloc'. Other studies examine a number of issues such as evaluating the most efficient way for Asian countries (including ASEAN) to form economic integration (Batra, 2006), and whether regional trade blocs are precursors to multilateral trade liberalization (Baharumshah, Onwuka and Habibullah, 2007).

In the study by Plummer (1997), it is argued that ASEAN will continue to benefit from the ASEAN Free Trade Area (AFTA) and further "deepening" measures through the effects on strengthening macroeconomic stability, encouraging investment flows, enhancing technology transfer, minimizing intra-regional transactions costs to conducting business, and fostering policy reform in the region. The study also predicts that ASEAN regional integration will help ASEAN countries to prevail over periodic crises by, among others, incorporating regional economic reform and providing information sharing with regards to crisis management. Similar to Kreinin and Plummer (1992) in comparing the effects of various Preferential Trade Agreements (PTAs) on trade flows, Clarete, Edmonds and Wallack (2003) extended the analysis to within and across membership groupings as well as the effect of PTAs on members' trade with Asian countries. Following Soloaga and Winters (2001), they used a combination of dummy variables in the gravity model that allows the separate identification of the effects of PTA on intra-bloc trade as well as trade between members and the rest of the world.

Preferential trading agreements are categorized into three groups based on whether they tend to foster intra-bloc trade, foster greater trade with trading partners worldwide, or they reduced trade in general without changing their respective intra-bloc trade. Contrary to earlier studies (Frankel, 1997; and Soloaga and Winters, 2001), AFTA and the North American Free Trade Area (NAFTA) were found to be the PTAs that have not changed their intra-bloc trade but reduced their overall trade with the world. This contradiction may be due to the inclusion of newer members of AFTA (Cambodia, Laos, Vietnam and Myanmar) who are relatively less integrated in the world economy compared to the founding members of AFTA. Gravity models have been extensively used to evaluate the trade effects between regional blocs. Martinez-Zarzoso (2003) used the gravity model to evaluate the effects of preferential agreements between several regional blocs: the European Union (EU), the NAFTA, the Caribbean Community (CARICOM),

the Centro-American Common Market (CACM) and other Mediterranean states (MEDIT). Although the results on the membership of trade blocs are mixed, he found an increase in intra-trade due to trade preference schemes among member states of a particular trade bloc. Specifically, there is an increase in intra-trade among EU members and the NAFTA members. The study by Yamarik and Ghosh (2005) provided an important examination of the robustness of variables used in the gravity model literature. By using a variant of Leamer's extreme bounds analysis, the sign and significance of the variables of interest to changes in the conditioning set of variables are tracked and the fragility of the coefficient estimates are tested to identify which independent variables are robustly linked to bilateral trade. Twenty variables are found to be robustly linked to bilateral trade, namely the level of development, trade policy, linguistic and colonial ties, geographic factors, relative population density, common currency, and membership in five RTAs, i.e., CACM, Caricom, Mercosur, ANZCERTA, and APEC. These findings serve as a point of reference for selecting new potential determinants of international trade in future studies that use the gravity model analysis.

Gravity models have also been applied in studies on ASEAN economic integration. Elliott and Ikemoto (2004) used a modified gravity equation to examine ASEAN intra- and extra-bilateral trade flows and how these relationships have changed throughout time. They found that trade flows did not increase significantly in the years immediately after AFTA was signed. In addition, trade with the rest of the world was found to be not notably affected, rather it was enhanced by the AFTA agreement and/or the Asian economic crisis. In his study, Tayyebi (2005), argued that any attempt at estimating a gravity equation that assume the intercept to be homogeneous for trading-partner pairs would yield biased results. Allowing the country pair intercept terms to vary, Tayyebi estimated a panel data on ASEAN member countries and their major trade partners for the period 1994-2000 using the Fixed Effects model. Similar to Elliott and Ikemoto (2004), Tayyebi also found that trade integration has increased trade flows among the ASEAN member countries. Tayyebi also found that ASEAN integration has led to increased trade between ASEAN members with non-members.

The discussion above has shown that there have been a considerable number of studies that examine regional economic integration in ASEAN through employing various methods including the gravity model. However, very few studies have looked at the effects of regional integration at the sectoral level, and none that employs a systematic disaggregation based on the Standard International Trade Classification (SITC) one-digit level. In addition, the inclusion of variables in the augmented gravity models is found to be rather ad hoc in nature which may affect the consistency of the results. This study provides a deeper analysis of ASEAN economic integration using the augmented or extended gravity model by examining the effects at the sectoral SITC Revision 2, one-digit level, in addition to re-examining the overall presence of trade creation or diversion within ASEAN. The variables included in the extended gravity model are mainly those that are found to be robust based on Yamarik and Ghosh (2005). The policy implications of the results are also provided which is found to be lacking in most of the related studies in the past.

3. Methodology and Data

As presented in Anderson (1979) and Oguledo and Macphee (1994), the gravity equation is derived from a linear expenditure system. The case of many commodity classes of goods flowing between each country *i* and *j* is considered in this study, integrating transport costs proxied by distance. In deriving the gravity equation, the overall preference function is assumed to be weakly separable with respect to the partition between traded and non-traded goods, while preferences for traded goods are assumed to be identical across countries and homothetic. Accordingly, for the purpose of simplicity, the utility function is assumed to take the Cobb-Douglas form with identical preferences and expenditure shares. Given the level of expenditure on traded goods, demands for individual traded goods are determined as if a homothetic utility function in traded goods alone was maximised subject to a budget constraint involving expenditure on traded goods. The traded goods share varies across regions and countries and has been found to be explained well by income and population (see Kuznets, 1966; Maizels, 1968). In addition, the linear or log-linear regression lines of traded goods' shares on income and population tend to be stable over time. The gravity model used in this study describes the relationship between bilateral trade to core factors such as GDP and distance. Rather than extending the gravity model beyond the core in an ad hoc manner as found in many earlier works, this study extends the gravity model by including additional factors that are found to be robust in the sensitivity analysis of gravity models conducted by Yamarik and Ghosh (2005).

These factors include level of development as represented by the sum of manufacturing exports as a percentage of merchandise exports, factor endowment as represented by population, geographical factors as represented by adjacency of one country to another and surface area, regional trading arrangement represented by membership in the ASEAN, as well as trade policy as represented by tariff rates. However, two additional variables are also included in the extended gravity model, namely relative development as represented by the log difference of real GDP per capita and exchange rate risk as represented by exchange rate volatility. This is for the purpose of investigating whether member countries' similarities or dissimilarities matter in determining trade, as well as whether there is a need to establish exchange rate policy coordination within ASEAN in order to ensure stable exchange rates in promoting trade.

The dependent variables are total bilateral exports as well as exports at the one-digit Standard International Trade Classification (SITC) disaggregated level, i.e., from SITC 0 to SITC 9.[3] Hence, eleven gravity equations are formulated and estimated using the Panel Data procedure for the five founding members of ASEAN, namely Indonesia, Malaysia, the Philippines, Singapore, and Thailand and their three major trading partners, namely Japan, the UK, and the US. Due to constraints in obtaining complete data for all the pairs of trading countries, estimations that exclude tariff utilize data from 1992 to 2006.[4] Estimations that include tariff face even larger data constraints to the extent that estimations can only be done for four years, i.e., 2001, 2003, 2005 and 2006.

