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Abstract

This paper uses an extended gravity model to shed light on the impact of the free trade area agreement between the Association of Southeast Asian Nations (ASEAN) and the People's Republic of China (PRC) on the members' trade flows and trade patterns. New determinants that capture the rising importance of global production sharing and intra-regional trade in parts and components in East Asia are proposed. Results from the extended gravity model show that the free trade agreement leads to substantially higher bilateral trade between ASEAN and the PRC, more than what a conventional gravity model predicts. The increase is concentrated in the ASEAN countries with stronger industrial linkages with the PRC.

Keywords: ACFTA, gravity model, parts and components trade.

JEL Classification: F17, O53

1. Introduction

The Association of Southeast Asian Nations (ASEAN)—the People‗s Republic of China (PRC) free trade agreement or ACFTA came into effect on 1 January 2010. It covers a free trade area with the highest population (1.9 billion) and an economic size next only to that of the North American Free-Trade Area (NAFTA) and the European Union (EU). As part of the agreement, the average tariff on ASEAN-origin exports to PRC was lowered from 9.8 percent to 0.1 percent in 2010, while the average tariff on PRC-origin exports to the six original ASEAN members—Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore and Thailand—was reduced from 12.8 percent to 0.6 percent. By 2015, the policy of zero-tariff rate for 90 percent of Chinese goods is expected to extend to the four new ASEAN members—Cambodia, the Lao People‗s Democratic Republic (PDR), Myanmar and Viet Nam (Xinhuanet 2010).

Numerous studies and reports have documented the benefits, opportunities, and challenges of ACFTA to its member countries (Chia 2005; Tongzon 2005). A key challenge is that ACFTA may intensify competition among member countries and lead to significant job losses. It may also reduce social welfare if the effects of trade diversion dominate trade creation. Still, the main attraction of ACFTA is that it offers vast opportunities and benefits to consumers and firms in member countries. Consumers benefit from having access to a wide variety and cheaper products and produce. Many ASEAN firms in particular can tap more easily into the Chinese market, the fastest growing market in the world. The removal of tariffs also allows freer flows of intermediate goods between the two regions, benefiting producers at every stage of production and deepening regional economic integration. Because of the increased significance of production fragmentation in both regions, it is therefore useful to investigate more closely how the free trade agreement will eventually reshape production and trade relationships between the PRC and the ASEAN countries.

By using an extended gravity model that takes into account bilateral imports, exports and related trade in parts and components between the PRC and the ASEAN countries, we note that ACFTA affects bilateral trade in parts and components via an additional channel of cross-country industrial linkages. We conjecture that if trade between member countries is mainly in components, then the formation of the free trade area is likely to generate more opportunities than if trade was in final goods alone. The additional trade opportunities come from the finer specializations in the production chain due to trade liberalization. This view is relatively novel and complement existing studies using computable general equilibrium (CGE) models and gravity models (Chirathivat 2002; Roberts 2004; Park et al. 2008; Park et al. 2010). The existing studies generally assume that trade flows between countries are mainly in final goods and are therefore determined by conventional factors such as country size and its living standards. However, they may underestimate the impact of a free trade area if the nature of trade among member countries has a large and growing proportion of component trade as in the case of ACFTA.

This paper aims to investigate (1) how trade in parts and components may differ from trade in final goods as a consequence of ACFTA; (2) how much trade flows and trade pattern between the PRC and the ASEAN countries would change after ACFTA; and (3) whether greater integration between the PRC and ASEAN would threaten trade between the PRC or ASEAN with non-member countries.

The main results are as follows. First, by explicitly accounting for component trade, ACFTA will have a substantially larger impact on the trade flows between the PRC and ASEAN than what the existing literature predicts—around 25 per cent more (US$343 billion at 2008 constant prices), which is more than double the existing projections in Chirathivat (2002), and Lee and Mensbrugghe (2007). Second, the larger trade flows between the two regions are more likely to be in parts and components and concentrated among a sub-group of member countries with stronger industrial linkages. This implies that industries in ASEAN and the PRC will become more closely integrated. Finally, trade creation in component trade between the two regions will generate positive spillovers to the rest of the world. This comes about because finer specializations in the production chain also involve countries outside ACFTA. These trade creation effects may in turn offset trade diversion effects and further improve the social welfare in both the PRC and ASEAN.

The paper is organized as follows. The next section provides an overview of trade between PRC and ASEAN. Sections 3 and 4 review the theory, empirical model and data sources. Section 5 reports the results and section 6 concludes.

2. Trade between the PRC and ASEAN: Some Stylized Facts

Bilateral trade flows between the PRC and ASEAN have grown rapidly in absolute terms as well as in its relative importance to each other‘s total trade (export plus import). Parallel to the rapid expansion of the PRC‘s exports and imports between 1998 and 2008 (Figure 1) was the significant increase in bilateral trade with ASEAN, especially after the PRC‘s accession to the World Trade Organization (WTO) in 2001 (Figure 2). In 1998 total trade between the PRC and ASEAN amounted to about $24 billion (Table 1). It increased nearly ten-fold to $231 billion in 2008, averaging more than 20 percent in annual growth. In addition, trade between the PRC and ASEAN has become more important to each other‘s total trade. Between 1999 to 2009 ASEAN‘s share in the PRC‘s total trade increased markedly, while the share of the US and Japan, the PRC‘s major trading partners fell (Figure 3.1). In 2009, ASEAN became the PRC‘s fourth largest trading partner accounting for 10.2 percent of the PRC‘s total trade, which is close to Japan‘s share. And in 2009, the PRC became ASEAN‘s largest trading partner outside of ASEAN (Figure 3.2). The PRC also became ASEAN‘s largest source of imports (accounting for 13.3% of total imports) and third largest export market (accounting for 10.1% of total exports).

In terms of bilateral trade pattern, there has been a shift from primary goods to manufacturing goods. From 1978 when PRC initiated the open-door policy to the 1997 Asian financial crisis, inter-industry trade of commodity goods was the dominant feature of the bilateral trade. For instance in 1985, trade in agricultural and mineral goods accounted for more than half of total ASEAN exports to and imports from PRC at 55 and 83 percent, respectively (Table 2). More recently, however, intra-industry trade in manufactured goods has grown in importance. This is most apparent in the rapid growth of the share of machinery and transport equipment in total ASEAN exports to PRC from 18% in 1980 to 49% in 2005 and its share in total ASEAN imports from PRC from 8% to 57% in the same period.

Compared to the rest of the world, trade in parts and components (fragmentation trade) has accounted for the bulk of the total trade growth in the Asia-Pacific region, in particular between ASEAN and the PRC (Uchida 2008; Li 2009; Athukorala 2011).[1] In 2004, parts and components accounted for 33.5 percent of the total manufacturing export of East Asian countries, such as Malaysia, the Philippines, Singapore and Thailand, while only 20.9 percent for EU, and 30.7 percent for NAFTA countries (Athukorala and Yamashita 2006). This change in the trade flows and trade pattern reflects the change in international production from the traditional pattern of producing a good from start to finish in one country to production fragmentation, where production processes are carried out in stages dispersed across multiple economies. For example, to meet an order for 10,000 shirts from a retailer in the US, a trading company sources the yarn from a factory in the Republic of Korea. It then dyes and weaves the fabric in factories in Taipei,China. And finally, the cutting, sewing and trimming of the shirts are done in Thailand where labor, capacity and skills have an advantage (Fung 2005).

The bilateral trade between ASEAN and the PRC is dominated by several countries and, despite some country differences, reinforcing the previous discussion, are mostly in parts and components trade. Singapore, Malaysia, Thailand, and Indonesia together account for more than 80 percent of either ASEAN's imports or exports with the PRC in 1980 to 2009 (Table 3).[2] In addition, the bulk of the trade (exports and imports) between Malaysia, Singapore, Thailand and the PRC are concentrated in two sectors (Figure 4): machinery and mechanical appliances and their parts and components (HS 84); and electrical machinery and equipment and their parts and components (HS 85).[3] That said, inter-industry trade remains important in some products. Malaysia continues to be a net exporter of animal or vegetable fats and oils to the PRC, while Thailand, of plastics and articles thereof.

3. Brief Literature Review

Interests in the economic impact of ACFTA on the PRC and ASEAN are evident from the growing number of studies in the literature. The two most common methodologies used to study the impact of free trade area on countries are the CGE models and gravity models. Using the CGE approach, Chirathivat (2002), Lee and Mensbrugghe (2007), Kawai and Wignaraja (2008), and Park et al. (2009) apply the Global Trade Analysis Project (GTAP) model or the Global Trade and Economic Analysis (GTEM) model to project trade and economic effects of ACFTA in the Asia-Pacific region. Results from these studies suggest that ACFTA generates a linear pattern of trade creation among

[1] For example in Athukorala (2011), the author shows that trade in parts and components has grown faster than total world trade in manufacturing and that this phenomenon is most apparent in East Asia than anywhere else in the world.

[2] From henceforth, —ASEAN imports" refers to —total ASEAN imports from PRC" and —ASEAN exports" refers to —total ASEAN exports to PRC", unless otherwise specified.

