Estimating the Impact of Cumulative Rules of Origin on Trade Costs: An Application to Mega-regional FTAs in the Asia-Pacific Region[*]

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Abstract

We quantitatively investigate the effects of FTAs focusing on the impact of cumulative ROO on trade costs. Firstly, we measure bilateral trade costs between trading partners covering 120 countries around the world by adopting methodology introduced in Novy (2013). Then, we estimate the effect of various cumulative ROO on the measured trade costs by using a gravity regression model analysis. Next, we apply these estimates to both static and capital accumulation CGE models to compare the effects of the mega-regional FTAs with different provisions of cumulative ROO in the Asia-Pacific region such as the RCEP, the CPTPP, and the FTAAP. We find that the size of FTAs matters. Both positive effects on members and negative effects on nonmembers in terms of changes in real GDP and welfare will be the lowest in the CPTPP followed by the RCEP and to the highest in the FTAAP. We also find that the provision of ROO cumulation system matters. The mega-regional FTAs with less restrictive cumulation system such as diagonal or full cumulation will generate significantly large additional gains in stark contrast to the small insignificant gains from FTAs with restrictive bilateral cumulation system. In addition, we find that the negative trade diversion effects on nonmembers are badly high with bilateral cumulation but will be significantly improved in the long run as we adopt less restrictive provision of ROO cumulation. Overall, we conclude that the mega-regional FTAs may not necessarily be a viable alternative to the multilateral trading system or bilateral FTAs unless less restrictive cumulative ROO regimes are adopted. The key to success in FTAs lies in the provision of cumulative ROO rather than the expansion of the membership.

Keywords: free trade agreement, trade costs, rules of origin, RCEP, CPTPP, FTAAP

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I. Introduction

Expecting gains from reducing trade costs through lowering trade barriers between members, formation of free trade agreements (FTAs) has been proliferating. As of March 2019, 441 preferential trade agreements (PTAs), mainly bilateral FTAs, have been notified to the World Trade Organization (WTO)[1]. However, the proliferating formation of bilateral FTAs may cause a spaghetti-bowl phenomenon where a whole host of FTAs increase trade costs due to the complexity and diversity of rules of origin (ROO). Meanwhile, the Doha Development Agenda (DDA) negotiations of the WTO are stalled without much progress since its inception in 2001. As such, plurilateral or mega-regional FTAs have emerged as a viable alternative to the multilateral trading system or bilateral FTAs.

Existing literature on the effect of ROO on trade costs provides mixed results. Designed to prevent free-riding behavior such as transshipment and to ensure that FTA benefits remain exclusively among members, ROO per se inevitably increases trade costs. Theoretically, however, allowing cumulation of ROO in FTAs should bring trade costs further down. Quite a few empirical studies elaborate the negative trade diversion effect of restrictive ROO as a serious impediment to the successful utilization of FTAs[2]. Accordingly, less restrictive application of ROO by adopting diagonal or full cumulation system has been recommended to reduce additional trade costs of verification incurred by strict ROO.[3] However, there is

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[1] Among the 471 regional trade agreements (RTAs) notified to the WTO, 30 Customs Unions, 158 Economic Integration Agreements, 259 Free Trade Agreements, and 24 Partial Scope Agreements have been notified. See http://rtais.wto.org/UI/publicsummarytable.aspx.

[2] As surveyed by Park and Park (2011), Brown et al. (2001), Baldwin (2006), Gasiorek et al. (2007), Harris (2008), and Estevadeordal et al. (2008) carefully evaluate ROO-related costs and suggest that FTAs could be compatible with multilateralism through the simplification or harmonization of ROOs. In particular, Estevadeordal and Suominen (2003), Augier et al. (2005 and 2006), Gasiorek et al. (2007), Park and Park (2009 and 2011), and Kim et al. (2013) find that diagonal cumulation of ROO boost intraregional trade.

[3] The World Customs Organization (WCO) defines the various cumulative ROO systems as follows: Under cumulation rules, contracting parties to a preferential trade agreement or beneficiary countries under the generalised system of preferences (GSP) regimes may source non-originating raw materials or components from specified countries and count them as originating. There are three types of cumulation: bilateral cumulation, where only raw material or components in the preference-granting country can be counted in this way, diagonal cumulation, where raw materials or components from the preference-granting

lack of empirical evidence about the effect of various cumulative ROO on trade costs. Alternatively, existing empirical studies investigate the effect of restrictive ROO and various cumulation systems on 'trade' rather than 'trade costs' because of difficulty in measuring trade costs. Accordingly, we may not accurately predict the gains from forming FTAs on the economic performances such as GDP, welfare, and so forth. For example, the commonly used computable general equilibrium (CGE) model analysis hypothetically assigns the impacts of implementing FTAs on trade costs.

Recognizing the limitation in existing studies, this study explicitly investigates the effect of ROO on trade costs. In particular, we examine different types of cumulative ROO considered by mega-regional FTAs in the Asia-Pacific region, which are highly interconnected with multiple number of countries through an extensive network of global value chains. As the first step, we adopt the methodology recently made available by Novy (2013) to measure bilateral trade costs between trading partners around the world. Then, we estimate the effect of various cumulative ROO on the measured trade costs by using a gravity regression analysis. Next, we contain (not assume) these estimated effects on trade costs in the CGE model of the Global Trade Analysis Project (GTAP) to analyze the economic effects of FTAs with different cumulative ROO systems. In particular, we apply the analysis to mega-regional FTAs in the Asia Pacific region such as the Regional Comprehensive Economic Partnership (RCEP), the Comprehensive and Progressive Trans Pacific Partnership (CPTPP), and the Free Trade Areas in the Asia- Pacific (FTAAP).

Followed by introduction, Section II measures bilateral trade costs around the world and provides estimation results on the effects of FTAs with various cumulative ROOs on trade costs by using a gravity regression model analysis. In Section III, we apply the estimates on trade costs to the CGE model analysis to predict the economic effects of mega-regional FTAs

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country and a list of other designated countries to which the same rules of origin apply can be counted, and full cumulation, where raw materials from all countries to which the same rules of origin apply can be counted" (WCO, *Rules of Origin-Handbook*, http://www.wcoomd.org/-/media/wco/public/global/pdf/topics/origin/overview/origin-handbook/rules-of-origin-handbook.pdf). See the Appendix Table 1 for the categorization of FTAs by types of cumulation.

with various cumulative ROOs on members and nonmembers in the Asia-Pacific region and report the results. Section IV concludes.