Following Yamarik and Ghosh (2005) and taking into consideration bilateral trade data, this study estimates the gravity model by scaling the export values by 'one'.[5] Thus, the extended gravity model can be written as:

$$\ln(1+X_{ij}) = \alpha_0 + \alpha_1 \ln Y_i Y_j + \alpha_2 \ln Distance + \alpha_3 Abs \ln(YPC_i - YPC_j) + \alpha_4 Border + \alpha_5 \ln(A_i A_j)$$
$$+ \alpha_6 \ln(N_i N_j) + \alpha_7 \left(\frac{manuf}{X_i} + \frac{manuf}{X_j} \right) + \alpha_8 ASEAN + \alpha_9 Volatility_{ij} + \varepsilon_{ij} \quad (1)$$

The model is later re-estimated individually using disaggregated exports from SITC 0 to SITC 9 as dependent variables. In order to see the effects of tariffs, cross-section estimations of the equation are also undertaken for the years 2001, 2003, 2005 and 2006. All variable definitions and sources are given in Table 1. The effects of income variables (Y_i, Y_j) on trade flows are expected to be positive. This is due to the fact that an increase in income will result in greater production available for exports. In addition, a rise in income usually leads to an increase in imports. *Distance*[6] is a proxy variable for natural trade resistance which is a composite of transportation costs and transport time (Aitken, 1973). Long distance between trading countries, *ceteris paribus*, leads to higher costs and a lower profit margin to the importer. Consequently, *Distance* is hypothesized to have a negative effect on exports. The sign of the coefficients of the absolute difference in per capita income $Abs(\ln YPC_i - \ln YPC_j)$ which represents relative development is, however, indeterminate since real GDP per capita can be either trade enhancing or trade inhibiting. If trade is driven more by the theory of comparative advantage, then the variable is trade enhancing and the sign is positive. The more countries differ, the more they will trade with each other. On the other hand, it is also possible that the more alike countries are, the more trade will take place since countries with similar levels of development have similar preferences. This is also known as the Linder hypotheses, in which case relative development is considered to be trade inhibiting, hence the sign is negative (Tayyebi, 2005, and Yamarik and Ghosh, 2005).

In order to examine the effects of the adjacency of countries that represents a geographic factor, the *Border* dummy variable is included in the model. Since neighborliness generally stimulates trade due to similarity of tastes and an awareness of common interests (Balassa, 1961), the coefficient of the variable is expected to be positive. The sign of the coefficients of another geographic factor namely $\ln(A_i A_j)$ is expected to be negative. It is argued that countries with larger surface area should have a higher transportation cost, *ceteris paribus* than the countries with smaller surface areas, thus can affect negatively the volume of trade (Yamarik and Ghosh, 2005). The sign of the coefficients of the population variables $\ln(N_i N_j)$ is, however, indeterminate since population size can be trade enhancing as well as trade inhibiting. According to Oguledo and Macphee (1994), a large population may, on the one hand, indicate large resource endowment, self-sufficiency and less reliance on international trade. On the other hand, it is possible that a large domestic market (or population) would promote division of labour, and thus, create an opportunity for trade in a wide variety of goods. Based on the latter argument, the expected sign of the population coefficient is positive.

One of the variables that capture the level of development is the manufactures export as a percentage of merchandise exports which is denoted by $\frac{manuf}{X_i} + \frac{manuf}{X_j}$ in the model. The sign of the coefficient of this variable is expected to be positive since the more developed the economies are, the higher the trade will be (Yamarik and Ghosh, 2005). *ASEAN* is a dummy variable representing preferential trading agreements among the Association of South East Asian Nations. A positive coefficient indicates trade creation among the ASEAN members while a negative coefficient indicates trade diversion (DeRosa, 2007).

Since the variability of bilateral exchange rates can also affect the export volume of two countries, the $Volatility_{ij}$ variable is added in the model. It measures the standard deviation of the first difference in monthly bilateral real exchange rate for every year (Yamarik and Ghosh, 2005). The sign of the coefficient is, however, indeterminate since volatility can either have positive or negative effects on trade. Previous studies such as Brada & Mendez, (1988) and Yamarik and Ghosh (2005) reported negative values, whereby an increase in exchange rate risk tend to lower trade flows. In contrast, other research such as Poon, Choong & Habibullah (2005) and Chou (2000) showed mixed results, whereby the signs of the exchange rate volatility were both found to be positive and negative. The positive sign implies that an increase in the exchange rate volatility imposes cost on risk averse market participants which then respond by trading at the margin and thus induces exports. As mentioned earlier, an additional variable namely tariff is regressed on cross-section estimations of equations (1) and (2) for the years 2001, 2003, 2005 and 2006. The variable $Trf_i + Trf_j$ is the sum of average tariff of the trading partners. The sign of the coefficient of the tariff variable is expected to be negative, as higher trade restrictions decrease trade (Yamarik and Ghosh, 2005).

Insert table (1) about here

4. Analysis of Results

4.1 Gravity model results without tariff

In this part of the analyses, eleven panel data estimations were performed. The first estimation uses total bilateral exports, while the second until the last estimations use disaggregated bilateral exports at SITC 0 to SITC 9. Using the Hausman Test, the fixed effect approach was found to be applicable for all the equations.[7] In addition, all the estimation results have been corrected for autocorrelation where necessary. Table 2 shows the results of panel data estimations of 517 observations of ASEAN members with their major trading partners for the years 1992 to 2006 for each of the eleven equations. The estimation results show that the gross domestic product (GDP) has a significant positive effect on trade as expected. All the GDP coefficients show consistent results and the elasticities are found to be between 0.102 per cent for chemicals & materials (SITC 5) and 0.527 per cent for minerals & fuels (SITC 3), except for other commodities (SITC 9) which shows a negative relationship. However, since SITC 9[8] is comprised of commodities that do not fall into any of the specific SITC 0-8, the result for SITC 9 is not of much concern in the study due to its heterogeneous nature.

Insert table (2) about here

Although negative for almost all classifications, *Distance* is found to be significant only for crude materials (SITC 2), manufactured goods (SITC 6), machinery & transport equipment (SITC 7) and other commodities (SITC 9). In contrast, relative development (i.e., $Abs(\ln YPC_i - \ln YPC_j)$) has a significant positive effect for SITC 2 only, implying that the more the two countries differ, the more trade will take place for the crude materials category. This finding is similar to that of Montenegro & Soto's (1996), which conform to the standard comparative advantage theory. Neighborliness stimulates only export of beverages and tobacco (SITC 1), as shown by the positive coefficient estimate of *Border*, which conforms to the results found by Balassa (1961) and Yamarik and Ghosh (2005). Surface area as another geographical factor is found to be insignificant for most of the classifications. However, as opposed to Yamarik and Ghosh (2005), surface area is found to be positively affecting trade in animal & vegetable oils (SITC 4), chemicals & materials (SITC 5) and other commodities (SITC 9). Factor endowments, $\ln(N_i N_j)$, of the two countries, is found to be significant only for chemicals & materials (SITC 5) and other commodities (SITC 9).