[3] "HS" refers to the *Harmonized Commodity Description and Coding System* or *Harmonized System* in short.

member countries either through tariff cuts (supply-side factor) or increases in GDP (demand-side factor), where the net effect is estimated around 20 to 40 percent. On the other hand, Roberts (2004) and Yuan (2010) use the gravity model and stimulate different scenarios of income increases and/or tariff reductions.[4] Estimated results from these studies, although different in magnitude from the CGE studies, generally confirm a linear growth trajectory of trade between the PRC and ASEAN.

Although both the CGE and gravity models provide estimates of bilateral trade impacts of ACFTA, they have their limitations. CGE results are based on estimated coefficients not accounted for in the model and thus cannot be statistically verified. More important, projections from the model do not distinguish between trade in parts and components and trade in final goods. As to be discussed later, the impact of a free trade agreement on final goods trade differs from its impact on components trade. Since the actual bilateral trade between the PRC and ASEAN comprise mainly of parts and components, studies that do not account for these are likely to generate misleading results. The gravity model, on the other hand, has an advantage over the CGE models for not relying on many demand and substitution elasticities (which are obtained externally) for simulation. Thus, it is more straightforward to provide statistical estimation on the impact of free trade agreement on bilateral trade. Nevertheless, the conventional gravity model still does not capture the salient feature of rising trade in parts and components. It ignores the increased component trade in the machinery and transport equipment industries, wherein a large number of multi-layered vertical production processes take place. Therefore, this paper contributes to the literature by extending the gravity model to explicitly account for the production linkages inherent in components trade.

4. The Estimation Strategy: Concept, Methodology, and Data

4.1 Concept: Component Trade and Its Determinants

Standard trade theories posit that productivity and comparative advantage differences across countries are key drivers of international trade. Empirically these drivers have done well in explaining the inter-industry trade between developed and developing countries (Leontief 1953; Leamer 1980; Trefler 1995). A third driver under the ambit of new trade theory (Krugman 1979 and 1980) emphasizes the role of market structure and behavior of firms in determining intra-industry trade among countries. It has also been used to explain trade patterns among countries arising from cross-country industrial linkages through vertical-specialization or product-fragmentation. Gonzales and Holmes (2011) review the theoretical underpinnings of vertical specialization and global trade and summarize studies in this area.

Three characteristics of component trade and its impact on trade creation are worth highlighting. First, its growth may follow a different path (perhaps exponentially) in contrast to the growth in final goods trade (linearly) (see Appendix A for details). Second, the pattern of new component trade among trading partners is likely to be determined by

[4] The gravity model has also been widely used in analyzing the effects of regional trade blocs (Frankel et al. 2007) and WTO membership (Rose 2004; Subramaniam and Wei 2007).

cross-country industrial linkages along with their comparative advantages, which are determined by endowment and relative productivity. Third, trade with the rest of world may increase since non-member countries may also be involved in the production chain, which in turn reduces the trade diversion effects of a free trade area. Intuitively, when a country specializes in finer stages of a global production chain, it sources different complementary components from different trading partners. This means when trade in parts and components increases between two member countries in a newly formed free trade area, part and component trade with other countries in the global production chain also increases. This is even more important if trade liberalizations encourage deeper production specialization. That is, importing more parts and components raises productivity and reduces cost of intermediate inputs, which in turn strengthens a country‘s comparative advantage in specific stages of global production chain. Thus, an increase in imports of parts and components from a member country leads to an increase in imports in other parts and components from either the same or different member countries (or even countries outside the free trade area). At the same time, because of the lower cost of production, there are more exports of either parts and components or final goods to the same or different member countries or even the rest of the world.

The well-known story of making iPod is a good example of global production sharing that offers increased trade opportunities for countries within and outside a free trade area. While it is not easy to tell which country really makes the Apple iPod, one thing is clear, it is not US (Varian 2007). The 451 parts that go into making an iPod are made in many countries, mostly in Asia. iPod‘s hard drive is manufactured by Toshiba in the Philippines and the PRC. Its display module, video/multimedia processor chip and the controller chip are made in Taipei,China, while the final assembly is done in the PRC. Given the deep production linkages of making iPods in Asia, an additional unit demand of iPod say from the US will increase the PRC‘s import of iPod‘s hard drive from the Philippines and the display module, video/multimedia processor chip and the controller chip from Taipei,China. At the same time, since they are other components that go into making the hard drive, display module and video/multimedia/controller chips, the Philippines and Taipei,China will in turn import these components from other countries. Thus, component trade generates more trade opportunities by strengthening industrial linkages between trading partners. This underlines the non-linear trend of trade flows between ASEAN and the PRC that more closely mimics the observed growth in parts and components trade. Also, this underlines the need to better account for the characteristics of part and component trade in the gravity estimations.

4.2 Gravity Model and Its Empirical Specification

The gravity model was developed by Tinbergen (1962), Linnemann (1966), Pöyhönen (1963), and Pulliainen (1963). Today, it is ―probably the most successful empirical trade device….and usually produces a good fit" (Anderson 1979, p.106). Its theoretical foundations can be found in Anderson (1979), Helpman and Krugman (1985), Bergstrand (1985), and Deardorff (1998).

The basic empirical model specification in this paper follows Rose (2004), and Subramanian and Wei (2007):

$$\ln import_{jkt} = \theta_0 + \sum_h \alpha_h M_{jt}^h + \sum_m \beta_m X_{kt}^m + \sum_n \gamma_n Z_{jkt}^n$$
$$+ \theta_1 FTA_{jkt} + \theta_2 WTO\_M_{jt} + \theta_3 WTO\_X_{kt} \qquad , \qquad (1)$$
$$+ \pi_1 \ln export_{jt} + \pi_2 \ln import_{j-kt} + \sum_t \varphi_t DT_t + \varepsilon_{jkt}$$

where $\ln import_{jkt}$ is the natural logarithm of the value of country j's import from country k at time t. This variable is used as the dependent variable rather than total trade between j and k in order to distinguish the asymmetric impact of free trade agreement on importing and exporting countries (Subramanian and Wei 2007). Besides, in practice, the balance in the balance of payments for a pair-wise trading partner is often not the same. M_{jt}s and X_{kt}s consist of time-varying importer- and exporter-specific variables, respectively. These variables are the natural logarithm of GDP and GDP per capita, which are used to capture importer- and exporter-specific characteristics such as economic size, income level and consumer preferences (Anderson and Wincoop 2003). In particular, GDP serves as a proxy for production capacity for an exporter or market size for an importer, while GDP per capita serves as a proxy for income level and consumption preference. Z_{jkt}'s are variables used to proxy for "multilateral resistance" or transaction costs associated with trading. They include greater circle distance between j and k, and dummies for common language, shared borders and islands. WTO_M_{jt} is a dummy variable for importer j who is a WTO member, while WTO_X_{kt} is a dummy variable for exporter k who is a WTO member. FTA_{jkt} is a dummy variable that takes on a value of one if j and k belong to a common free trade area or common market in year t. Also, DT_t is a year dummy to control for time-specific effects.

The aforementioned are the standard variables in a gravity model. To better capture the features of part and component trade, two additional variables are introduced. The first is the natural logarithm of an importer's total imports from the rest of the world, $\ln import_{j-kt}$, and the other is the natural logarithm of an importer's total exports, $\ln export_{jt}$. The first variable is used to account for complementary or substitution effects of trade between a trading country-pair and a third country. Eichengreen et al. (2007) use this to study how exports from Asia (excluding the PRC) to other countries are affected by rising exports from the PRC to the same markets. Mulapruk and Coxhead (2005) provide theoretical justification for using this variable and its sign to identify a country's comparative advantage. Here, we use it only for substitutability or complementarity of products. The substitution effect dominates if country k and the rest of the world, $-k$, competes with each other, that is, the coefficient of $\ln import_{j-kt}$ is negative. If country j increases its imports from $-k$ and, $-k$ competes with k, then j will import less from k. On the other hand, the complementary effect dominates if j increases its imports from $-k$ at the same time as its imports from k, that is, the coefficient of $\ln import_{j-kt}$ is positive. The iPod example is instructive. To meet an increase for iPod, factories in the PRC will increase their imports of hard drives from the Philippines together with their imports of video/multimedia processor chip from Taipei,China (a third country).

The second variable ($\ln export_{jt}$) is used to capture the sensitivity of imports in parts and components in response to changes in an importer's exports. Consider a case where export of hard-disks by a member country (say Thailand) rises in response to an increase in demand from a non-member country (say the US). If inputs into the hard-disks are produced and exported by another member country (say the PRC), then Thailand will import more of these parts and components from the PRC—higher exports from Thailand contribute to higher imports of parts and components from the PRC. In this way, trade in parts and components plays a vital role in expanding trade within and outside a free trade area due to the existence of cross-country production linkages among member countries and between member and non-member countries. Thus, if product fragmentation and component trade are important, then the coefficient of $\ln export_{jt}$ is expected to be positive and significant—an increase in exports results in an increase in the demand for its parts and components, which are being imported.