II. Cumulative Rules of Origin (ROO) and Trade Costs

II.1. Measuring Trade Costs: Theoretical Review

Numerous researchers have attempted to measure trade costs. Anderson and van Wincoop (2004) report 170% of ad-valorem tax equivalent total trade costs in representative industrialized countries covering transportation costs of 21% (both freight costs and time costs), border-related policy barriers of 44% (tariffs and non-tariff barriers, information costs, contract enforcement costs, costs associated with the use of different currencies, and legal and regulatory costs), and local distribution costs of 55% (wholesale and retail). Limao and Venables (2001) pay attentions to the difference between FOB (free on board) export prices and CIF (cost, insurance and freight) import prices of the same exporting and importing countries and consider the CIF/FOB ratio as an indicator of trade costs. Hummels (2007) also interprets the CIF/FOB ratio as transportation costs. Combes and Lafourcade (2005) use the geographical information such as traffic conditions, energy prices, and infrastructure as to derive interregional transportation costs.

Since there is no complete data available to cover all the components of trade costs between trading partners, measuring trade costs is troublesome. Accordingly, the quantitative analysis on trade policy such as estimating the impacts of the formation of FTAs with various cumulative ROO on trade costs in this research, has not been directly investigated. Instead the policy effect has been indirectly estimated by using traditional gravity regression analysis with trade (not trade costs) as a dependent variable.

Recently, Novy (2013) introduced a methodology to measure micro-founded implicit bilateral trade costs by comparing bilateral trade flows to domestic trade flows. Until now, as summarized in Table 1, trade costs used to be measured by either bottom-up approach of calculating trade costs incurred by major components of transaction between countries or top-down approach of comparing differences in trade values between internal transaction and external transaction. As we evaluate each of the methodologies in Table 1, Novy (2013)'s methodology (M3) is more desirable and applicable than other alternatives (M1, M2, and M4).

Table 1. Methodological Comparison of Measuring Trade Costs

Methods		Evaluation
Bottom-up approach	M1. Directly measure all the components of trade costs	**Desirable but not Applicable** - Serious problem of omitted variables - Problem of unobservable and unmeasurable components
	M2. Assume a particular trade cost function to specify certain determinants of trade costs as proxies and investigate the relations between the selected proxies and trade flows	**Applicable but not Desirable** - Similar to M1, problem of omitted variable bias and data limitation - Limited applicability: time-invariant proxies such as distance, and difficulty to quantify, especially nontariff barriers
Top-down approach	M3. Indirectly measure micro-founded implicit bilateral trade costs by comparing bilateral trade flows to domestic trade flows	**Desirable and Applicable** - Theoretically derived, not estimated, from micro-founded Gravity equation • No problem of omitted variable bias that is common in traditional econometric estimations • Strong theoretical foundation that is consistent with most theoretical trade models - Efficient for empirical experiments • Comprehensive coverage of trade costs • Less dependence on observable and reliable data requirement • Time-varying observable trade data for empirical investigation
	M4. Implicit trade costs from price differences across borders based on no arbitrage condition	**Desirable but not Applicable** - Difficulty of collecting reliable price data on goods and services in different countries and at different times

Sources: Anderson and van Wincoop (2004), Novy (2013), Miroudot et al. (2013), Dee et al. (2003), and Miroudot and Shepherd (2014).

II.2. Measuring Trade Costs: Empirical Estimation

We estimate trade cost equivalents between bilateral trading partners in accordance to the methodology introduced in Novy (2013). Anderson and van Wincoop (2003) derive the following equation of the gravity model including trade costs.

$$X_{hj} = \frac{Y_h Y_j}{Y^w} \left(\frac{t_{hj}}{\Pi_h P_j}\right)^{1-\sigma} \quad (1)$$

Where, X_{hj} is an export from country h to country j, Y_h is a nominal income of country h, and Y^w ($Y^w = \Sigma_h Y_h$) is the world income. The σ (>1) refers to the elasticity of substitution, Π_h is the price index of country h, and P_j is the price index of country j. The $\Pi_h P_j$ represents multilateral resistance, that is, the relative trade costs with third countries. Anderson and van Wincoop (2003) assume $t_{hj} = b_{hj} d_{hj}$ as bilateral trade costs between country h and j, where b_{hj} represents the border-related variable, bilateral historic linkage, or bilateral cultural relations, and d_{hj} is bilateral distance.

Novy (2013) points out that Anderson and van Wincoop's (2003) multilateral resistance term does not take domestic transaction into consideration and includes country h's domestic transaction X_{hh} into Equation (1) and presents a new multilateral resistance term as follow.

$$\Pi_h P_h = \left(\frac{X_{hh}/Y_h}{Y_h/Y^w}\right)^{1/(\sigma-1)} t_{hh} \quad (2)$$

Then, the value of bilateral trade between country h and country j can be derived as follow.

$$X_{hj} X_{jh} = \left(\frac{Y_h Y_j}{Y^w}\right)^2 \left(\frac{t_{hj} t_{jh}}{\Pi_h P_h \Pi_j P_j}\right)^{1-\sigma} \quad (3)$$

From Equations (2) and (3), the following relationship between internal and external trade activities is derived.

$$\frac{t_{hj}t_{jh}}{t_{hh}t_{jj}} = \left(\frac{X_{hh}X_{jj}}{X_{hj}X_{jh}}\right)^{1/(\sigma-1)} \tag{4}$$

Further utilizing Equation (4), the geometric mean of bilateral trade cost (τ_{hj}) between country h and country j can be derived as follows:

$$\tau_{hj} = \left(\frac{t_{hj}t_{jh}}{t_{hh}t_{jj}}\right)^{\frac{1}{2}} - 1 = \left(\frac{X_{hh}X_{jj}}{X_{hj}X_{jh}}\right)^{\frac{1}{2(\sigma-1)}} - 1 \quad . \tag{5}$$

In Equation (5), τ_{hj} represents domestic transaction costs ($t_{hh}t_{jj}$) relative to bilateral trade costs ($t_{hj}t_{jh}$). If the bilateral trade ($X_{hj}X_{jh}$) between country h and country j increases in comparison to domestic transaction ($X_{hh}X_{jj}$), bilateral trade becomes relatively easier than domestic transaction and τ_{hj} decreases. Now we can directly measure the bilateral trade costs by using Equation (5).