The negative sign implies that the large resource endowment had led to self-sufficiency and less reliance on international trade for both sectors. The level of development, as proxied by $\frac{manuf}{X_i} + \frac{manuf}{X_j}$, is found to have a positive impact on trade for manufactured goods (SITC 6), machinery & transport equipment (SITC 7) and miscellaneous manufactures (SITC 8). The more developed the economies are, the higher the trade will be in these three product classifications. Such a result is expected since the three sectors are categorized as high technology goods which are naturally intensively produced and traded by the more developed countries, whether in the form of finished or intermediate manufactured products. Analyzing the integration effects on the trade flows of ASEAN countries and their major trading partners, evidence of trade creation only appears for beverages & tobacco (SITC 1). The evidence of trade diversion seems to occur for other commodities (SITC 9), but as mentioned earlier, the result found for this sector is not much of a concern. Higher trade with efficient members is found to exist for beverages and tobacco. The negative coefficients of $Volatility_{ij}$ for SITC 3 and SITC 7 imply that an increase in exchange rate risk lower trade flows for these 2 product classifications namely minerals and fuels, and machinery and transport equipment. This may be due to the large financing (including foreign financing) usually required for the production and the trading of these goods.

4.2 Gravity model results with tariff

Tables 3 – 6 show the results of the estimations of the augmented gravity model with tariff for the years 2001, 2003, 2005, and 2006. The results show the coefficients of the variable ASEAN to be positive and significant for the four selected years, indicating trade creation or increased trade with efficient member countries. This net trade creation is contributed by beverages & tobacco (SITC 1), minerals & fuels (SITC 3) in all the years. Being a member of ASEAN, however, has no effect on trade in crude materials (SITC 2), animal & vegetable fat (SITC 4) and other commodities (SITC 9).

Insert table (3) about here

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An examination of the core variables shows income to be generally significant in total export and in almost all sectors except for animal & vegetable fat (SITC 4). Distance has a significant negative effect on total trade as well as for the specific sectors of food & live animals (SITC 0), crude materials (SITC 2), manufactured goods (SITC 6), machinery & transport equipment (SITC 7), minerals & fuels (SITC 3) for most years. This variable, however, has no significant effect on intra-industry trade among ASEAN members for beverages & tobacco (SITC 1), chemicals & materials (SITC 5), miscellaneous manufactures (SITC 8), and other commodities (SITC 9).

Relative development is an important determinant of bilateral trade for total trade, and at the sectoral level for food & live animals (SITC 0) and manufactured goods (SITC 6), conforming to the comparative advantage argument. However, for crude materials (SITC 2) and other commodities (SITC 9) for the year 2006, and chemicals & materials (SITC 5) for the years 2001, 2005 and 2006, relative development shows a negative effect, conforming to Linder's hypothesis. Thursby & Thursby (1987) and Egger (2000) also found similar results, arguing that countries with similar industrial structures and per capita GDP trade more with each other. The level of development is found to be generally significant in determining trade between the country pairs for food & live animals (SITC 0), beverages and tobacco (SITC 1), manufactured goods (SITC 6), machinery & transport equipment (SITC 7), and miscellaneous manufactures (SITC 8).

Geographical factors as represented by border and the log product of surface areas of both countries are found to be similar to the earlier results without tariffs. Large resource endowment creates less reliance on total trade as demonstrated by the negative effect of factor endowments. Similar results are found at the sectoral level, namely for machinery & transport equipment (SITC 7), miscellaneous manufactures (SITC 8), animal & vegetable fat (SITC 4), crude materials (SITC 2) for 2006, and manufactured goods (SITC 6) for 2003. On the other hand, factor endowment has a positive effect only for trade in food & live animals (SITC 0) for the years 2005 and 2006. Tariffs of the pairs of countries is found to have no significant impact on total trade in general, except for food & live animals (SITC 0) for 2001 and crude materials (SITC 2) for 2006.

Similarly, exchange rate risk is also found to have no significant effect on total trade in general, except for crude materials (SITC 2) for 2006 and miscellaneous manufactures (SITC 8) for all the four years.

5. Discussion on Findings and Policy Recommendations for Priority Areas

As mentioned before, ASEAN seeks to accelerate regional integration in eleven priority areas in order to establish an ASEAN Economic Community. However, only nine are relevant in this study and the SITC 2-digit level classifications are matched against these nine sectors[9] as shown in Table 7. The table shows that the priority areas fall mainly in SITC 0, 1, 2 and 4, and to a lesser extent in SITC 5, 6, 7 and 8, while there is no match found for SITC 3 and 9 classifications.

Insert table (7) about here

Summary results for the estimations performed are consolidated in Table 8. Trade creation is found to be present for total exports, which is found to be mainly contributed by beverages & tobacco (SITC 1), minerals & fuels (SITC 3), chemicals & materials (SITC 5), machinery & transport equipment (SITC 7), and miscellaneous manufactures (SITC 8). Intra-trade in these five sectors has caused a shift in the product origin from a domestic producer who faces higher costs to a member producer with lower resource costs, leading to a higher efficiency. This finding is encouraging as it reflects only 'good' intra-regional trade is taking place within ASEAN. On the one hand, this does not come as a surprise since ASEAN adopts an "open regionalism" rather than an inward-looking or a "Fortress ASEAN". On the other hand, in the context of establishing deeper integration in the nine priority areas as one of the measures towards an ASEAN Economic Community (AEC), the insignificant effect of ASEAN on intra-trade activities may imply that trade within ASEAN in food & live animals (SITC 0), crude materials, inedible, except fuels (SITC 2), animal & vegetable oils, fats, & waxes (SITC 4) and manufactured goods (SITC 6) is inadequate and need to be intensified. ASEAN countries should import goods in these four sectors from efficient member countries so as to generate trade creation rather than trade diversion from the deeper integration sought after. Higher income levels are found to promote inter-industry as well as intra-industry trade in all sectors, as expected *a priori.* Again, policies that promote growth automatically stimulate trade, and thus such policies should be maintained, particularly during periods of low inflation. In periods of high inflation, however, governments should be aware that contractionary policies may have a negative effect on trade.

Insert table (8) about here

Similar to income levels, lower transportation costs promote total trade as well as trade in all sectors except for beverages & tobacco (SITC 1), chemicals & materials (SITC 5) and miscellaneous manufactures (SITC 8). Policies that ensure low transportation costs are, therefore, necessary to stimulate trade in general. In the face of increases in international oil prices, maintaining low transportation costs will pose to be a challenge as many governments are either unable or unwilling to subsidize oil prices continuously. In such a situation, the governments will need to formulate alternative strategies to keep transportation costs related to fuel prices low. In addition, measures should also be taken to upgrade physical infrastructure and improve transportation efficiency to reduce costs related to time.

The theory of comparative advantage is found to hold for food & live animals (SITC 0), crude materials, inedible, except fuels (SITC 2), and manufactured goods (SITC 6) as reflected by the results on relative development. Production of these goods is more intensively undertaken by countries that possess comparative advantage in the specific sectors. Linder's hypothesis, on the other hand, are also found for crude materials, inedible, except fuels (SITC 2), as well as chemicals & materials (SITC 5), implying that higher intra-industry trade for these two sectors is also due to similar preferences for the goods. Factor endowments show a negative relationship with total trade for animal & vegetable oils, fats, & waxes (SITC 4), chemicals & materials (SITC 5), machinery & transport equipment (SITC 7), and miscellaneous manufactures (SITC 8). This may imply that for total trade and the four sectors a large resource endowment creates self-sufficiency and less reliance on international trade. In general, the level of development shows a positive effect on both inter-industry and intra-industry trade in almost all sectors containing the priority areas, except for only two sectors, namely, SITC 4 and SITC 5. Similar to growth, policies that promote development should be continuously implemented so as to stimulate trade. Tariffs are found to have no effect on both total trade and intra-industry trade except for SITC 4. This may imply that tariffs are no longer much of an issue to promote trade, given the tariff reductions that have taken place, both due to tariff reductions in AFTA as well as compliance to WTO agreements.