Appendix A discusses how changes in $\ln import_{j\text{-}kt}$ and $\ln export_{jt}$, affect $\ln import_{jkt}$ through the outsourcing effects of component trade. Note that component trade is only a necessary but not sufficient condition for the coefficient of $\ln import_{j\text{-}kt}$ to be positive since there is also the substitution effect among trading partners. It is also important to note that the outsourcing effects may not be limited to the initial trading partners, that is, between the PRC and Thailand. Given the industrial linkages between the PRC or Thailand with other countries, a free trade agreement between the two countries can also generate additional demand for components from the rest of world—trade externality.

Although Equation 1 can be used to examine total bilateral trade flows, it cannot be used to test the hypothesis on trade creation that is specific to component trade. More specifically, $\ln import_{jkt}$ does not clearly differentiate between trade in parts and components, which is of interest, from trade in final goods. The ideal solution is to split total trade into final good trade and component trade and use the latter as the dependent variable. However, there is no general agreement on the definition of component trade (Athukorala and Yamashita 2006). Practically, it is also difficult to calculate bilateral component trade for all paired countries. Fortunately, component trade is usually classified into the same industry according to the standard international trade code (SITC) given the similar nature of the type of trade. From a statistical perspective, bilateral component trade is highly correlated to bilateral intra-industry trade (Grimwade 2000). Thus, the bilateral intra-industry trade can be used as an approximation to the bilateral component trade.

In this paper, the value of bilateral intra-industry trade is defined as the product of the intra-industry trade index (at 3-digit level, SITC Rev.1) and the value of bilateral imports used for $\ln import_{jkt}$ in Equation 1. This value of intra-industry trade is used as the dependent variable that approximates the bilateral component trade. Thus, the extended gravity model can be re-estimated as follows:

$$\begin{aligned}\ln intra\_import_{jkt} &= \theta_0 + \sum_h \alpha_h M_{jt}^h + \sum_m \beta_m X_{kt}^m + \sum_n \gamma_n Z_{jkt}^n \\ &+ \theta_1 FTA_{jkt} + \theta_2 WTO\_M_{jt} + \theta_3 WTO\_X_{kt} \\ &+ \pi_1 \ln export_{jt} + \pi_2 \ln import_{j-kt} + \sum_t \phi_t DT_t + \varepsilon_{jkt}\end{aligned} \quad , \qquad (2)$$

where $\ln intra\_import_{jkt}$ is the logarithm of the value of intra-industry imports of country j from country k at time t. The other variables are defined as in Equation 1.

The magnifying effect of the formation of a FTA on components trade of country j through $\ln import_{j\text{-}kt}$ and $\ln export_{jt}$, is captured by the trade multiplier that is derived in Appendix A, which is based on the extended gravity model similar to Equation 2 above. The multiplier shows that the overall impact of FTA on the volume components trade is not determined solely by θ_1; π_1 and π_2 play significant roles. Since Equation 2 examines the determinants of component trade using the same model specification as Equation 1, we can compare the estimated coefficients of FTA_{jkt}, $\ln import_{j\text{-}kt}$ and $\ln export_{jt}$ in both equations to see whether Equation 2 can better explain variations in component trade. Specifically, if the estimated coefficient of FTA_{jkt}, θ_1, is smaller in Equation 2 than in Equation 1, this suggests that the conventional trade determinant (FTA_{jkt})—defined as the relationship between FTA_{jkt} and bilateral trade flow—cannot explain component (or intra-industry) trade flows as well as for total trade. Put differently, FTA contributes to a smaller change in component trade compared to total trade. Therefore, for Equation 2 to better explain component (or intra industry) trade, it must account for the intrinsic characteristics of cross-country production linkages. This suggests that the estimated coefficients π_1 and π_2 in Equation 2 should be larger than those in Equation 1.[5]

As a benchmark, Equations 1 and 2 are first run as pooled OLS regressions. Later as comparisons, panel random and fixed effect regressions are applied. Heteroscedasticity robust standard errors are used in all estimations.[6] Wang et al. (2010) contends that the panel fixed effect regression that controls for the trade-pair fixed effect (or assume $\varepsilon_{jkt}=u_{jk}+v_{jkt}$) may still lead to biased estimates. This is because the trade-pair fixed effect (u_{jk}) may come from trading partners' country specific characteristics (η_j and η_k), which are more likely to be correlated with the explanatory variables such as M_{jt} and X_{kt}. Incorrectly specifying the source of fixed effects may lead to endogeneity problem, such that $E(X_{jkt}\varepsilon_{jkt}) = E[(X_{jkt})(\eta_j + \eta_k - u_{jk})] \neq 0$ or the ―gold medal error" as described by Baldwin and Taglioni (2006). To address this, the equations are estimated with country-specific fixed effects (or assume $\varepsilon_{jkt} = \eta_j + \eta_k + v_{jkt}$) as follows:

$$\begin{aligned}\ln import_{jkt} &= \theta_0 + \sum_h \alpha_h M_{jt}^h + \sum_m \beta_m X_{kt}^m + \sum_n \gamma_n Z_{jkt}^n \\ &+ \theta_1 FTA_{jkt} + \theta_2 WTO\_M_{jt} + \theta_3 WTO\_X_{kt} \\ &+ \pi_1 \ln export_{jt} + \pi_2 \ln import_{j-kt} + \sum_t \phi_t DT_t \text{ ,} \\ &+ \sum_j \varphi_j D_j + \sum_k \chi_k D_k + + \varepsilon_{jkt}\end{aligned} \tag{3}$$

[5] More detailed information on the trade multiplier effect involving π_1 and π_2 is discussed in Appendix A.
[6] Autocorrelation is unlikely to be an issue considering the small estimated sample period, see data section.

$$\ln intra\_import_{jkt} = \theta_0 + \sum_h \alpha_h M_{jt}^h + \sum_m \beta_m X_{kt}^m + \sum_n \gamma_n Z_{jkt}^n + \theta_1 FTA_{jkt} + \theta_2 WTO\_M_{jt} + \theta_3 WTO\_X_{kt} + \pi_1 \ln export_{jt} + \pi_2 \ln import_{j-kt} + \sum_t \phi_t DT_t + \sum_j \varphi_j D_j + \sum_k \chi_k D_k + \varepsilon_{jkt}, \quad (4)$$

where D_j and D_k are a group of dummies for country-specific effects.

4.3 Data

This study uses unbalanced panel data of bilateral trade flows, income, population, distance, geographical, cultural and historical information and a few other group-specific measures. The data from 1980 to 2000 are obtained directly from Subramanian and Wei (2007). For the period 2001 to 2008, they are updated based on the International Monetary Fund (IMF)'s *Direction of Trade Statistics* (DOTS) for the trade data and the World Bank's *World Development Indicator* (WDI) for the income and population data.

Bilateral import values (c.i.f. price) are based on the records of the importing countries, measured in US dollar and deflated by the US CPI for urban areas (1982 price). Geographical variables, dummies for WTO and FTA memberships and other dummies are taken from Subramanian and Wei (2007) and updated to incorporate the PRC's accession to WTO. Bilateral intra-industry trade is measured using the bilateral intra-industry index from the Australian National University (ANU)'s *International Economic Data Bank* (IEDB). It is calculated based on the bilateral trade data at the 3-digit level (ISTC Rev. 3).

The dataset consists of 76,417 observations covering 117 countries for every five-year period from 1980 to 2008, except the last one, which is from 2005 to 2008. This gives 6 five-year blocks of data for estimations. We follow Subramanian and Wei (2007) in using the five-year average to smooth the year-to-year fluctuations of bilateral trade flows and to make the estimations and projections more reflective of long-term trend. Appendix B provides more detailed information on the data and their sources.

5. Results

5.1 Determinants of Bilateral Trade: Total vs. Component Trade

Controlling for country-pair effects is important as pooled OLS estimates are inherently biased. Table 4 shows the results for bilateral trade where the dependent variable is $\ln import_{jkt}$ under the different estimation methods (columns): (i) pooled OLS; (ii) panel fixed effects; (iii) panel random effects; and (iv) panel country-specific effects. Specifically, columns one to three are estimated based on Equation 1, while column four, on Equation 3. For the pooled OLS model, the estimated coefficients for most explanatory variables are overestimated due to potential correlation between the country-pair/country-specific fixed effects and the explanatory variables as discussed above. After controlling for the country-pair effects (columns two and three), the R^2 has generally become larger suggesting improvements in the results.

Controlling for country-specific effects instead of country-pair effects appears to further reduce the biasness. There may still be some country-specific fixed effects in the residuals which are correlated with the explanatory variables. Thus, country-specific fixed effects are controlled for by estimating Equation 3. Compared with columns one to three, column four is the preferred specification—most of the coefficients have the expected signs and are statistically significant consistent with previous literature (Baldwin and Taglioni 2006; Subramanian and Wei 2007). In particular, the coefficients of FTA_{jkt} and $\ln import_{j\text{-}kt}$ are smaller, which suggests the country-specific fixed effects are important and should be controlled for. Also, the R^2 is 0.831, higher than those obtained from the other specifications. The ensuing discussion will focus on the results from the panel country-specific effect model.