In order to calculate trade costs equivalents as per Equation (5), domestic transaction data is needed, which can be derived through the utilization of the $Y_h = X_{hh} + \sum_j X_{hj}$ relationship. The GDP, commonly used as a proxy variable of income is not appropriate here because it is a concept of value-added whilst both domestic transaction and international trade should be involved. In the process of calculating trade costs of major countries of the world throughout the period of 1970-2000, Novy (2013) instead uses gross production as the proxy variable of domestic transaction. To include as many countries as possible, we utilize the GTAP database version 9, which provides the gross production data for 120 countries as of year 2011. Appendix Table 2 reports the calibrated bilateral trade costs of major countries in this experiment.

II.3. Cumulative ROO and Trade Costs: A Gravity Model Analysis

A. Model and Data

In search of a best practice for region-wide FTAs in the Asia Pacific region and as a first step, we estimate the effects of regime-wide ROO for FTAs– bilateral, diagonal, and full cumulation– on trade costs by adopting an extended gravity regression model. Anderson and van Wincoop (2003), Noguera(2012), Novy (2013), and Fouquin and Hugot (2016) specify bilateral trade costs as the function of the border-related variables, historic and cultural relations, and distance. Accordingly, we construct the following regression model to investigate the impact of various cumulative ROO systems on trade costs.

$$\ln\tau_{hj} = \alpha_0 + \alpha_h + \beta\ln Dist_{hj} + \eta' X' + \gamma_1 RTA\_Bilateral_{hj} + \gamma_2 RTA\_Diagonal_{hj} + \gamma_3 RTA\_Full_{hj} + u_{hj} \quad (6)$$

Between country h and j,

τ: bilateral trade costs

$Dist$: bilateral distance

X: border adjacency, bilateral historic, cultural relations such as colonial experience and the use of common language.

$RTA\_Bilateral$: FTA with bilateral cumulation provision

$RTA\_Diagonal$: FTA with diagonal cumulation provision

RTA_Full : FTA with full cumulation provision

In line with previous studies, we control cultural and historic determinants such as bilateral distance, common language, and colonial experience and distinguish different levels of restrictiveness of ROO into bilateral, diagonal, and full cumulation. In addition, the country fixed effect (α_h) is included in order to control unobservable distinct features of a country.

Data for the gravity model in this study come from various sources. Data on country pair specific variables, such as distance, colonial ties, adjacency, and common languages are obtained from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Data for distinguishing regional trade agreements into bilateral, diagonal, and full cumulation are based on Estevadeordal and Suominen (2003) and then we updated them to year 2011 by investigating the WTO Regional Trade Agreements database.

The cross-sectional estimation uses data for 2011 covering 120 countries because the estimated bilateral trade costs equivalents in the previous section were derived from the GTAP version 9, which collects world-wide data for 2011. Summary statistics for the data used in this estimation are presented in Table 2. Of all observations, 73.7 percent of 6,338 country pairs (4,669) are not members of any FTA and 26.3 percent of 6,338 country pairs (1,669) are members of at least one FTA of which 16.5 (3.0 and 6.9) percent of 6,338 country pairs, apply bilateral (diagonal and full, respectively) cumulation of ROO to members in their FTAs.[4] In Table 2, we observe some notable findings. First, bilateral trade costs between FTA members (0.654, 0.444, and 0.277 for bilateral, diagonal, and full cumulation, respectively) are lower than the average bilateral trade costs in the whole sample (0.794). It is not surprising since the whole sample includes countries that are not participating in any type of FTA. Second, shorter geographical distance, sharing colonial experience, and sharing borders are important factors for the membership while the use of common language is not a significant factor for the membership. Third, when we focus on the cumulation of ROO, bilateral trade costs decrease as the type of ROO cumulation is relaxed, that is, from the highest in bilateral cumulation (0.654) followed by diagonal cumulation (0.444) and to the lowest in full cumulation (0.277). The transportation cost resulting from distance also affects the choice of the cumulation system of ROO. However, country specific characteristics, such as border sharing, speaking a common language, and colonial background, do not reveal any specific pattern.

[4] Covering the 120 countries, the data should contain 7,140 country pairs but some country pairs were deleted because of zero trade between them.

Table 2. Summary Statistics

	All Country-pairs (6,338)		FTAs with Bilateral Cumulation (1,045)		FTAs with Diagonal Cumulation (187)		FTAs with Full Cumulation (437)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Log of Trade costs	0.794	0.445	0.654	0.458	0.444	0.322	0.277	0.402
Log of Distance	8.654	0.840	8.352	0.917	7.436	0.708	7.164	0.647
Border Adjacency	0.027	0.161	0.098	0.297	0.048	0.214	0.082	0.275
Common Language	0.123	0.328	0.249	0.433	0.096	0.296	0.050	0.219
Colony	0.017	0.130	0.033	0.180	0.048	0.215	0.030	0.170

Note: FTAs with diagonal cumulation include EU-Switzerland, EU-Turkey, EU-Egypt, EU-Israel, EU-Jordan, EU-Croatia, Switzerland-Egypt, Switzerland-Israel, Switzerland-Jordan, Switzerland-Morocco, Switzerland-Tunisia, Switzerland-Turkey, Switzerland-Croatia, Norway-Turkey, Norway-Israel, Norway-Egypt, Norway-Jordan, Norway-Croatia, Israel-Jordan, Israel-Turkey, Israel-Croatia, Israel-Canada, Egypt-Jordan, Egypt-Morocco, Egypt-Tunisia, Egypt-Turkey, Egypt-Croatia, Jordan-Morocco, Jordan-Tunisia, Jordan-Turkey, Tunisia-Turkey, and Turkey-Croatia; FTAs with full cumulation include the European Economic Area (the EU and Norway), EU-Morocco, EU-Tunisia, Morocco-Tunisia, Switzerland-Norway, and Australia-New Zealand.

B. Results

The results estimated from the Equation (6) are reported in Table 3. We estimate four different model specifications as follows:

① Model (1) without considering the ROO effects and the country fixed effect

② Model (2) without considering the ROO effects and with considering the country fixed effect

③ Model (3) with considering the ROO effects and without considering the country fixed effect

④ Model (4) with considering the ROO effects and the country fixed effect

As we interpret the estimated coefficients, first, all the control variables behave in the way the model predicts. Coefficient estimates of distance, border adjacency, use of common language and sharing colonial experience all show a negative (-) sign at the 1% statistically significance level. Second, the values of coefficient estimates are not significantly affected by the inclusion of cumulative ROO system as an explanatory variable as can be seen in the comparison of the estimates in models (1) and (2) with those of models (3) and (4). Third, Table 3 shows that in the case of model (4), which includes both ROO effects and the country fixed effect, the coefficient estimate of FTAs with bilateral cumulation is –0.082. It means that FTAs with bilateral cumulation reduce bilateral trade costs between members by approximately 7.87%.[5] Similarly, we find that FTAs with diagonal cumulation and full cumulation reduce trade costs by 15.8% and 25.9%, respectively. Overall, full cumulation is the optimal provision of ROO cumulation in terms of reducing bilateral trade costs between members.