In addition, it also reflects that price competitiveness (including from lower tariffs) is no longer a very important factor for market access. Other factors such as quality of products and other product characteristics are increasingly becoming more important in determining export demand. Therefore, based on the results, tariff reductions to promote trade is applicable only to the animal & vegetable fat sector. Product development to improve the quality of exports and to meet the preferences of the export demand should perhaps be emphasized instead of continuing to focus on tariff reductions for market access. Exchange rate risk is found to adversely affect only SITC 7 among sectors containing the priority areas apart from SITC 3. Since these sectors are vulnerable to foreign exchange risks, a close monitoring of these sectors may need to be established in the presence of exchange rate volatility. Similar to tariffs, low exchange rate risk is not a very important determinant of trade in general. However, SITC 1 and SITC 8 are found to benefit from exchange rate fluctuations since it is positively related to trade. The policy recommendations are summarized in Table 9 for each product classification.

Insert table (9) about here

6. CONCLUSION

This study aims at investigating whether intra-trade in general and at the sectoral level leads to higher efficiency (trade creation) or whether it leads to a fall in efficiency and welfare (trade diversion). It adopts the extended gravity model at the one-digit Standard International Trade Classification (SITC) Revision 2 by including additional factors that are found to be robust in the sensitivity analysis of gravity models by Yamarik and Ghosh (2005). These factors include level of development, factor endowment, geographical factors, regional trading arrangement, as well as trade policy. Two additional variables are also included in the extended gravity model, namely relative development and exchange rate risk for the purpose of investigating whether member countries' similarities or dissimilarities matter in determining trade, as well as whether there is a need to establish exchange rate policy coordination within ASEAN in order to ensure stable exchange rates in promoting trade. Two models are estimated in this study: without tariff (1992-2006), and with tariff (2001, 2003, 2005, 2006). For each of the models, estimations are performed for total bilateral exports as well as disaggregated level for the five founding members of ASEAN and their three major trading partners.

Trade creation is found to be present for total exports, for SITC 1, SITC 3, SITC 5, SITC 7, and SITC 8. This implies that the increased inter-industry and intra-industry trade in the five sectors within ASEAN involves trade in efficient sectors of fellow member countries. Neither trade creation nor trade diversion is found in any of the other sectors. Thus, this study finds that only 'good', i.e., efficient intra-regional trade is taking place within ASEAN, which is in line with the objective of establishing the AEC. Income levels, transportation costs as well as level of development are shown to have a significant effect on total trade as well as most sectors. Relative development affects only SITC 0, SITC 2, SITC 5, and SITC 6. Factor endowments are important determinants of total trade as well as trade in SITC 4, SITC 5, SITC 7, and SITC 8. Tariffs do not seem to have any effect on trade except for SITC 4, while exchange rate risk affects only SITC 1, SITC 3, SITC 7, and SITC 8.

Based on the findings, in general, policies that promote growth and development in the region should be maintained. This is in line with Hanoi Plan of Action and the ASEAN Vision 2020 that emphasize on sustainable and equitable growth to promote economic integration in ASEAN. In addition, measures need to be undertaken to ensure low transportation costs that include improving both the physical infrastructure and the efficiency of transportation systems as well as considering policies that ensure low fuel prices. Since tariffs are no longer much of an issue to promote trade, emphasis should be placed on other factors that affect export demand such as product development to improve the quality of exports and to meet the preferences of importing countries.

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Table 1: List of variables and data sources

Variable	Definition	Source
Dependent variable		
$\ln(1+X_{ij})$	Scaled export values (i.e., 1+ export values) between countries *i* and *j* in logarithmic form (in real US million dollars).	*United Nations COMTRADE Data*, World Integrated Trade Solution (WITS) Database.
$\ln(1+X_{ij}^{PC})$	Scaled export values (i.e., 1+ export values) of 1-digit level product classification between countries *i* and *j* in logarithmic form (in real US million dollars).	
Core factors		
$\ln Y_i Y_j$	Gross domestic product of countries *i and j* in multiplicative and logarithmic form (in real US million dollars).	*International Financial Statistics, CD-ROM* (2007)
ln *Distance*	Distance between two countries from capital cities in logarithmic form (in kilometers).	http://www.chemical-ecology.net/java/lat-long.htm
Relative development		
$Abs(\ln YPC_i - \ln YPC_j)$	The difference of real GDP per capita of countries *i and j* in logarithmic and absolute form (in real US million dollars).	*International Financial Statistics, CD-ROM* (2007)
Level of development		
$\frac{manuf}{X_i} + \frac{manuf}{X_j}$	The sum of manufactures exports (% of merchandise exports)	*United Nations COMTRADE Data*, World Integrated Trade Solution (WITS) Database.
Trade Policy		
$Trf_i + Trf_j$	Sum of mean tariff rates of trading partners (ratio of import duties to imports)	*United Nations TRAINS Data*, World Integrated Trade Solution (WITS) Database.
Geographical factor		
Border	A dummy variable which takes the value of one if two countries have a common border and zero otherwise.	
$\ln(A_i A_j)$	Product of surface areas of both countries in logarithmic form	*World Development Indicators Database*
Exchange rate risk		
$Volatility_{ij}$	Standard deviation of first difference in monthly bilateral real exchange rate during previous 5-year period	*Bloomberg Professional Service Database*
Factor endowment		
$\ln(N_i N_j)$	The sum of population (measured in millions) of exporter country *i* and importer country *j* in logarithmic form.	*International Financial Statistics, CD-ROM* (2007).
Regional trading arrangements		
ASEAN	A dummy variable which takes the value of one if both countries are members of the ASEAN and zero otherwise	

Table 2: Estimation results of gravity model specification 1992-2006 (without tariffs)