All the standard gravity variables have the expected sign and statistically significant. GDP and GDP per capita of both importing and exporting countries are positive and significant. This is consistent with the theory that GDP per capita has a positive effect on bilateral trade flows over and above that of GDP. The negative coefficient of *ln(distance)* indicates that the longer geographical distance between two countries, the lesser is the trade between them. Economies which share a common language and border also trade more with each other. So do economies within the same free trade area—bilateral trade increases by around 38.8 percent if both countries belong to the same FTA.

Similarly, the proposed variables are significant and positive. Total exports of country j ($\ln export_{jt}$) and its imports from the rest of the world ($\ln import_{j\text{-}kt}$)—are both positive and significant at 5 percent and 1 percent levels respectively. An increase in the total exports of country j increases its imports from country k by about 4.6 percent, while an increase of country j's imports from the rest of the world raises its imports from country k by a notable 37.3 percent. This suggests with product fragmentation and increasing proportion of trade in parts and components in the total trade, importing country's trade (including both import and export) with the rest of the world tends to generate more bilateral trade between trading partners (especially trade in component) through the cross-country industrial linkages. In particular, the significantly positive coefficient of $\ln import_{j\text{-}kt}$ implies that complementary effects generally dominate substitution effects in bilateral trade flows—since imports from country k increases alongside imports from the rest of the world ($-k$).

The extended gravity model explains component trade reasonably well. Table 5 presents the results using bilateral intra-industry trade as the dependent variable as per Equations 2 and 4. Recall, these regressions are meant to examine how well the extended gravity model explains component trade vis-à-vis total trade. For brevity, the discussion focuses on the most preferred specification of column four. By and large, the coefficients for the standard variables (GDP, GDP per capita, distance, etc.) are similar to those from the same column in Table 4.[7] However, the coefficient of FTA_{jkt} in Table 5 (0.225) is smaller than in Table 4 (0.388). This is consistent with the hypothesis that the conventional trade determinant has less power in explaining component trade (or intra-industry trade). Also, the coefficient of the importer's total exports ($\ln export_{jt}$) is more important in determining the imports of parts and components (0.140 in Table 5) than total imports (0.046 in Table 4). On the other hand, the coefficient of the importer's imports from other countries ($\ln import_{j\text{-}kt}$) in Table 5 (0.184) is lower than in Table 4 (0.373), which suggests an importer's imports are more likely to come from total trade rather than component trade. In other words, substitution effects between countries may be stronger for component trade than final good trade. These effects seem to dampen the trade creation effects due to cross-country industrial linkages.

Estimates of the proposed variables are useful for trade projection, when they are converted into trade creation multipliers. Although the estimated trade creation multiplier (namely, $1/(1\text{-}2\pi_1\text{-}\pi_2)$) from the coefficients of $\ln export_{jt}$ and $\ln import_{j\text{-}kt}$ in Table 5 (1.86) is similar to that in Table 4 (1.87), their positive and statistically significant signs support the importance of cross-country industrial linkages in creating more trade. As such, it is beneficial to use these estimates to project trade flows between member countries arising from ACFTA, where such phenomenon is known to be most prevalent.

5.2 Projection of ASEAN-PRC Trade Flows from ACFTA

Projections of bilateral imports, exports and total trade are made under six scenarios. Real values of these variables for 2008 are used as base. Three methods of projection are adopted: (1) conventional, (2) new, and (3) hybrid. Each method has two projections based on the estimates of Equations 3 and 4. Hence, this produces the six scenarios.[8] For the conventional method, the first projection is calculated as: $e^{\theta_1} \times \text{base}$, where θ_1 is the coefficient of FTA_{jkt} from Equation 3, while the second projection uses the same formula but with θ_1 taken from Equation 4. These are presented in the top half (Scenario 1) and bottom half of column two (Scenario 2), Table 6, respectively. The new method, on the other hand, uses the estimated coefficients of $\ln export_{jt}$ and $\ln import_{j\text{-}kt}$ in addition to the estimated coefficient of FTA_{jkt} based on Equation 3 (column 3, top half, Scenario 3) and Equation 4 (column 3, bottom half, Scenario 4). It is calculated as: $\text{base} + (e^{\theta_{1,3}} \times \text{base} - \text{base}) / (1 - 2\pi_1 - \pi_2)$, where π_1 and π_2 are the estimated coefficients of $\ln export_{jt}$ and $\ln import_{j\text{-}kt}$ based on Equations 3 or 4, and $(1\text{–}2\pi_1\text{–}\pi_2)$ is the trade multiplier (as per Appendix A).

Two differences of the four projections are worth highlighting. First, the main difference between the conventional and new projections is that the former assumes a one-off trade creation effect after the formation of a free trade area, while the latter assumes a multiplicative impact through greater trade opportunities in parts and components arising from the international industrial linkages. As alluded to above, after the free trade agreement, firms may reallocate their production among member countries and

[7] Interestingly, economies with common language have more bilateral component trade (or intra-industry trade) with each other. A possible explanation is that countries with common language and similar culture are more likely to establish vertical linkages through production specialization.

[8] The hybrid method will be discussed below.

specialize further in the finer stages of production chain. This generates more trade among member countries. Moreover, as member countries are more closely linked together, an increase in demand for a final good will lead to more imports as well as exports by member countries, since the production of this unit of final good requires parts and components from different countries (member and non-member). The effect of this is a multiplicative process of trade growth. Second, the main difference between the two projections of the new method is that the first is based on the total trade model (Equation 3), which does not differentiate between final or component trade, while the second on the intra-industry model (Equation 4), which specifically accounts for component trade. Thus, trade projection for component trade can be more accurate using the coefficients of $\ln export_{jt}$ and $\ln import_{j\text{-}kt}$ from Equation 4.

The hybrid method of projections is used to distinguish between final and component goods in the projections of total trade, imports and exports, unlike the conventional and new methods which make no such differentiation. In particular, the two hybrid projections are:

Scenario 5 = [(Scenario 1) × 1–*weight*)] + [(Scenario 3) × *weight*]; and
Scenario 6 = [(Scenario 2) × 1–*weight*)] + [(Scenario 4) × *weight*],

where *weight* for each ASEAN country is obtained from Athukorala (2011), which is the proportion of component goods in total trade. Note that only the component share of trade (*weight*) is subject to multiplier effects, that is, the third right-hand term of Scenarios 5 and 6 take into account the multiplier effects from $\ln export_{jt}$ and $\ln import_{j\text{-}k}$ of Equations 3 and 4 respectively. In essence, the hybrid method attempts to differentiate the two types of trade in approximating the overall trade creation effects of ACFTA.

Results from Table 6 show both the new and hybrid methods projecting a larger trade increase than the conventional method. For instance, total ASEAN and PRC trade could increase by as much as 47 to 89 percent according to the new method. While the hybrid method shows an increase by about 39 to 72 percent. The conventional method projects a smaller increase of 25 to 47 percent. This highlights that ACFTA will encourage more trade between the PRC and ASEAN than what the traditional gravity model predicts.

5.3 Implication for ASEAN-PRC Trade Pattern and Trade Diversion

The increased trade flows from ACFTA will impact differently on different ASEAN economies. As the extended gravity model hypothesized, the newly created bilateral trade will concentrate in countries with a higher proportion of component trade. Table 7 breakdowns the hybrid projections of Scenario 5 (Panel B) and Scenario 6 (Panel C) for each ASEAN country with the PRC. In general, although ACFTA will have a positive impact on the bilateral trade flows, the impact will be felt unevenly among ASEAN countries. The Philippines, Singapore and Thailand see the largest trade increase of over 70 percent (Panel B). This is to be expected as a relatively higher proportion of their trade is in parts and components. What is also noteworthy is the projection of trade increases in the extended mechanism (rather than the conventional mechanism) more closely reflects the changing trade pattern between PRC and ASEAN over the last two decades.

As for the impact of ACFTA on trade between the PRC or ASEAN and the rest of the world, the extended gravity model also shows some interesting results. There has always been a concern that the PRC and ASEAN countries may compete with each other in a third-country‘s market as well as their own domestic markets given the similarity in the stage of economic development and export structure. However, this concern is less valid in an environment where trade growth is driven mainly driven by component trade with production linkages across countries. As Equations 3 and 4 suggest there is always a positive correlation between a county‘s total trade and intra-industry trade with a specific trading partner and its trade with the rest of the world, that is, the coefficients of $\ln export_{jt}$ and $\ln import_{j\text{-}k}$ in Tables 4 and 5 are all positive. This implies that an increase in intra-regional trade leads to an increase in trade between the PRC or ASEAN countries with the rest of the world. In other words, trade creation effects dominate trade diversion effects after the establishment of ACFTA.