[5] [exp(-0.082)-1]=-0.0787.

Table 3. Effects of Cumulative ROOs on Trade Costs

Dependent Variable: Log of trade costs	(1)	(2)	(3)	(4)
Log of Distance	0.191 (0.007)***	0.229 (0.006)***	0.109 (0.008)***	0.177 (0.007)***
Border Adjacency	-0.349 (0.033)***	-0.198 (0.028)***	-0.404 (0.031)***	-0.230 (0.028)***
Common Language	-0.083 (0.015)***	-0.068 (0.014)***	-0.109 (0.015)***	-0.082 (0.014)***
Colony	-0.395 (0.031)***	-0.339 (0.032)***	-0.360 (0.032)***	-0.320 (0.031)***
FTAs with Bilateral Cumulation			-0.111 (0.014)***	-0.082 (0.018)***
FTAs with Diagonal Cumulation			-0.253 (0.024)***	-0.172 (0.030)***
FTAs with Full Cumulation			-0.388 (0.021)***	-0.300 (0.023)***
Country Fixed Effect	no	yes	no	yes
No. of Observation	6,338	6,338	6.338	6,338
R-sq.	0.22	0.50	0.26	0.51

- Constant term is included but not reported.
- Standard errors are figured in parentheses; *, **, and *** denote statistical significance at the 10%, 5%, and, 1% levels, respectively.

III. Economic Effects of Mega-regional FTAs in the Asia-Pacific Region: A CGE Model Analysis

III.1. Methodology

A. Static and Capital Accumulation CGE Models

We work with a multi-sector and multi-region CGE model of the world economy by employing the commonly used Global Trade Analysis Project (GTAP) model. In order to provide a quantitative assessment on the effects of various cumulative ROOs on both member and nonmember countries, two CGE models are utilized in this study. The first is the static CGE model, in which the one-shot effects caused by changes in efficiency through resource reallocation are simulated in a steady state. The second model is the capital accumulation CGE model, which is introduced by Baldwin (1989, 1992) in order to capture not only the static efficiency effects but also the capital accumulation effects that are caused by income-saving-investment linkage over time. That is, the standard static CGE model has been modified in order to identify medium- or long-run growth effects in which the magnitudes of changes in the capital stock and output can be properly incorporated.

B. Trade Costs in the CGE models

To estimate the effects of the formation of FTAs with various cumulative ROOs on the member and nonmember countries, we have modified the standard CGE model so that it can include the simple "iceberg" concept of trading costs as introduced by Samuelson (1954). Some units of the good melt in transit, which can be thought of as a cost of trading the good. As we define the unit trade cost as δ, only ($1/\delta$) unit arrives in the importing country. As in Hertel et al. (2001), an effective price of good i imported from country r at domestic price is introduced in destination country s: P^*_{irs}. This is associated with the observed price, P_{irs}, as the following:

$$P^*_{irs} = \delta_{irs} P_{irs} \qquad (7)$$

where δ_{irs} reflects the trade costs for good i between exporting country r and importing country s. A change in δ_{irs}, which is assumed to be 1 for the base solution, causes an equivalent change in the effective price of good i imported from r to s.

To ensure a balanced data set, a quantity adjustment equation is required. Similar to the definition of the effective price, the adjusted effective quantity is defined as follows:

$$Q^*_{irs} = \frac{Q_{irs}}{\delta_{irs}} . \qquad (8)$$

For example, the rise in δ_{irs} (trade cost) reduces imports of the good *i* from *r* to *s*. Multiplying Equation (7) and Equation (8), we derive the following equation:

$$P^*_{irs} Q^*_{irs} = P_{irs} Q_{irs} . \qquad (9)$$

Incorporating Equations (7) and (8) into the linearized standard GTAP CGE model, the effects of any policy such as implementing a specific cumulative ROO system, which in turn affects trade costs and trade, can be specified by deriving total derivative as follows:[6]

$$\frac{dP_{is}}{P_{is}} = \sum_r \theta_{irs} \left(\frac{dP_{irs}}{P_{irs}} + \frac{d\delta_{irs}}{\delta_{irs}} \right) \qquad (10)$$

where P_{is} is an aggregated import price of good *i* at domestic market *s* and θ_{irs} is an import share of country *r* at the domestic market *s* in good *i*.

$$\frac{dQ_{is}}{Q_{is}} = \frac{dQ_{irs}}{Q_{irs}} - \frac{d\delta_{irs}}{\delta_{irs}} + \sigma_{irs} \left(\frac{dP_{irs}}{P_{irs}} + \frac{d\delta_{irs}}{\delta_{irs}} - \frac{dP_{is}}{P_{is}} \right) \qquad (11)$$

where Q_{is} is an aggregated import of good *i* at domestic market *s* and σ_{irs} is an elasticity of substitution.

Equations (10) and (11) will be included in the CGE model and values of δ_{irs} (trade cost) will be adjusted by estimated coefficients of bilateral, diagonal, and full cumulation as reported in Table 3.

[6] Trade is linked through Armington substitution and aggregated by CES composite import function.

C. Sub-regional FTAs

In order to avoid the possibility of overestimation, we do not apply policy shocks of eliminating tariffs and reducing bilateral trade costs to some of the mega-regional FTA member countries if they are already members of existing sub-regional FTAs which have been effective since 2011, the base year of this experiment. For example, we do not include trade effects of eliminating tariffs between Korea and the United States to this CGE model analysis on an FTAAP because the Korea-US FTA has entered into effect on March 15, 2012 and has been generating trade effects regardless of the formation of the FTAAP. The trade effects should be contained in the base value. This approach can avoid the double counting problem of trade effects of already effective sub-regional FTAs because expansion of the Korea-US FTA into the FTAAP may not generate additional effect of eliminating bilateral tariffs between Korea and USA on the two countries.[7] On the other hand, the sub-regional FTAs implemented before 2011, will not be controlled because the economic effects have been contained in the base year data we use. By appropriately excluding the possibility of double counting, we can estimate more precisely the effects of mega-regional FTAs on member and nonmember countries.