	Dependent variable: $ln(1+X_{ij})$	**Dependent variable:** $\ln(1+X_{ij}^{PC})$									
	Total	**SITC 0**	**SITC 1**	**SITC 2**	**SITC 3**	**SITC 4**	**SITC 5**	**SITC 6**	**SITC 7**	**SITC 8**	**SITC 9**
$ln Y_i Y_j$	0.165*** (4.582)	0.158*** (2.942)	0.488*** (3.668)	0.268*** (3.447)	0.527** (2.027)	0.446** (2.454)	0.102* (1.735)	0.252*** (4.420)	0.162*** (2.624)	0.210*** (3.830)	-0.690*** (-2.683)
ln Distance	-0.429 (-0.989)	-0.772 (-1.458)	0.066 (0.111)	-1.649*** (-3.097)	-1.475 (-1.524)	-1.000 (-1.194)	1.684 (0.558)	-1.399* (-1.938)	-0.754* (-1.668)	-0.826 (-0.996)	-1.746** (-2.126)
$Abs(\ln YPC_i - \ln YPC_j)$	0.037 (0.652)	0.070 (0.849)	-0.116 (-0.711)	-0.196* (-1.834)	0.284 (0.988)	0.270 (1.193)	-0.071 (-0.635)	-0.027 (-0.299)	0.000 (-0.003)	-0.096 (-1.081)	-0.083 (-0.315)
Border	-0.160 (-0.201)	-0.001 (-0.001)	2.091* (1.924)	-0.758 (-0.765)	1.016 (0.574)	0.140 (0.091)	3.497 (0.637)	-0.267 (-0.201)	-0.203 (-0.246)	-0.490 (-0.321)	-2.627* (-1.728)
$\ln(A_i A_j)$	0.217 (1.166)	0.117 (0.523)	-0.157 (-0.634)	0.179 (0.758)	-0.425 (-1.065)	0.626* (1.784)	1.672*** (2.595)	0.433 (1.362)	0.146 (0.764)	0.592 (1.557)	0.978*** (2.808)
$\ln(N_i N_j)$	-0.503 (-1.313)	0.172 (0.373)	0.092 (0.185)	0.358 (0.715)	0.903 (1.118)	-1.120 (-1.588)	-3.714*** (-2.620)	-0.287 (-0.447)	-0.285 (-0.713)	-0.966 (-1.280)	-3.055*** (-4.329)
$\frac{manuf}{X_i} + \frac{manuf}{X_j}$	0.001 (1.369)	0.000 (-0.038)	0.003 (0.787)	-0.006** (-2.333)	0.011 (1.267)	-0.010 (-1.623)	0.002 (0.786)	0.005*** (3.018)	0.024*** (12.571)	0.012*** (7.266)	-0.113*** (-12.506)
$Volatility_{ij}$	0.000 (0.322)	0.000 (0.596)	0.000** (2.392)	0.000** (2.002)	-0.001** (-2.382)	0.000 (-1.439)	0.000 (1.442)	0.000 (-0.008)	-0.0001* (-1.710)	0.000 (0.625)	0.001 (1.466)
ASEAN	0.142 (0.172)	-0.331 (-0.341)	2.417** (2.141)	-1.263 (-1.210)	1.300 (0.685)	0.225 (0.143)	3.934 (0.789)	-0.268 (-0.206)	-0.833 (-1.064)	-1.142 (-0.756)	-8.176*** (-4.844)
Constant	16.409*** (4.795)	12.235*** (2.844)	2.394 (0.450)	15.817*** (3.888)	15.390* (1.691)	5.054 (0.681)	0.754 (0.041)	12.678* (2.203)	14.477*** (3.941)	10.603 (1.627)	58.561*** (7.184)
R^2	0.979	0.962	0.866	0.953	0.817	0.825	0.966	0.950	0.964	0.979	0.723
Adjusted-R^2	0.979	0.961	0.863	0.952	0.814	0.821	0.966	0.949	0.963	0.978	0.718

Notes: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Figures in parentheses represent *t*-values.
SITC 0 = Food & live animals; SITC 1 = Beverages & tobacco; SITC 2 = Crude materials, inedible, except fuels; SITC 3 = Minerals & fuels; SITC 4 = Animal & vegetable oils, fats, & waxes; SITC 5 = Chemicals & materials; SITC 6 = Manufactured goods; SITC 7 = Machinery & transport equipment; SITC 8 = Miscellaneous manufactures; SITC 9 = Other commodities.

Table 3: Estimation results of gravity model specification with tariffs for 2001

	Dependent variable: $ln(1+X_{ij})$	**Dependent variable:** $\ln(1+X_{ij}^{PC})$									
	Total	**SITC 0**	**SITC 1**	**SITC 2**	**SITC 3**	**SITC 4**	**SITC 5**	**SITC 6**	**SITC 7**	**SITC 8**	**SITC 9**
$ln Y_i Y_j$	1.360*** (10.472)	2.064*** (5.489)	1.335** (2.693)	1.001** (2.565)	4.465*** (3.920)	0.761 (1.137)	1.711*** (4.970)	1.182*** (4.611)	1.374*** (10.877)	1.219*** (6.076)	1.074 (1.662)
ln Distance	-0.548*** (-2.986)	-0.780** (-2.131)	0.079 (0.112)	-1.917*** (-3.503)	-2.180* (-1.978)	-1.022 (-1.156)	-0.803 (-1.701)	-1.111*** (-3.264)	-0.465** (-2.594)	-0.329 (-1.314)	-0.154 (-0.205)
$Abs(\ln YPC_i - \ln YPC_j)$	0.176** (2.522)	0.208 (1.478)	-0.028 (-0.103)	0.068 (0.311)	-0.143 (-0.346)	0.012 (0.036)	-0.429** (-2.295)	0.186 (1.464)	0.184** (2.701)	0.151 (1.314)	-0.088 (-0.254)
Border	-0.080 (-0.234)	0.888 (1.283)	2.256 (1.688)	-1.285 (-1.217)	-0.087 (-0.043)	-1.618 (-0.966)	-0.223 (-0.245)	-0.349 (-0.557)	-0.317 (-0.947)	0.230 (0.467)	0.561 (0.411)
$\ln(A_i A_j)$	0.106 (1.228)	0.028 (0.185)	-0.300 (-0.868)	0.325 (1.416)	-0.814 (-1.322)	0.715* (1.953)	-0.029 (-0.137)	0.080 (0.387)	0.228** (2.626)	0.181 (1.409)	-0.399 (-0.546)
$\ln(N_i N_j)$	-0.642*** (-4.095)	-0.630 (-1.627)	0.120 (0.179)	-0.583 (-1.271)	0.411 (0.454)	-0.694 (-0.910)	-0.473 (-1.178)	-0.403 (-1.201)	-1.003*** (-6.267)	-0.812*** (-3.553)	0.493 (0.237)
$\frac{manuf}{X_i} + \frac{manuf}{X_j}$	0.015** (2.323)	-0.014 (-1.004)	0.031 (1.267)	-0.010 (-0.481)	-0.013 (-0.148)	0.040 (1.294)	-0.017 (-0.961)	-0.012 (-1.071)	0.041*** (5.255)	0.028** (2.770)	0.018 (0.552)
ASEAN	2.688*** (4.774)	4.644*** (3.329)	4.974** (2.277)	-0.162 (-0.095)	11.846*** (3.595)	4.385 (1.586)	4.107*** (2.817)	1.339 (1.285)	2.948*** (5.379)	1.045 (1.224)	2.494 (1.064)
$Trf_i + Trf_j$	0.022 (0.641)	0.186*** (3.111)	0.021 (1.116)	-0.014 (-0.112)	0.988 (0.771)	-0.432*** (-4.341)	-0.002 (-0.025)	0.058 (1.077)	0.034 (0.890)	0.015 (0.509)	-0.380 (-0.791)
$Volatility_j$	0.000 (-0.039)	0.001 (0.734)	0.002 (1.004)	0.001 (0.366)	0.001 (0.447)	0.000 (-0.060)	0.000 (-0.079)	0.001 (0.931)	0.000 (-0.132)	0.002*** (3.020)	-0.005** (-2.164)
Constant	-23.108*** (-3.008)	-51.873*** (-3.377)	-54.684* (-1.854)	-2.199 (-0.100)	-165.022*** (-3.794)	-13.691 (-0.379)	-36.386* (-1.832)	-16.935 (-1.034)	-19.738** (-2.485)	-18.676* (-1.777)	-45.278 (-1.004)
R^2	0.921	0.745	0.497	0.591	0.646	0.617	0.687	0.763	0.946	0.926	0.644
Adjusted-R^2	0.889	0.638	0.288	0.413	0.499	0.457	0.551	0.664	0.923	0.888	0.466

Notes: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Figures in parentheses represent *t*-values.