6. Conclusions

In the past decade or so, East Asian economies have increasingly participated in finer division of labor within the region specializing in one or more stages of a good‘s production process. This feature of product fragmentation has changed the landscape of trade in Asia characterized by increased trade in parts and components. Bilateral trade flows between the PRC and ASEAN countries mirror this changing trade pattern. Although the PRC-ASEAN trade has increased substantially in the past decade following significant bilateral tariff reductions, how the newly established ACFTA will impact on the PRC and ASEAN remains an important an interesting question. This paper attempts to answer this from a trade flow perspective by introducing two new variables to the conventional gravity model to take into account the significance of trade in parts and components.

The key result suggests that ACFTA will have a substantially larger impact on bilateral trade flows between the PRC and ASEAN than what the conventional gravity model predicts, especially given the close international production linkages and high proportion of trade in parts and components within the region. Without accounting for this phenomenon, policy makers and business community may underestimate the benefits of ACFTA and misformulate their strategies and responses to new trade creation and trade diversion due to free trade agreement.

In addition, since ACFTA has asymmetric impacts on trade in final goods and trade in parts and components, the extended gravity model that adjust for trade in parts and components can shed light on the trade pattern between the PRC and individual ASEAN countries. Generally, as expected the higher the proportion of component trade in the bilateral trade between member countries, the larger is the increase in bilateral trade flows after the formation of ACFTA. Finally, since trade in parts and components is usually complementary among member countries (driven by the international production linkages), trade creation may dominate trade diversion effects.

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Table 1: People's Republic of China and ASEAN Trade, 1984–2009

Year	Value ($ million)			Annual Growth Rate (%)		
	Export	Import	Total Trade	Export	Import	Total Trade
1984	2,032	851	2,883			
1985	2,657	1,112	3,769	31	31	31
1986	1,909	1,550	3,459	(28)	39	(8)
1987	2,390	2,162	4,552	25	39	32
1988	2,879	3,194	6,073	20	48	33
1989	3,192	3,758	6,950	11	18	14
1990	3,904	3,060	6,964	22	(19)	0
1991	4,239	3,917	8,156	9	28	17
1992	4,668	4,413	9,081	10	13	11
1993	5,340	6,304	11,644	14	43	28
1994	7,160	7,179	14,339	34	14	23
1995	10,473	9,901	20,374	46	38	42
1996	10,308	10,850	21,158	(2)	10	4
1997	12,708	12,455	25,163	23	15	19
1998	11,164	12,571	23,735	(12)	1	(6)
1999	12,274	14,927	27,201	10	19	15
2000	17,341	22,181	39,522	41	49	45
2001	18,376	23,215	41,591	6	5	5
2002	23,584	31,197	54,781	28	34	32
2003	30,927	47,328	78,255	31	52	43
2004	42,899	62,967	105,866	39	33	35
2005	55,367	74,994	130,361	29	19	23
2006	71,311	89,527	160,838	29	19	23
2007	94,717	108,509	203,226	33	21	26
2008	114,317	117,003	231,320	21	8	14
2009	81,591	96,594	178,185	(29)	(17)	(23)

Source: Authors' calculation from UN Comtrade database. The reporting country is the People's Republic of China.

Table 2: ASEAN's Exports to and Imports from the People's Republic of China, by Product, 1980–2009

Year	Agricultural and mineral goods SITC 0-4	Chemicals SITC 5	Manufactured goods classified chiefly by material SITC 6	Machinery and transport equipment SITC 7	Others SITC 8 & 9	Total value ($ billion)
Exports to People's Republic of China (Share of Total Exports to People's Republic of China, %)						
1980	68	2	8	18	4	0.7
1985	55	14	15	11	5	0.9
1990	57	11	20	9	3	2.6
1995	52	8	19	18	4	8.3
2000	38	11	10	36	4	16.0
2005	29	12	6	49	5	52.0
2008	33	9	6	42	10	88.0
2009	30	12	7	47	4	76.0
Imports from People's Republic of China (Share of Total Imports from People's Republic of China, %)						
1980	55	9	23	8	6	1.7
1985	83	3	9	2	3	3.3
1990	46	8	28	12	6	4.6
1995	18	10	33	28	12	10.0
2000	17	7	16	49	10	18.1
2005	11	7	17	57	9	59.7
2008	7	9	21	53	10	109.6
2009	10	8	14	60	9	78.3

SITC = Standard International Trade Classification.
Note: Since the reporting country is different from the data source, the result may not be exactly the same as those found in other figures or tables.
Source: Authors' calculation from UN Comtrade database. The reporting country is ASEAN.

Table 3: ASEAN Members and the People's Republic of China, Trade Share (%)

Year	Singapore	Malaysia	Thailand	Indonesia	Viet Nam	Philippines	ASEAN
Exports to People's Republic of China (Share of Total ASEAN Exports to People's Republic of China)							
1980	44.4	31.3	17.8	0.0		6.5	100
1985	35.8	17.8	29.2	9.1		8.1	100
1990	30.9	24.0	10.3	32.3		2.4	100
1995	33.2	23.5	19.7	21.0		2.6	100
2000	33.1	18.7	17.4	17.1	9.5	4.1	100
2005	37.9	17.8	17.5	12.8	6.2	7.8	100
2008	35.3	21.5	18.2	13.2	5.5	6.2	100
2009	34.6	25.1	21.2	15.1	-	3.9	100
Imports from People's Republic of China (Share of Total ASEAN Imports from People's Republic of China)							
1980	36.2	14.7	24.2	11.5	0.0	12.8	100
1985	68.6	7.8	6.8	7.6	0.0	8.9	100
1990	45.2	12.2	24.0	14.1	0.0	4.0	100
1995	40.4	17.1	20.9	14.9	0.0	6.6	100
2000	39.2	17.9	18.6	11.1	7.7	4.8	100
2005	34.3	22.1	18.7	9.8	9.9	5.2	100
2008	30.8	18.3	18.3	13.9	14.6	4.2	100
2009	33.1	22.0	21.8	17.9	-	5.2	100

Note: "-" means not available.
Source: Authors' calculation from UN Comtrade database. The reporting country is ASEAN.

Table 4: Results for Bilateral (Total) Trade Flows, All Countries, 1980–2008

Variables	OLS (1)	Panel Random Effects (2)	Panel Fixed Effects (3)	Country-Specific Effects (4)
Dependent variable: $\ln import_{jk}$				
ln(real GDP$_j$)	0.388***	0.270***	0.088***	0.082***
	(0.009)	(0.010)	(0.013)	(0.012)
ln(real GDP per capita$_j$)	-0.017	0.187***	0.320***	0.343***
	(0.011)	(0.018)	(0.033)	(0.030)
ln(real GDP$_k$)	0.958***	0.336***	0.303***	0.319***
	(0.005)	(0.010)	(0.014)	(0.012)
ln(real GDP per capita$_k$)	0.577***	0.645***	0.324***	0.333***
	(0.008)	(0.017)	(0.032)	(0.030)
ln(distance)	-1.016***	-0.751***	0.044	-1.395***
	(0.011)	(0.022)	(0.065)	(0.011)
Common Language dummy	0.671***	0.414***	0.170	0.605***
	(0.019)	(0.042)	(0.163)	(0.020)
Land border dummy	0.907***	1.333***	-0.139	0.397***
	(0.045)	(0.116)	(0.391)	(0.044)
Importer WTO member dummy	-0.049**	0.068***	0.155***	0.201***
	(0.020)	(0.026)	(0.031)	(0.032)
Exporter WTO member dummy	0.385***	0.407***	0.147***	0.107***
	(0.022)	(0.028)	(0.033)	(0.032)
Island dummy	0.154***	-0.436***	-0.309**	1.144***
	(0.017)	(0.036)	(0.124)	(0.108)
FTA dummy (FTA_{jk})	0.999***	0.754***	0.421***	0.388***
	(0.036)	(0.043)	(0.036)	(0.032)
$\ln export_{jk}$	0.008	0.023	0.028	0.046**
	(0.020)	(0.020)	(0.021)	(0.021)
$\ln import_{j\text{-}k}$	0.673***	0.550***	0.530***	0.373***
	(0.022)	(0.023)	(0.025)	(0.026)
Constant	-23.128***	0.000	1.691**	21.658***
	(0.160)	(0.000)	(0.774)	(0.647)
n	76,417	76,417	76,417	76,417
R^2	0.742	0.735	0.828	0.831

WTO = World Trade Organization.