D. Data

The CGE models are calibrated using the GTAP database Version 9, which represents the world economy in the year 2011 classifying 140 regions (120 individual countries and 20 regional economies) for all 57 GTAP commodities.[8]

III.2. Results

[7] This does not necessarily preclude the possibility of gaining additional benefits from joining FTAAP for both Korea and the United States in the future. It is simply assumed in this study that no additional tariff elimination between Korea and the US occurs in the case of FTAAP further than the Korea-US FTA.

[8] Refer to the GTAP website, https://www.gtap.agecon.purdue.edu/

As the first step, we run the CGE models for an initial base solution without considering the possible formation of the mega-regional FTAs– RCEP, CPTPP and FTAAP– and derive general equilibrium values for each of the countries in the model.[9] As a next step, we rerun the model with considering the formation of FTAs under different cumulative ROOs and recalculate the equilibrium values for each case. More specifically for simulations with diagonal or full cumulation, in addition to eliminating tariffs between corresponding FTA members with bilateral cumulation, the additional reduction of trade costs by forming an FTA with diagonal or full cumulation, which is 7.9% (=15.8%-7.87%) and 18.0% (=25.9%-7.87%), respectively, is assigned to the aforementioned Equations (10) and (11).[10] Then, we compare the different equilibrium values with the initial base solution in terms of percentage deviation of real GDP and deviation of welfare from the base. Thus, we can evaluate the experimental impacts of FTAs with bilateral, diagonal, and full cumulation on members, nonmembers, and the world economy as a whole.

Table 4 reports the CGE model estimation results to compare the mega-regional FTAs' impacts on members, nonmembers, and the world economy.[11] It is predicted that the discriminatory trade liberalization efforts by forming mega-regional FTAs in the Asia-Pacific region generate positive gains to members but harmful effects on nonmembers. The overall effects on the world economy are positive. The positive contribution to members' real GDP and trade creation effects on members and trade-diverting negative effects on nonmembers range from the lowest in the CPTPP followed by the RCEP and to the highest in the FTAAP. That is, we find that "the larger the size of the FTA the bigger the gains" argument holds.[12]

However, the strict application of ROO under bilateral cumulation system will not generate significant impacts even in the long run. It is because already proliferating sub-regional FTAs in the region will not generate significant additional gains when we expand the existing trade

[9] We exclude Myanmar for the RCEP simulation and Papua New Guinea for the FTAAP simulation because of data problem.
[10] We found that FTAs with bilateral, diagonal, and full cumulation will reduce bilateral trade costs between FTA members by 7.87%, 15.8%, and 25.9%, respectively. See Table 3.
[11] See Appendix Tables 3, 4, and 5 for the effects on individual countries.
[12] The global GDP share of CPTPP, RCEP, and FTAAP was 13.4%, 31.4%, and 59.7%, respectively, in 2016 and the global merchandise trade share of CPTPP, RCEP, and FTAAP was 15.0%, 29.4%, and 48.7%, respectively, in 2017.

blocs to mega-regional FTAs. Already participating members under the sub-regional FTAs may not generate positive trade creation effects with each other while they may have some trade creation effects generated from new membership with previous nonmembers. In addition, they may face trade diversion effects incurred by trade creation between newly joined members. The net effect is uncertain and depends on the current status of sub-regional FTAs. Thus, we argue that the worrisome spaghetti bowl phenomenon of complicated ROOs incurred by overlapping regional trade agreements may not be solved by simply expanding the membership to region-wide FTAs.

More specifically, in stark contrast to the effects of existing CGE model analyses on the aforementioned three mega-regional FTAs, our estimations by using both the static and the capital accumulation CGE model with bilateral cumulation system are significantly lower.[13] This finding implies that the mega-regional FTAs may not necessarily be a viable alternative to the multilateral trading system or bilateral FTAs unless less restrictive cumulative ROO regimes are adopted. We argue that it strongly depends on provisions of specific cumulative ROO rather than the expansion of the membership. By comparing the relative effects of the mega-regional FTAs with various ROO cumulation systems in Table 5 in combination with Table 4, we find that less restrictive cumulation systems such as diagonal and full cumuraion, result in significantly large additional gains for intra-bloc trade members. Further, the increased additional losses to nonmembers are much smaller than the increased additional gains to members. Thus we can conclude that on net gains outweigh losses.

Appendix Tables 3, 4, and 5 also support the positive role of less restrictive ROO cumulation system. Joining to the mega-regional FTAs with bilateral ROO cumulation, some countries will be worse off but if the FTAs adopt less restrictive ROO system, all the members will be better off. It reconfims that the positive effects of joining the FTAs are mainly caused by the reduction of verifying costs from the less restrictive ROO cumulation system rather than simply eliminating tariffs.

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[13] For the comparison, see Kawai and Wignaraja (2007), Urata (2008), Ando (2009), Gilbert (2013), APEC (2009, 2016), Petri et al. (2011, 2012, 2017), Lee and Itakura (2018), and Park (2018).

Table 6 compares the long-run effects of the mega-regional FTAs by cumulating capital over time to the static effects. In general, the long-run effects on members and nonmembers are much stronger than the static effects. Interestingly, the negative trade diversion effects on nonmembers are badly high in the case of bilateral cumulation but getting better as we adopt more relaxed provision of diagonal or full cumulation of ROO. This finding supports the frequently described positive long-run gains from forming the discriminatory regional trade blocs for both members and nonmembers through income growth effects.