SITC 0 = Food & live animals; SITC 1 = Beverages & tobacco; SITC 2 = Crude materials, inedible, except fuels; SITC 3 = Minerals & fuels; SITC 4 = Animal & vegetable oils, fats, & waxes; SITC 5 = Chemicals & materials; SITC 6 = Manufactured goods; SITC 7 = Machinery & transport equipment; SITC 8 = Miscellaneous manufactures; SITC 9 = Other commodities.

Table 4: Estimation results of gravity model specification with tariffs for 2003

	Dependent variable: $ln(1+X_{ij})$	**Dependent variable:** $\ln(1+X_{ij}^{PC})$									
	Total	**SITC 0**	**SITC 1**	**SITC 2**	**SITC 3**	**SITC 4**	**SITC 5**	**SITC 6**	**SITC 7**	**SITC 8**	**SITC 9**
$ln Y_i Y_j$	1.447*** (12.101)	0.847*** (3.190)	1.080** (2.225)	1.169*** (3.121)	3.200*** (3.109)	0.637 (0.736)	2.012*** (5.622)	0.924*** (5.459)	1.486*** (10.501)	1.424*** (6.793)	0.364 (0.414)
ln Distance	-0.541*** (-3.273)	-0.873*** (-3.302)	-0.031 (-0.035)	-1.611*** (-3.225)	-1.607* (-1.931)	-1.503 (-1.711)	-0.506 (-1.058)	-1.234*** (-5.264)	-0.477** (-2.491)	-0.165 (-0.589)	-0.566 (-0.812)
$Abs(\ln YPC_i - \ln YPC_j)$	0.093 (1.502)	0.359*** (2.910)	-0.114 (-0.442)	0.033 (0.173)	0.331 (0.955)	-0.260 (-0.837)	-0.517*** (-2.827)	0.236** (2.393)	0.078 (1.080)	0.174 (1.634)	-0.073 (-0.244)
Border	-0.188 (-0.617)	0.832 (1.690)	1.507 (1.231)	-0.963 (-1.019)	-0.820 (-0.597)	-3.084* (-1.849)	-0.104 (-0.116)	-0.584 (-1.500)	-0.429 (-1.192)	0.571 (1.086)	-0.154 (-0.116)
$\ln(A_i A_j)$	0.198** (2.596)	-0.073 (-0.639)	-0.379 (-0.501)	0.321 (1.511)	-0.383 (-1.207)	1.317*** (3.870)	-0.075 (-0.354)	0.404* (2.042)	0.340*** (3.760)	0.222* (1.787)	-0.166 (-0.290)
$\ln(N_i N_j)$	-0.714*** (-5.048)	0.419 (1.532)	0.519 (0.385)	-0.434 (-1.033)	0.226 (0.167)	-2.366*** (-3.198)	-0.432 (-1.072)	-0.726* (-2.482)	-1.076*** (-6.123)	-0.867*** (-3.642)	0.218 (0.119)
$\frac{manuf}{X_i} + \frac{manuf}{X_j}$	0.019*** (3.300)	0.024** (2.125)	0.050* (1.920)	0.012 (0.647)	0.044 (0.635)	0.000 (0.006)	-0.008 (-0.450)	0.018* (1.875)	0.044*** (6.098)	0.029*** (2.880)	0.039 (0.721)
ASEAN	3.505*** (6.402)	1.402 (1.369)	4.621* (2.000)	1.337 (0.769)	10.075*** (3.857)	1.397 (0.387)	5.907*** (3.593)	1.090 (1.505)	3.991*** (6.156)	2.481** (2.592)	-0.203 (-0.077)
$Trf_i + Trf_j$	-0.040 (-1.414)	-0.001 (-0.024)	0.014 (0.446)	0.001 (0.012)	0.392 (0.250)	-0.286*** (-3.810)	-0.057 (-0.671)	-0.012 (-0.194)	-0.029 (-1.008)	-0.007 (-0.284)	-0.774 (-0.943)
$Volatility_{ij}$	-0.001 (-0.592)	0.000 (-0.087)	0.004 (0.536)	0.003 (0.481)	-0.008 (-0.947)	0.003 (0.298)	-0.002 (-0.419)	-0.001 (-0.367)	-0.001 (-0.443)	0.007** (2.325)	-0.005 (-0.632)
Constant	-27.369*** (-3.902)	-36.237*** (-3.219)	-57.504 (-1.203)	-21.549 (-0.993)	-126.708*** (-3.77652)	47.633 (0.939)	-54.286** (-2.615)	-5.353 (-0.414)	-25.175*** (-2.970)	-28.735** (-2.395)	-9.174 (-0.243)
R^2	0.928	0.794	0.490	0.597	0.690	0.613	0.739	0.864	0.928	0.908	0.657
Adjusted-R^2	0.898	0.696	0.277	0.429	0.542	0.428	0.631	0.799	0.897	0.869	0.493

Notes: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Figures in parentheses represent *t*-values.

SITC 0 = Food & live animals; SITC 1 = Beverages & tobacco; SITC 2 = Crude materials, inedible, except fuels; SITC 3 = Minerals & fuels; SITC 4 = Animal & vegetable oils, fats, & waxes; SITC 5 = Chemicals & materials; SITC 6 = Manufactured goods; SITC 7 = Machinery & transport equipment; SITC 8 = Miscellaneous manufactures; SITC 9 = Other commodities.

Table 5: Estimation results of gravity model specification with tariffs for 2005

	Dependent variable: $ln(1+X_{ij})$	**Dependent variable:** $\ln(1+X_{ij}^{PC})$									
	Total	**SITC 0**	**SITC 1**	**SITC 2**	**SITC 3**	**SITC 4**	**SITC 5**	**SITC 6**	**SITC 7**	**SITC 8**	**SITC 9**
$ln Y_i Y_j$	1.360*** (10.530)	0.868*** (4.325)	0.959** (2.783)	0.576 (1.232)	3.344*** (3.842)	0.641 (0.994)	2.230*** (4.621)	1.031*** (6.119)	1.653*** (10.899)	1.460*** (6.666)	1.690* (1.752)
ln Distance	-0.567*** (-3.819)	-0.996*** (-4.327)	-0.473 (-0.987)	-1.932*** (-4.327)	-1.764* (-1.750)	-1.927** (-2.731)	-0.521 (-1.019)	-1.361*** (-6.467)	-0.712*** (-3.562)	-0.307 (-1.035)	-1.233 (-1.351)
$Abs(\ln YPC_i - \ln YPC_j)$	0.051 (1.104)	0.320*** (3.286)	-0.307 (-1.439)	-0.179 (-1.184)	0.035 (0.096)	-0.133 (-0.554)	-0.413** (-2.240)	0.180* (2.046)	-0.023 (-0.305)	0.148 (1.341)	-0.308 (-0.893)
Border	-0.070 (-0.284)	0.399 (1.020)	0.711 (0.791)	-1.014 (-1.197)	-0.635 (-0.346)	-2.138 (-1.557)	0.110 (0.117)	-0.559* (-1.752)	-0.591 (-1.552)	0.463 (0.828)	-1.250 (-0.719)
$\ln(A_i A_j)$	0.041 (0.533)	-0.063 (-0.655)	-0.133 (-0.508)	0.283 (1.600)	-0.220 (-0.512)	1.189*** (4.217)	-0.408 (-1.139)	0.294* (1.809)	0.268** (2.716)	0.104 (0.737)	0.229 (0.409)
$\ln(N_i N_j)$	-0.512*** (-4.582)	0.413* (1.990)	0.209 (0.466)	-0.454 (-1.162)	-0.491 (-0.441)	-2.145*** (-3.656)	-0.097 (-0.208)	-0.403 (-1.591)	-0.877*** (-4.792)	-0.717*** (-2.848)	-0.723 (-0.450)
$\frac{manuf}{X_i} + \frac{manuf}{X_j}$	-0.005 (-1.080)	0.019** (2.199)	0.041* (1.947)	-0.018 (-0.806)	-0.028 (-0.728)	-0.006 (-0.198)	-0.018 (-1.154)	0.014* (2.025)	0.030*** (4.272)	0.017* (1.759)	0.062 (1.378)
ASEAN	2.890*** (5.830)	1.180 (1.484)	3.932** (2.484)	-2.021 (-1.019)	8.952*** (2.866)	0.068 (0.026)	5.392*** (3.245)	1.561** (2.217)	4.212*** (6.399)	2.138** (2.216)	4.315 (1.390)
$Trf_i + Trf_j$	0.006 (0.097)	-0.007 (-0.130)	0.002 (0.102)	0.249 (1.557)	0.266 (0.646)	-0.217 (-3.314)	0.237 (0.912)	-0.004 (-0.106)	-0.072 (-1.311)	0.062 (1.077)	-1.342 (-1.410)
$Volatility_{ij}$	-0.003 (-1.914)	0.002 (0.770)	0.007 (1.299)	0.009 (1.614)	-0.003 (-0.275)	0.014 (1.747)	-0.003 (-0.475)	0.000 (-0.193)	-0.001 (-0.331)	0.007* (2.012)	-0.006 (-0.575)
Constant	-22.724 (-3.104)	-35.005*** (-3.875)	-40.704* (-1.969)	14.653 (0.513)	-97.678** (-2.271)	47.036 (1.236)	-67.871** (-2.431)	-17.124 (-1.393)	-33.269*** (-3.527)	-30.066** (-2.298)	-42.855 (-0.983)
R^2	0.942	0.849	0.633	0.656	0.615	0.679	0.719	0.889	0.917	0.888	0.701
Adjusted-R^2	0.914	0.777	0.457	0.491	0.454	0.526	0.602	0.836	0.882	0.842	0.577