Note: n = number of observations. Robust standard errors are in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 5: Results for Intra-Industry Trade Flows, All Countries, 1980–2008

Variables	OLS (1)	Panel Random Effects (2)	Panel Fixed Effects (3)	Country-Specific Effects (4)
Dependent variable: ln*intra_import*$_{jk}$				
ln(real GDP$_j$)	0.593***	0.603***	0.520***	0.544***
	(0.014)	(0.017)	(0.023)	(0.022)
ln(real GDP per capita$_j$)	0.203***	0.274***	0.354***	0.398***
	(0.018)	(0.025)	(0.055)	(0.053)
ln(real GDP$_k$)	1.078***	0.974***	0.572***	0.582***
	(0.008)	(0.013)	(0.023)	(0.022)
ln(real GDP per capita$_k$)	0.647***	0.685***	0.752***	0.787***
	(0.014)	(0.022)	(0.053)	(0.054)
ln(distance)	-1.102***	-1.068***	-0.560***	-1.417***
	(0.016)	(0.024)	(0.139)	(0.018)
Common Language dummy	0.758***	0.750***	0.434	0.724***
	(0.029)	(0.048)	(0.335)	(0.034)
Land border dummy	0.722***	0.878***	-2.017***	0.360***
	(0.070)	(0.113)	(0.457)	(0.075)
Importer WTO member dummy	0.256***	0.252***	0.300***	0.170***
	(0.033)	(0.039)	(0.056)	(0.057)
Exporter WTO member dummy	0.500***	0.368***	0.135**	0.040
	(0.036)	(0.043)	(0.059)	(0.059)
Island dummy	0.229***	0.130***	-0.262	0.819***
	(0.025)	(0.039)	(0.237)	(0.141)
FTA dummy (FTA_{jk})	0.964***	0.319***	0.388***	0.225***
	(0.050)	(0.051)	(0.051)	(0.053)
ln*export*$_{jk}$	-0.092***	0.003	0.132***	0.140***
	(0.032)	(0.032)	(0.044)	(0.042)
ln*import*$_{j-k}$	0.600***	0.431***	0.342***	0.184***
	(0.036)	(0.037)	(0.050)	(0.048)
Constant	-28.277***	-26.635***	-23.613***	-11.575***
	(0.257)	(0.400)	(1.495)	(1.191)
n	46,215	46,215	46,215	46,215
R^2	0.587	0.289	0.265	0.651

WTO = World Trade Organization.
Note: n = number of observations. Robust standard errors are in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 6: Impact of ACFTA on ASEAN and the People's Republic of China's Trade Flows (billion $ at 2008 prices)

Item	2008 Real value	Conventional Projection	New Projection	Hybrid Projection
Total Trade Model (Equation (3))		Scenario 1	Scenario 3	Scenario 5
ASEAN-PRC Import	107.12	157.90	202.03	184.5
ASEAN-PRC Export	85.56	126.12	161.37	147.8
ASEAN-PRC Total Trade	192.68	284.02	363.40	332.2
ASEAN-PRC Total Trade Growth (%)	-	47.40	88.60	72.4
Intra-Industry Trade Model (Equation (4))		Scenario 2	Scenario 4	Scenario 6
ASEAN-PRC Import	107.12	134.15	157.55	148.2
ASEAN-PRC Export	85.56	107.15	125.84	118.6
ASEAN-PRC Total Trade	192.68	241.30	283.38	266.9
ASEAN-PRC Total Trade Growth (%)	-	25.23	47.1	38.5

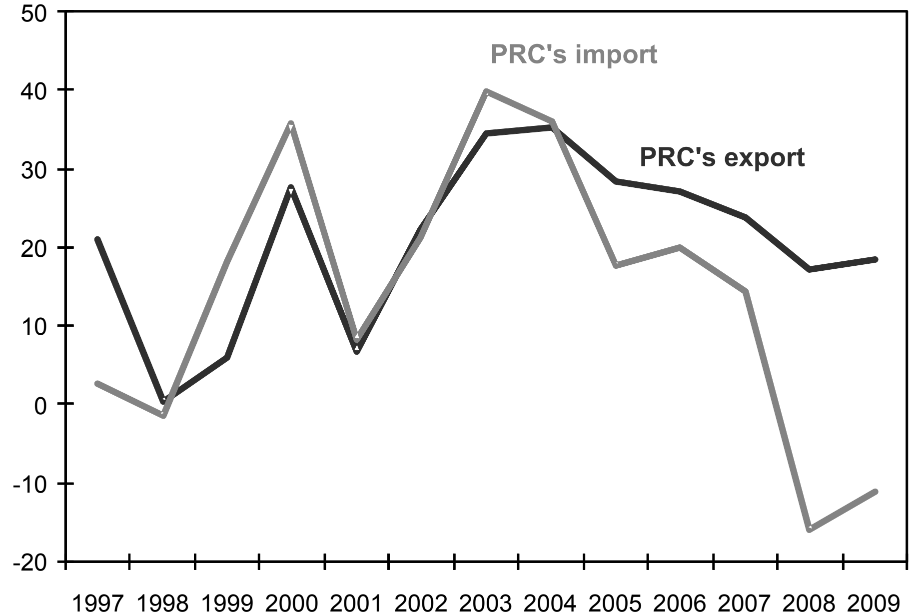
FTA = Free Trade Agreement, PRC = People's Republic of China.
Note: Each scenario as described in the main text. "-" means not available.

Table 7: Impact of ACFTA on ASEAN and the People's Republic of China Trade Pattern (billion $ at 2008 prices)

Reporter ASEAN	Viet Nam	Brunei Darussalam	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand
2008 Trade Pattern										
ASEAN-PRC Import	15.55	0.17	0.93	15.25	0.13	18.65	0.67	4.25	31.58	19.94
ASEAN-PRC Export	4.49	0.00	0.01	11.64	0.02	18.42	0.50	5.47	29.08	15.93
ASEAN-PRC Total	20.04	0.17	0.94	26.89	0.15	37.07	1.17	9.72	60.66	35.87
Total Trade Model (Scenario 5)										
ASEAN-PRC Import	25.95	0.25	1.37	26.50	0.19	27.49	1.16	7.50	59.17	34.88
ASEAN-PRC Export	7.49	0.00	0.01	20.23	0.03	27.15	0.86	9.65	54.49	27.86
ASEAN-PRC Total	33.45	0.25	1.39	46.73	0.22	54.64	2.02	17.15	113.66	62.74
ASEAN-PRC Trade Growth (%)	66.91	47.40	47.40	73.77	47.40	47.40	72.87	76.41	87.37	74.92
Intra-Industry Trade Model (Scenario 6)										
ASEAN-PRC Import	21.08	0.21	1.16	21.23	0.16	23.36	0.93	5.98	46.24	27.88
ASEAN-PRC Export	6.09	0.00	0.01	16.20	0.03	23.07	0.69	7.69	42.58	22.27
ASEAN-PRC Total	27.17	0.21	1.18	37.43	0.19	46.42	1.62	13.67	88.82	50.15
ASEAN-PRC Trade Growth (%)	35.57	25.23	25.23	39.21	25.23	25.23	38.73	40.61	46.42	39.82

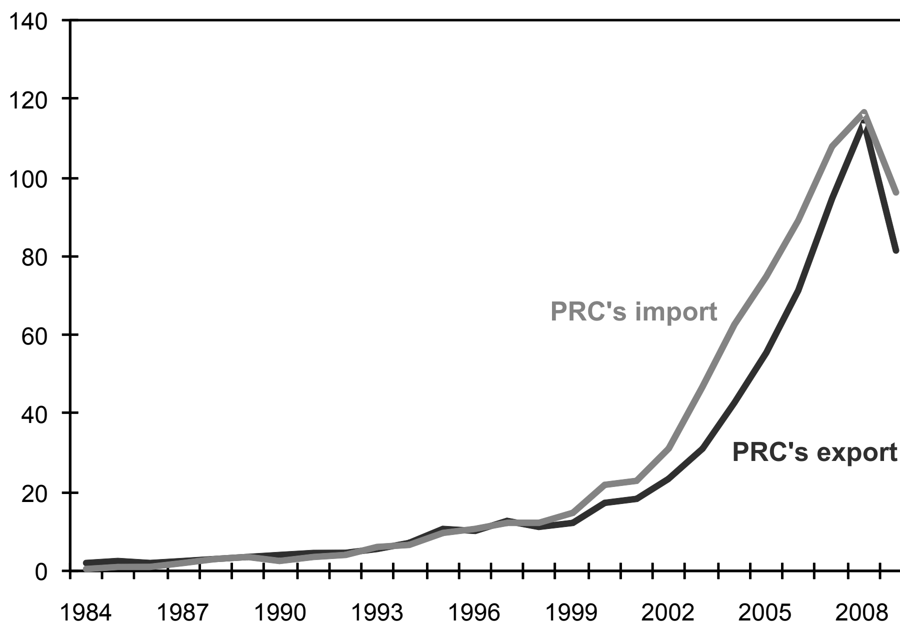
FTA = Free Trade Agreement, Lao PDR = Lao People‘s Democratic Republic, PRC = People‘s Republic of China.
Note: Scenarios 5 and 6 are as described in the main text.