Table 4. Effects of Mega-regional FTAs in the Asia-Pacific Region

Effects of Cumulation		Real GDP (% Deviation)			Welfare (Deviation, Million USD)		
		Bilateral	Diagonal	Full	Bilateral	Diagonal	Full
Static Model							
RCEP	Members	0.021	0.524	1.252	18,262	261,818	629,806
	Nonmembers	-0.005	-0.043	-0.086	-8,614	-61,798	-130,487
	World	0.010	0.399	0.707	9,648	200,020	499,318
CPTPP	Members	0.006	0.126	0.280	3,633	51,197	112,007
	Nonmembers	-0.001	-0.007	-0.015	-2,354	-20,442	-43,568
	World	0.002	0.043	0.096	1,279	30,755	68,439
FTAAP	Members	0.066	1.345	3.077	54,754	659,460	1,454,278
	Nonmembers	-0.022	-0.115	-0.219	-34,936	-166,432	-314,896
	World	0.027	0.695	1.609	19,818	493,027	1,139,382
Capital Accumulation Model							
RCEP	Members	0.067	1.445	3.524	27,853	515,216	1,245,495
	Nonmembers	-0.095	-0.216	-0.298	-25,256	-87,744	-125,429
	World	0.025	1.060	1.967	2,597	427,472	1,120,066
CPTPP	Members	0.022	0.429	0.949	5,771	97,073	213,802
	Nonmembers	-0.004	-0.024	-0.058	-2,664	-2,543	-2,389
	World	0.005	0.146	0.320	3,107	94,530	211,413
FTAAP	Members	0.259	3.458	7.985	94,939	1,170,615	2,677,478
	Nonmembers	-0.290	-0.610	-0.938	-87,029	-223,464	-365,422
	World	0.014	1.646	4.010	7,910	947,150	2,312,057

Table 5. Relative Effects of Mega-regional FTAs in the Asia-Pacific Region: Ratio to Bilateral Cumulation

Effects of Cumulation		Real GDP			Welfare		
		Bilateral	Diagonal	Full	Bilateral	Diagonal	Full
Static Model							
RCEP	Members	1.0	25.4	60.6	1.0	14.3	34.5
	Nonmembers	-1.0	-8.0	-16.1	-1.0	-7.2	-15.1
	World	1.0	39.6	70.2	1.0	20.7	51.8
CPTPP	Members	1.0	20.9	46.3	1.0	14.1	30.8
	Nonmembers	-1.0	-9.1	-19.4	-1.0	-8.7	-18.5
	World	1.0	24.1	53.5	1.0	24.0	53.5
FTAAP	Members	1.0	20.5	46.9	1.0	12.0	26.6
	Nonmembers	-1.0	-5.3	-10.1	-1.0	-4.8	-9.0
	World	1.0	26.0	60.2	1.0	24.9	57.5
Capital Accumulation Model							
RCEP	Members	1.0	21.5	52.4	1.0	18.5	44.7
	Nonmembers	-1.0	-2.3	-3.1	-1.0	-3.5	-5.0
	World	1.0	42.8	79.5	1.0	164.6	431.3
CPTPP	Members	1.0	19.7	43.7	1.0	16.8	37.0
	Nonmembers	-1.0	-5.7	-13.7	-1.0	-1.0	-0.9
	World	1.0	26.6	58.3	1.0	30.4	68.1
FTAAP	Members	1.0	13.4	30.9	1.0	12.3	28.2
	Nonmembers	-1.0	-2.1	-3.2	-1.0	-2.6	-4.2
	World	1.0	116.6	284.1	1.0	119.7	292.3

Table 6. Relative Effects of Mega-regional FTAs in the Asia-Pacific Region: Ratio to Static Model

Effects of Cumulation		Real GDP			Welfare		
		Bilateral	Diagonal	Full	Bilateral	Diagonal	Full
Capital Accumulation Model							
RCEP	Members	3.3	2.8	2.8	1.5	2.0	2.0
	Nonmembers	-17.8	-5.1	-3.4	-2.9	-1.4	-1.0
	World	2.5	2.7	2.8	0.3	2.1	2.2
CPTPP	Members	3.6	3.4	3.4	1.6	1.9	1.9
	Nonmembers	-5.5	-3.5	-3.9	-1.1	-0.1	-0.1
	World	3.1	3.4	3.3	2.4	3.1	3.1
FTAAP	Members	3.9	2.6	2.6	1.7	1.8	1.8
	Nonmembers	-13.4	-5.3	-4.3	-2.5	-1.3	-1.2
	World	0.5	2.4	2.5	0.4	1.9	2.0

IV. Concluding Remarks

We quantitatively investigated whether mega-regional FTAs can be a viable policy option to recently proliferating formation of bilateral FTAs where the complexity and diversity of ROO increase trade costs and significantly reduce gains from freer trade. In particular, we examined different types of cumulative ROOs that are implemented or considered by various mega-regional FTAs in the Asia-Pacific region such as the RCEP, the CPTPP, and the FTAAP.

We found that the size of the FTAs matters. The formation of mega-regional FTAs in the Asia-Pacific region will contribute to members' real GDP growth and generate trade creation effects on members' welfare while incurring trade-diverting negative effects on nonmembers. The effects will be the lowest in the CPTPP followed by the RCEP and to the highest in the FTAAP.

We also found that the provision of ROO cumulation matters. Unlike the insignificant impacts of mega-regional FTAs with bilateral cumulation, same mega-regional FTAs with less restrictive cumulation system such as diagonal or full cumulation will generate significantly large additional gains. Thus, we argue that the worrisome spaghetti bowl effects incurred by complicated web of overlapping regional trade agreements may not be solved by simply expanding the membership of sub-regional FTAs to region-wide FTAs.

Furthermore, we found that the negative trade diversion effects on nonmembers are badly high with bilateral cumulation but will be improved in the long run as we adopt less restrictive provision of ROO, diagonal or full cumulation. Thus, we argue that the provision of less restrictive cumulative ROO system will be beneficial for both members and nonmembers through growth effects in the long run.

Overall, we conclude that the mega-regional FTAs may not necessarily be a viable alternative to the multilateral trading system or bilateral FTAs unless less restrictive cumulative ROO regimes are adopted. The key to success in FTAs lies in provision of cumulative ROO rather than the expansion of the membership.

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Appendix Table 1. Major FTAs by Types of Cumulative ROO

<table>
<tr><th colspan="2">Type</th><th>Number of FTAs</th><th>FTAs</th></tr>
<tr><td colspan="2">Bilateral</td><td>29</td><td>ASEAN-Australia-New Zealand, ASEAN-China, ASEAN-India, ASEAN-Japan, ASEAN-Korea, Australia-Chile, Chile-China, Chile-India, Chile-Japan, China-Singapore, Dominican Rep-Central America-USA, EFTA-Chile, EFTA-Korea, EFTA-Mexico, EFTA-SACU, EFTA-Singapore, EU-Chile, EU-Korea, EU-Mexico, India-Singapore, Japan-India, Japan-Malaysia, Japan-Switzerland, MERCOSUR-Chile, MERCOSUR-India, MERCOSUR-Mexico, USA-Chile, USA-Singapore, USA-Australia</td></tr>
<tr><td colspan="2">Diagonal</td><td>6</td><td>APTA, ATIGA, ECOWAS, EU-Switzerland, GSTP, SADC</td></tr>
<tr><td colspan="2">Full</td><td>5</td><td>Canada-Chile, Chile-Mexico, Japan-Mexico, Japan-Singapore, NAFTA</td></tr>
<tr><td rowspan="3">Combined</td><td>Bilateral and Full</td><td>2</td><td>Korea-Chile, Korea-Singapore</td></tr>
<tr><td>Diagonal and Full</td><td>1</td><td>EU-CARIFORUM</td></tr>
<tr><td>Bilateral and Diagonal and Full</td><td>2</td><td>EU-Algeria, EU-South Africa</td></tr>
<tr><td colspan="2">Not mentioned</td><td>2</td><td>Singapore-Australia, Pan-Arab Free Trade Area</td></tr>
</table>

Source: WCO, Categorization and Analysis on Preferential Rules of Origin, Version 2017, p. 244.