Notes: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Figures in parentheses represent *t*-values.

SITC 0 = Food & live animals; SITC 1 = Beverages & tobacco; SITC 2 = Crude materials, inedible, except fuels; SITC 3 = Minerals & fuels; SITC 4 = Animal & vegetable oils, fats, & waxes; SITC 5 = Chemicals & materials; SITC 6 = Manufactured goods; SITC 7 = Machinery & transport equipment; SITC 8 = Miscellaneous manufactures; SITC 9 = Other commodities.

Table 6: Estimation results of gravity model specification with tariffs for 2006

	Dependent variable: $ln(1+X_{ij})$	**Dependent variable:** $\ln(1+X_{ij}^{PC})$									
	Total	**SITC 0**	**SITC 1**	**SITC 2**	**SITC 3**	**SITC 4**	**SITC 5**	**SITC 6**	**SITC 7**	**SITC 8**	**SITC 9**
$ln Y_i Y_j$	1.607*** (9.058)	0.935*** (4.968)	1.224*** (4.126)	0.443 (0.938)	3.832*** (4.957)	0.693 (0.925)	1.941*** (4.489)	1.396*** (5.620)	1.710*** (10.488)	1.628*** (7.379)	2.463* (1.726)
ln Distance	-0.734*** (-3.565)	-0.970*** (-4.689)	-0.337 (-0.892)	-1.996*** (-5.046)	-1.496* (-1.721)	-1.786** (-2.503)	-0.725 (-1.468)	-1.208*** (-4.612)	-0.558*** (-3.147)	-0.402 (-1.420)	-1.373 (-1.432)
$Abs(\ln YPC_i - \ln YPC_j)$	0.075 (1.014)	0.298*** (3.485)	-0.219 (-1.170)	-0.281** (-2.115)	0.096 (0.258)	-0.219 (-0.903)	-0.394* (-2.113)	0.235** (2.175)	0.010 (0.184)	0.137 (1.306)	-0.595* (-1.799)
Border	-0.215 (-0.573)	0.425 (1.231)	1.074 (1.466)	-1.215 (-1.632)	-0.112 (-0.069)	-2.340 (-1.689)	0.058 (0.061)	-0.484 (-1.142)	-0.691** (-2.257)	0.246 (0.464)	-0.138 (-0.077)
$\ln(A_i A_j)$	0.108 (0.922)	-0.072 (-0.810)	-0.173 (-0.899)	0.324 (2.096)	-0.464 (-1.184)	1.125*** (3.947)	-0.236 (-0.987)	0.069 (0.343)	0.192*** (2.919)	0.135 (0.917)	0.455 (0.731)
$\ln(N_i N_j)$	-0.437** (-2.534)	0.469** (2.578)	0.214 (0.606)	-0.588** (-1.568)	0.164 (0.168)	-1.980*** (-3.218)	-0.110 (-0.254)	-0.121 (-0.403)	-0.786*** (-5.941)	-0.725*** (-2.935)	-1.667 (-0.867)
$\frac{manuf}{X_i} + \frac{manuf}{X_j}$	0.011 (1.692)	0.026*** (3.344)	0.038** (2.198)	-0.028 (-1.270)	0.023 (0.583)	-0.007 (-0.219)	-0.011 (-0.706)	0.021** (2.353)	0.028*** (4.966)	0.024** (2.573)	0.072 (1.493)
ASEAN	3.746*** (5.534)	1.465* (2.023)	4.837*** (3.568)	-3.031 (-1.540)	11.063*** (3.721)	1.112 (0.376)	4.605** (2.714)	2.724*** (2.843)	4.546*** (7.352)	2.743*** (2.904)	4.933 (1.318)
$Trf_i + Trf_j$	-0.114 (-0.977)	-0.031 (-0.619)	0.005 (0.322)	0.324* (2.013)	0.395 (0.970)	-0.311*** (-4.222)	0.039 (0.223)	0.058 (0.912)	-0.056 (-1.406)	0.036 (0.595)	-0.141 (-0.109)
$Volatility_{ij}$	-0.002 (-0.869)	0.001 (0.593)	0.004 (1.069)	0.007* (2.025)	-0.004 (-0.422)	0.011 (1.686)	-0.002 (-0.445)	-0.001 (-0.236)	-0.002 (-1.602)	0.007** (2.574)	0.002 (0.193)
Constant	-39.074*** (-3.752)	-40.872*** (-4.614)	-53.009*** (-2.973)	26.958 (0.899)	-148.499*** (-3.647)	39.519 (0.878)	-57.009*** (-2.295)	-41.208** (-2.423)	-38.813*** (-4.241)	-38.413*** (-2.860)	-50.573 (-0.986)
R^2	0.904	0.871	0.718	0.719	0.642	0.708	0.692	0.822	0.947	0.899	0.667
Adjusted-R^2	0.863	0.809	0.583	0.585	0.471	0.568	0.564	0.736	0.922	0.857	0.508

Notes: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Figures in parentheses represent *t*-values.

SITC 0 = Food & live animals; SITC 1 = Beverages & tobacco; SITC 2 = Crude materials, inedible, except fuels; SITC 3 = Minerals & fuels; SITC 4 = Animal & vegetable oils, fats, & waxes; SITC 5 = Chemicals & materials; SITC 6 = Manufactured goods; SITC 7 = Machinery & transport equipment; SITC 8 = Miscellaneous manufactures; SITC 9 = Other commodities.