Figure 1: Growth in the People's Republic of China's Import from and Export to the World, 1997–2009 (%)



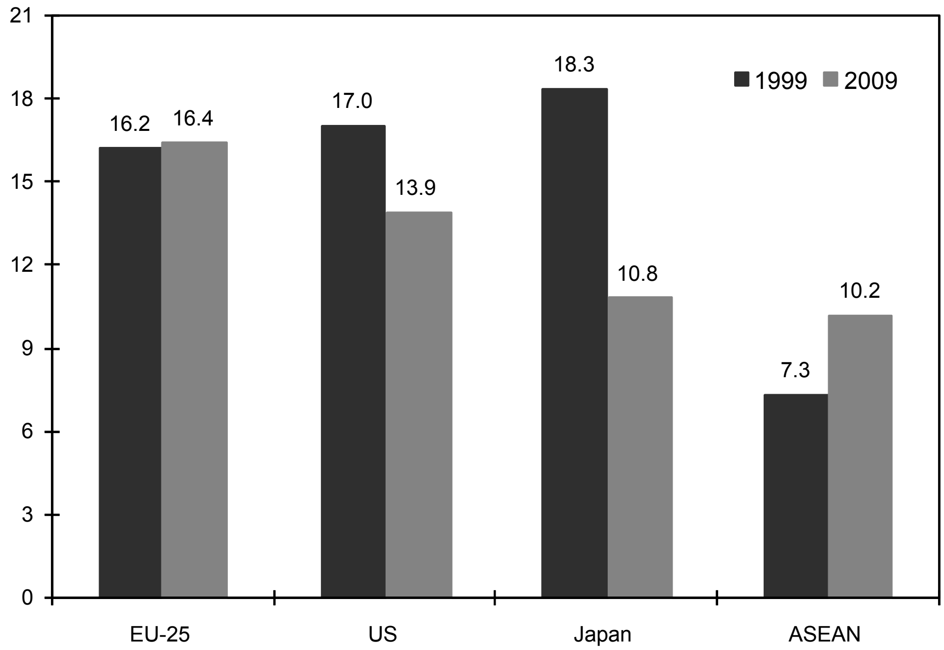
Source: People's Republic of China Customs Statistics.

Figure 2: The People's Republic of China's Import from and Export to ASEAN, 1984–2009 (billion $)



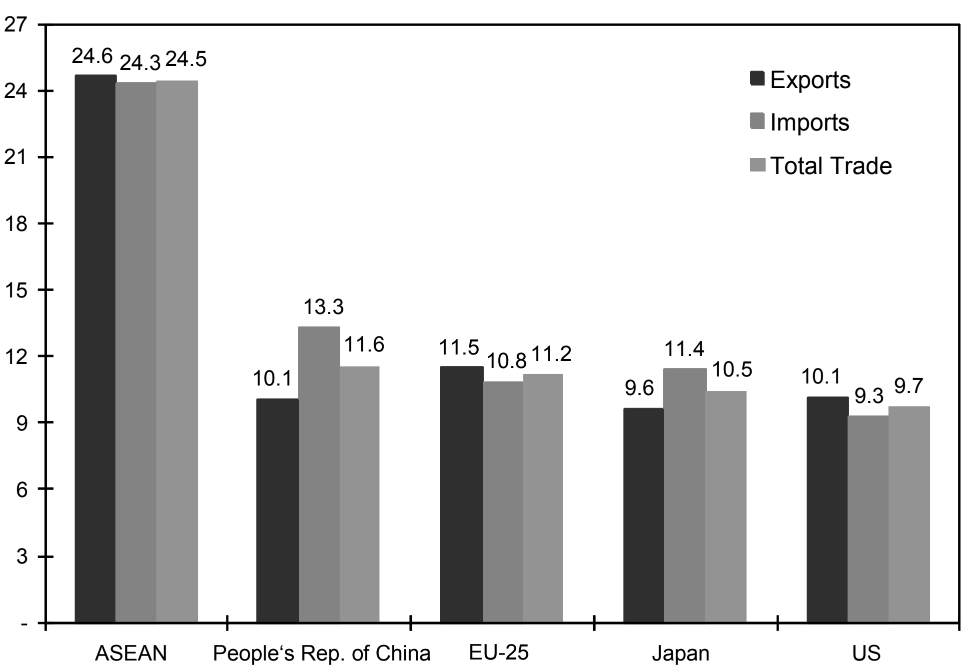
Source: People's Republic of China Customs Statistics.

Figure 3.1: Major Trading Partners of the People's Republic of China, 1999 & 2009 (%)



Source: Data are from UN Comtrade database. The reporting country is the People's Republic of China.

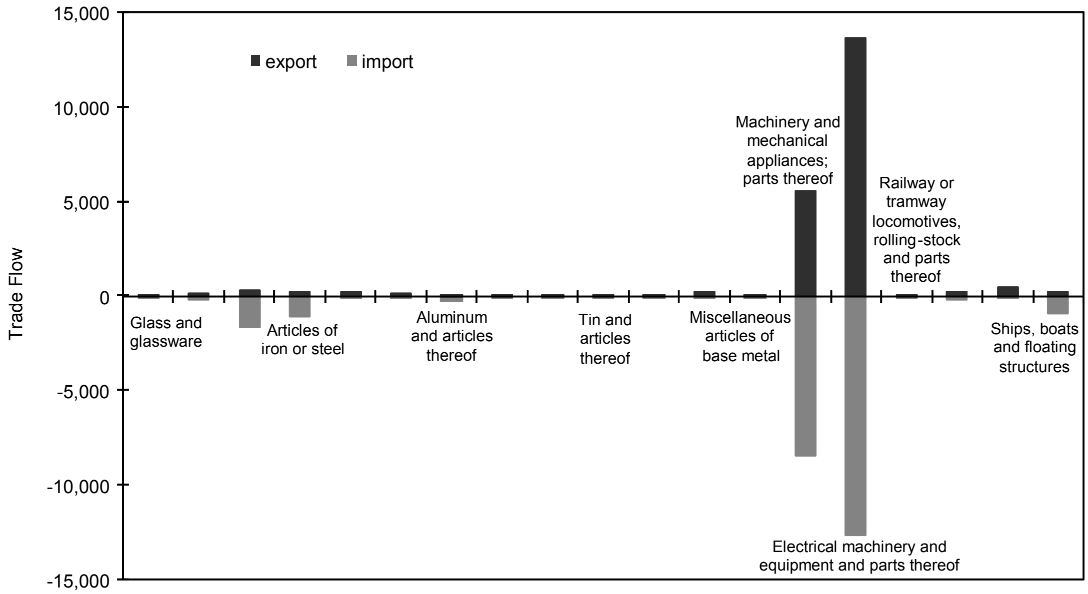
Figure 3.2: Major Trading Partners of ASEAN, 2009 (%)



Source: ASEAN's official website.

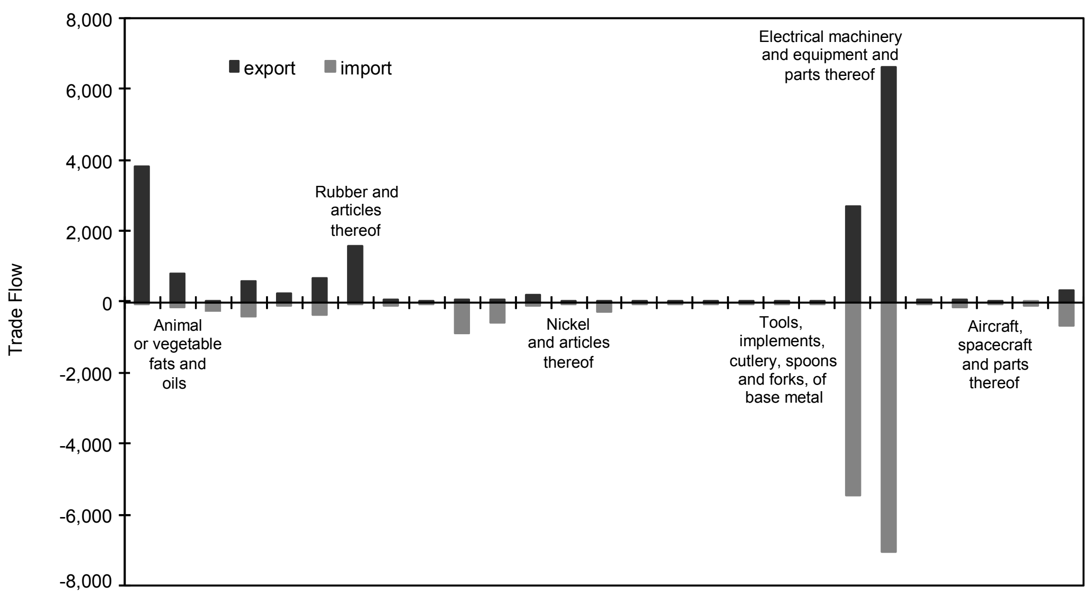
Figure 4: Trade Structure of Selected ASEAN Countries with the People's Republic of China, 2008 (million $)