Appendix Table 2. Bilateral Trade Cost Equivalents of Major Country Pairs

Country Pair		Trade Cost	Country Pair		Trade Cost
Korea	USA	0.837	Japan	USA	0.778
Korea	Japan	0.754	Japan	Canada	1.115
Korea	China	0.715	Japan	England	1.116
Korea	Australia	0.871	Japan	Austria	1.478
Korea	England	1.295	Japan	Belgium	1.187
Korea	Belgium	1.396	Japan	Denmark	1.612
Korea	Denmark	1.630	Japan	France	1.133
Korea	France	1.186	Japan	Germany	1.018
Korea	Germany	1.052	Japan	Italy	1.362
Korea	Italy	1.378	Japan	Netherlands	1.375
Korea	Canada	1.199	Japan	Norway	1.520
Korea	Taiwan	0.804	Japan	Sweden	1.481
Korea	Hong Kong	0.933	Japan	Finland	1.640
Korea	India	1.193	Japan	Greece	2.066
Korea	Indonesia	0.862	Japan	Ireland	1.443
Korea	Malaysia	1.000	Japan	Australia	0.778
Korea	Philippines	1.019	Japan	Malaysia	0.832
Korea	Singapore	0.894	Japan	Philippines	0.932
Korea	Thailand	1.037	Japan	Thailand	0.731
Korea	Vietnam	0.846	Japan	China	0.707
China	USA	0.736	USA	England	0.789
China	England	1.038	USA	Austria	1.146
China	Austria	1.361	USA	Belgium	0.918
China	Belgium	1.116	USA	Denmark	1.247
China	Denmark	1.329	USA	France	0.907
China	France	1.015	USA	Germany	0.786
China	Germany	0.828	USA	Italy	1.036
China	Italy	1.141	USA	Luxembourg	1.445
China	Luxembourg	2.036	USA	Netherlands	0.985
China	Netherlands	1.313	USA	Norway	1.155
China	Taiwan	0.724	USA	Sweden	1.165
China	Hong Kong	0.746	USA	Switzerland	0.931
China	India	1.040	USA	Canada	0.423
China	Indonesia	0.981	USA	Finland	1.380

China	Malaysia	0.858	USA	Greece	1.351
China	Philippines	0.997	USA	Ireland	0.836
China	Singapore	0.888	USA	Malta	1.552
China	Thailand	0.896	USA	Portugal	1.439
China	Vietnam	0.928	USA	Spain	1.126
China	Australia	0.784	USA	Australia	1.029
Germany	Austria	0.472	England	Austria	1.052
Germany	Belgium	0.526	England	Belgium	0.614
Germany	Denmark	0.713	England	Denmark	0.828
Germany	France	0.556	England	France	0.695
Germany	Italy	0.635	England	Germany	0.607
Germany	Luxembourg	0.763	England	Italy	0.848
Germany	Netherlands	0.546	England	Luxembourg	1.275
Germany	Norway	0.752	England	Netherlands	0.656
Germany	Sweden	0.723	England	Norway	0.749
Germany	Switzerland	0.522	England	Sweden	0.807
Germany	Canada	1.150	England	Switzerland	0.876
Germany	Australia	1.178	England	Canada	0.893
Germany	New Zealand	0.930	England	Turkey	0.995
Germany	Taiwan	1.055	England	Australia	1.116
Germany	Hong Kong	1.242	England	New Zealand	0.755
Germany	India	1.142	England	Argentina	1.622
Germany	Indonesia	1.357	England	Brazil	1.317
Germany	Malaysia	1.079	England	Chile	1.415
Germany	Philippines	1.365	England	Colombia	1.466
Germany	Thailand	1.194	England	Israel	1.002
Malaysia	England	1.255	Singapore	Austria	1.735
Malaysia	Austria	1.614	Singapore	Belgium	1.326
Malaysia	Belgium	1.515	Singapore	Denmark	1.864
Malaysia	Denmark	1.768	Singapore	France	1.093
Malaysia	France	1.205	Singapore	Italy	1.578
Malaysia	Italy	1.546	Singapore	Netherlands	1.018
Malaysia	Netherlands	1.441	Singapore	Norway	1.923
Malaysia	Norway	1.898	Singapore	Sweden	1.722
Malaysia	Sweden	1.528	Singapore	Switzerland	1.292

Malaysia	Switzerland	1.418	Singapore	Canada	1.362
Malaysia	Canada	1.477	Singapore	Turkey	1.979
Malaysia	Turkey	1.768	Singapore	Australia	0.884
Malaysia	Australia	0.934	Singapore	New Zealand	0.923
Malaysia	New Zealand	0.916	Singapore	Taiwan	0.801
Malaysia	Taiwan	0.865	Singapore	Hong Kong	0.807
Malaysia	India	1.087	Singapore	India	1.010
Malaysia	Indonesia	0.845	Singapore	Indonesia	0.676
Malaysia	Philippines	1.076	Singapore	Philippines	0.829
Malaysia	Thailand	0.696	Singapore	Thailand	0.743
Malaysia	Vietnam	0.956	Singapore	Vietnam	0.850