Table 7: ASEAN priority sectors with matching SITC

ASEAN Priority Sectors	Matching SITC							
	SITC 0 (Food & live animals)	**SITC 1 (Beverages & tobacco)**	**SITC 2 (Crude materials, inedible, except fuels)**	**SITC 4 (Animal & vegetable oils, fats, & waxes)**	**SITC 5 (Chemicals & related products)**	**SITC 6 (Manufactured goods classified chiefly by material)**	**SITC 7 (Machinery & transport equipment)**	**SITC 8 (Miscellaneous manufactured articles)**
1.Agro-based products	(00) Live animals chiefly for food (01) Meat & meat preparations 02) Dairy products & bird's eggs (03) Fish, crustaceans, mollucs, preparations thereof (04) Cereals & cereal preparations (05) Vegetables & fruit (06) Sugar, sugar preparations & honey (07) Coffee, tea, cocoa, spices, manufactures thereof (08) Feeding stuff for animals (09)Miscellaneous edible products & preparations	(11) Beverages (12) Tobacco & tobacco manufactures	(21) Hides, skins & fur skins, raw (22) Oil seeds & oleaginous fruit (29) Crude animal & vegetable materials	(41) Animal oils & fats (42) Fixed vegetable oils & fats (43) Animal-vegetable oils-fats, processed, & waxes				
2.Automotives							(78) Road vehicles (79) Other transport equipment	
3.e-ASEAN (ICT)							(75) Office machines & automatic data processing equipment (76) Telecommunications & sound recording apparatus	
4.Electronics							(77) Electrical machinery, apparatus & appliances	(88) Photographic apparatus, optical goods, watches
5.Fisheries	(03) Fish, crustaceans, mollucs,							
6.Healthcare					(54) Medicinal & pharmaceutical products			(87) Professional, scientific & controlling instruments
7.Rubber-based products						(62)Rubber manufactures		
8.Textiles & apparels			(26) Textile fibres & their wastes			(65) Textile yarn, fabrics, made-upart., related products		(83) Travel goods, handbags, & similar containers (84) Articles of apparel & clothing accessories (85) Footwear
9.Wood-based products			(24) Cork & wood (25) Pulp & waste paper			(63) Cork & wood manufactures (excluding furniture) (64) Paper, paperboard, artic. of paper, paper-pulp/board		
Share out of total no. of products of each SITC at 2 digit level	**9/9**	**2/2**	**6/9**	**3/3**	**1/9**	**4/9**	**5/9**	**5/9**

Table 8: Consolidation of determinants of inter-industry and intra-industry trade

Categories		Total	SITC 0	SITC 1	SITC 2	SITC 3	SITC 4	SITC 5	SITC 6	SITC 7	SITC 8	SITC 9
Core	$\ln Y_i Y_j$	+	+	+	+	+	+	+	+	+	+	-
Core	ln *Distance*	-	-		-	-	-		-	-		
Relative development	$Abs(\ln YPC_i - \ln YPC_j)$		+		+/-			-	+			
Geographical factors	*Border*			+								
Geographical factors	$\ln(A_i A_j)$						[+]	[+/-]		[+]		[+]
Factor endowment	$\ln(N_i N_j)$	-					-	+/-		-	-	-
Level of development	$\frac{manuf}{X_i} + \frac{manuf}{X_j}$	+	+	+	+/-				+	+	+	[-]
Regional trading arrangement	*ASEAN*	+		+		+		+		+	+	-
Trade policy	$Trf_i + Trf_j$						-					
Exchange rate risk	$Volatility_{ij}$			+		-				-	+	
Number of determinants of trade		5	4	5	5	4	5	5	4	7	5	5

Note: Figures in square parentheses represent results that do not conform to the expected signs.
SITC 0 = Food & live animals; SITC 1 = Beverages & tobacco; SITC 2 = Crude materials, inedible, except fuels; SITC 3 = Minerals & fuels; SITC 4 = Animal & vegetable oils, fats, & waxes; SITC 5 = Chemicals & materials; SITC 6 = Manufactured goods; SITC 7 = Machinery & transport equipment; SITC 8 = Miscellaneous manufactures; SITC 9 = Other commodities

Table 9: Summary of policy recommendations for total trade and by sector

Product classification	Product description	Policy recommendations
Total	Total exports	Maintain policies that promote growth and development Policies that ensure low transportation costs Measures on product improvements
SITC 0	Food & live animals	Maintain policies that promote growth and development Measures on product improvements
SITC 1	Beverages & tobacco	Maintain policies that promote growth and development Policies that ensure low transportation costs Measures on product improvements
SITC 2	Crude materials	Maintain policies that promote growth and development Measures on product improvements
SITC 3*	Minerals & fuels	Maintain policies that promote growth and development Measures on product improvements Close monitoring in the presence of exchange rate volatility
SITC 4	Animal & vegetable fat	Maintain policies that promote growth Tariff reduction policies Measures on product improvements
SITC 5	Chemicals & materials	Maintain policies that promote growth Policies that ensure low transportation costs Measures on product improvements
SITC 6	Manufactured goods	Maintain policies that promote growth and development Measures on product improvements
SITC 7	Machinery & transport equipment	Maintain policies that promote growth and development Measures on product improvements Close monitoring in the presence of exchange rate volatility
SITC 8	Miscellaneous manufactures	Maintain policies that promote growth and development Policies that ensure low transportation costs Measures on product improvements
SITC 9*	Other commodities	Maintain policies that promote growth and development Measures on product improvements

Note: * Non-priority sectors of ASEAN.

Notes

[1] The six member countries were Brunei, Indonesia, Malaysia, Philippines, Singapore, and Thailand. Cambodia, Laos, Myanmar and Vietnam (CLMV) later become signatories upon joining ASEAN.

[2] The eleven priority areas are air travel, agro-based products, automotives, e-commerce, electronics, fisheries, healthcare, rubber-based products, textiles and apparels, tourism, and wood-based products.

[3] For SITC 2 and SITC 5, Singapore's exports to Indonesia had to be omitted in all the estimations due to incomplete data.

[4] This is due to unavailable monthly exchange rate data for Indonesia' and the Philippines from the Bloomberg database, which is one of the most comprehensive online real time database for data on global financial markets, among others.

[5] This is because zero data values may reflect small trade values (i.e., less than USD 0.5 million) that still need to be captured in the estimation.

[6]Despite extensive efforts made, data on actual transportation cost for each country could not be obtained. Hence, the variable *Distance* has been maintained as a proxy to transportation cost as is the standard practice for gravity models.

[7] The Hausman test is a standard procedure to determine whether the random effect or the fixed effect model is applicable in panel data estimation (Gujarati, 2003). In this study, the null hypothesis that the independent variables and the individual effects are uncorrelated (i.e., random effect) is rejected at the 1 per cent significance level for all the models estimated.

[8] Other commodities or "commodities and transactions not classified elsewhere" (SITC 9) comprise of UN special code items (SITC 90, 91 & 93), animals, live zoo animals, dogs, cats, etc (SITC 94), arms of war and ammunition (SITC 95), coin (other than gold) not being legal tender (SITC 96), and gold, non-monetary (SITC 97).

[9] The SITC 2-digit level is referred as it provides a further disaggregation of the product classification which is necessary for the matching to be conducted. Two priority areas omitted, namely, air travel and tourism, as they do not fall into any of the SITC classification.