(a) Singapore's Trade with the People's Republic of China



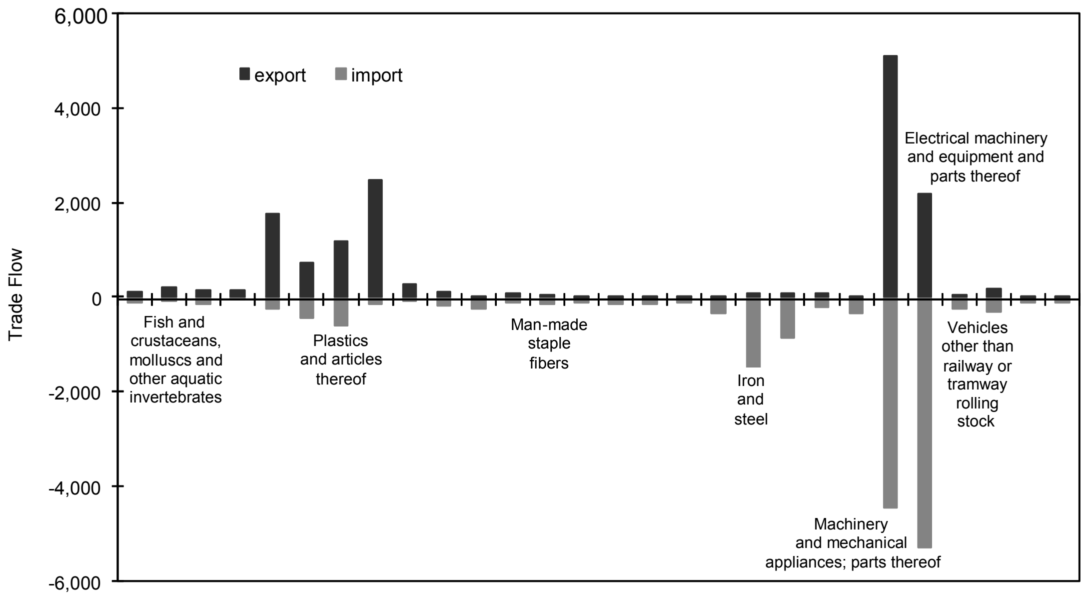
Source: Data are from UN Comtrade database.

(b) Malaysia's Trade with the People's Republic of China



Source: Data are from UN Comtrade database.

(c) Thailand's Trade with the People's Republic of China



Source: Data are from UN Comtrade database.

Appendix A: Derivation of the Determinants of Component Trade Flow

A key characteristic of component trade is its extensive country-country industrial linkages. This implies country j's imports of parts and components from country k tend to be highly correlated with j's imports from other countries ($-k$) as well as its exports to the rest of the world. Thus, the imports of parts and components of country j from country k at time t ($cimport_{jkt}$) can be specified using an extended version of the gravity model specification used by Rose (2004), and Anderson and van Wincoop (2005) as follows:

$$cimport_{jkt} = \pi_0 + \pi_1 cexport_{jt} + \pi_2 cimport_{j-kt} + \theta_m X_{mjkt} + \omega_{jkt} \quad \text{(A1)}$$

where $cexport_{jt}$ is exports of country j to the world, $cimport_{j-kt}$ is imports of country j from the rest of the world, and π_1 and π_2 are coefficients corresponding to $cexport_{jt}$ and , $cimport_{j-kt}$, respectively. X is a vector of m variables that affect imports of country j from country k, □ is the vector coefficients corresponding to X and ω_{jkt} is the residual. X represents the GDP, GDP per capita of each country, the distance between trading partners, FTA and trade preference relationship and other covariates. In equilibrium, the first difference of equation 1A is:

$$\Delta cimport_{jkt} = \pi_1 \Delta cexport_{jt} + \pi_2 \Delta cimport_{j-kt} + \theta_m \Delta X_{mjkt} \quad \text{(A2)}$$

where $\Delta(.)$ is the first difference of a variable, $\Delta\omega_{jkt}$=0 , and $\Delta\pi_0$=0.

By definition, $cimport_{jkt} + cimport_{j-kt} = cimport_{j,wrd}$, which is implied by the balance of payment for each country in the long run.Taking its first difference gives $\Delta cimport_{jkt} + \Delta cimport_{j-kt} = \Delta cimport_{j,wrd}$. In equilibrium, $\Delta cimport_{j,wrd,t} = \Delta cexport_{j,wrd,t}$ if symmetry of all countries is assumed. Substituting $\Delta cimport_{j,wrd,t} = \Delta cexport_{j,wrd,t}$ into equation 2A gives:

$$\Delta cimport_{jkt} = \pi_1(\Delta cimport_{jkt} + \Delta cimport_{j-kt}) + \pi_2 \Delta cimport_{j-kt} + \theta_m \Delta X_{mjkt} \quad \text{(A3)}$$

The assumption of symmetry also implies that country j and k are of a similar size, hence, $\Delta cimport_{jkt} = \Delta cimport_{j-kt}$. Equation 3A can then be rearranged as:

$$(1-2\pi_1-\pi_2)\Delta cimport_{jkt} = \theta_m \Delta X_{mjkt} \quad \text{(A4)}$$

which gives:

$$\Delta cimport_{jkt} = \theta_m \Delta X_{mjkt} / (1-2\pi_1-\pi_2) . \quad \text{(A5)}$$

Given the focus is on trade creation due to the formation of FTA, other covariates represented by X except for the FTA dummy are assumed to remain unchanged, that is, $\Delta X_{mjkt} = \Delta X_{FTA,jkt}$. Thus, equation 5A can be written as:

$$\Delta cimport_{jkt} = \frac{\theta_{FTA} \times 1}{(1-2\pi_1-\pi_2)} \quad \text{(A5′)}$$

Equation 5A′ provides the trade creation effects of FTA, with the trade multiplier specific to the new trade creation mechanism proposed in this paper given by $1/(1–2\pi_1–\pi_2)$.

The trade multiplier $1/(1–2\pi_1–\pi_2)$ is usually larger than one, which suggests that a unit change in the initial bilateral trade, ΔX_{jkt}, could lead to more than one unit change in trade in parts and components, wherein the magnifying effect is determined by π_1 and π_2. A necessary condition for the trade multiplier to exceed unity is for the sum of $2*\pi_1$ and π_2 to be less than 1.

Appendix B: Data Descriptions and Sources

Variable Name	Description	Source [*]
ln*import*	Log of real bilateral trade in 100 million US dollars (c.i.f price)	IMF *Direction of Trade Statistics*
ln*intra_import*	Log of real bilateral intra-industry trade in 100 million US dollars (c.i.f price), estimated by using the intra-industry index multiplying the real bilateral trade.	Australian National University International Economic Data Bank (IEDB)
ln(real GDP$_j$)	Log of real GDP of importer	World Bank *World Development Indicator*
ln(real GDP per capita$_j$)	Log of real GDP per capita of importer	World Bank *World Development Indicator*
ln(real GDP$_k$)	Log of real GDP of exporter	World Bank *World Development Indicator*
ln(real GDP per capita$_k$)	Log of real GDP per capita of exporter	World Bank *World Development Indicator*
ln(distance)	Log of distance	Subramanian and Wei (2004)
Common language dummy	Take a value of 1 if trading partners share a common language, 0 otherwise	Subramanian and Wei (2004)
Dummy for land border	Take the value of 1 if the trading partners share the border otherwise 0.	Subramanian and Wei (2004)
Importer WTO member	Take a value of 1 if importer is a WTO member, 0 otherwise	Authors' own calculations
Exporter WTO member	Take a value of 1 if exporter is a WTO member, 0 otherwise	Authors' own calculations
Island dummy	Take a value of 0 if neither of trading partners is an island, 1 one of the trading partners is an island country, 2 both are islands.	Subramanian and Wei (2004)
Land border dummy	Take a value of 1 if trading partners share a common border, 0 otherwise	Subramanian and Wei (2004)
FTA dummy	Take a value of 1 if trading partners are in the same FTA, 0 otherwise	Authors' own calculations
$\ln export_j$	Log of real export of j to the world	Authors' own calculations
$\ln import_{j-k}$	Log of real import of j from countries other than k	Authors' own calculations
DT_t	A group of dummy variables for specific time periods, which take on a value of 1 at the following periods: DT_1=1980–1984, DT_2=1985–1989, DT_3=1990–1994, DT_4=1995–1999, DT_5=2000–2004, and DT_6=2005–2008, 0	Authors' own calculations

Variable Name	Description	Source *
	otherwise.	
D_j	A group of dummy variables representing each importing country. For example, if an importer is country A, $D_{j=A}$ =1, 0 otherwise; and if an importer is country B, $D_{j=B}$ =1, 0 otherwise.	Authors' own calculations
D_k	A group of dummy variables representing each exporting country.	Authors' own calculations
D_{jk}	A group of dummy variables for specific importer-exporter (country) pair. For example, if importer is country A and exporter is country B, $D_{jk=AB}$=1, 0 otherwise. If importer is country A and exporter is country is C, $D_{jk=AC}$=1, 0 otherwise.	Authors' own calculations

* Original data were from Subramanian and Wei (2007) and updated from various sources as indicated below.

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The Impact of ACFTA on People's Republic of China–ASEAN Trade
Estimates Based on an Extended Gravity Model for Component Trade

This paper uses an extended gravity model to shed light on the impact of the free trade area agreement between the Association of Southeast Asian Nations (ASEAN) and the People's Republic of China (PRC) on the members' trade flows and trade patterns. Results from the extended gravity model show that the free trade agreement leads to substantially higher bilateral trade between ASEAN and the People's Republic of China, more than what a conventional gravity model predicts.

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