Appendix Table 3. Effects of RCEP on Major Countries

	Static Model						Capital Accumulation Model					
	Real GDP (% Deviation)			Welfare (Deviation, Million USD)			Real GDP (% Deviation)			Welfare (Deviation, Million USD)		
	Bilateral	Diagonal	Full	Bilateral	Diagonal	Full	Bilateral	Diagonal	Full	Bilateral	Diagonal	Full
Members												
Australia	-0.01	0.95	2.30	-48.5	22,855.2	54,184.7	-0.02	2.35	5.70	57.5	35,492.0	85,520.3
Brunei	-0.01	1.45	3.27	-12.0	658.2	1,380.7	-0.15	6.79	15.56	-27.9	1,510.8	3,544.5
Cambodia	-0.01	6.07	13.46	-12.8	766.0	1,611.2	-0.18	13.75	32.57	-27.1	1,435.8	3,393.4
China	0.08	0.98	2.34	6,610.6	72,272.1	170,006.6	0.21	2.11	5.01	12,095.3	127,054.9	299,902.4
India	0.09	1.08	2.59	539.4	20,079.5	50,066.5	0.35	2.82	6.59	3,754.0	43,313.6	105,168.6
Indonesia	-0.02	1.37	3.29	-608.6	14,887.2	36,500.5	-0.15	3.30	8.27	-1,287.4	28,408.2	71,551.4
Japan	0.05	0.62	1.47	18,473.2	68,160.2	155,660.4	0.37	2.31	5.07	25,825.9	121,231.1	251,554.2
Korea	0.02	2.09	5.05	1,226.2	33,408.2	81,641.9	0.17	6.17	15.08	1,314.7	60,732.6	150,485.3
Lao PDR	-0.01	3.95	8.88	-3.5	463.9	997.6	-0.07	7.79	18.23	-7.6	659.8	1,547.5
Malaysia	-0.05	4.08	9.68	-653.0	15,644.4	37,416.9	-0.34	11.93	30.86	-1,022.2	29,062.1	74,894.3
New Zealand	0.07	1.29	2.98	554.2	3,133.9	7,878.4	0.44	4.48	10.10	975.4	7,826.0	17,130.0
Philippines	0.00	2.06	4.79	-284.8	6,123.6	14,501.1	-0.36	8.74	22.48	-740.7	15,888.9	40,772.6
Singapore	-0.01	3.18	7.56	-266.9	14,582.9	34,767.6	-0.25	11.55	29.88	-591.4	25,891.8	66,170.8
Thailand	-0.07	3.63	8.51	-1,022.5	16,388.8	38,908.2	-0.55	12.70	33.51	-1,807.7	34,571.7	90,768.5
Vietnam	-0.06	5.57	12.72	-504.9	11,926.2	27,676.4	-0.23	10.61	26.57	-441.5	13,823.1	34,841.7
Nonmembers												
Argentina	-0.01	-0.07	-0.15	-125.0	-896.5	-2,099.1	-0.06	-0.08	-0.07	-264.0	-529.2	-707.7

Brazil	-0.01	-0.08	-0.16	-573.4	-4,616.9	-10,452.3	-0.06	-0.13	-0.18	-1,136.8	-3,309.7	-5,320.2
Canada	-0.01	-0.03	-0.06	-301.4	-1,715.7	-4,057.7	-0.06	-0.08	-0.08	-863.6	-1,799.5	-2,479.5
Chile	-0.01	-0.07	-0.13	-230.6	-1,251.0	-2,590.2	-0.23	-0.67	-1.14	-585.4	-2,102.2	-3,772.6
Mexico	-0.01	-0.06	-0.12	-182.3	-1,336.8	-3,222.6	-0.18	-0.26	-0.24	-1,791.4	-2,985.1	-3,412.1
Paraguay	-0.02	-0.11	-0.23	-12.6	-63.8	-146.0	-0.07	-0.12	-0.13	-20.5	-43.1	-62.0
Peru	0.00	0.02	0.04	-42.1	-333.5	-748.6	-0.05	-0.08	-0.09	-75.9	-297.6	-536.0
Uruguay	-0.02	-0.12	-0.25	-14.7	-110.8	-251.2	-0.09	-0.15	-0.16	-32.5	-78.5	-112.2
Venezuela	-0.02	-0.07	-0.14	-102.7	-491.0	-1,151.2	-0.09	-0.21	-0.32	-262.8	-750.7	-1,268.3
USA	0.00	-0.02	-0.04	-4,139.3	-28,716.5	-58,673.8	-0.04	-0.09	-0.12	-5,183.3	-19,790.8	-34,079.7
EU_27	0.00	-0.03	-0.06	-2,657.1	-19,743.6	-38,696.5	-0.07	-0.12	-0.13	-10,026.6	-26,251.3	-34,265.4
Row	-0.01	-0.06	-0.13	-5,957.2	-42,054.2	-91,790.7	-0.13	-0.36	-0.56	-15,229.5	-61,492.8	-91,164.0

Appendix Table 4. Effects of CPTPP on Major Countries

	Static Model						Capital Accumulation Model					
	Real GDP (% Deviation)			Welfare (Deviation, Million USD)			Real GDP (% Deviation)			Welfare (Deviation, Million USD)		
	Bilateral	Diagonal	Full	Bilateral	Diagonal	Full	Bilateral	Diagonal	Full	Bilateral	Diagonal	Full
Members												
Australia	0.00	0.38	0.87	-218.0	8,442.7	19,515.3	-0.01	0.90	2.06	-240.6	12,279.2	28,285.6
Brunei	0.03	0.87	1.93	5.6	389.1	879.3	0.23	4.04	8.91	33.1	852.4	1,899.9
Canada	0.03	0.16	0.32	1,511.8	4,924.8	9,288.3	0.07	0.39	0.79	1,948.9	7,246.7	14,019.8
Chile	0.00	0.37	0.84	-12.2	1,968.7	4,501.3	0.02	1.51	3.40	16.9	3,925.1	8,921.7
Japan	0.01	0.21	0.45	1,642.5	20,890.8	45,499.5	0.05	0.69	1.51	2,508.2	33,626.3	73,410.2
Malaysia	0.00	2.01	4.58	86.8	9,219.6	20,895.6	0.08	6.20	14.01	210.8	15,503.6	35,055.2
Mexico	0.03	0.20	0.42	374.1	2,822.1	5,951.9	0.08	0.91	1.98	762.0	9,281.6	20,173.8
New Zealand	0.02	0.38	0.83	192.4	968.1	1,959.8	0.21	1.36	2.84	397.5	2,163.8	4,422.1
Peru	0.00	0.24	0.54	-9.7	914.0	2,094.8	0.00	0.66	1.49	-9.4	1,267.7	2,900.4
Singapore	0.00	1.39	3.17	41.7	7,758.7	17,624.9	0.02	5.45	12.39	69.3	12,633.9	28,697.4
Vietnam	0.05	1.71	3.83	359.2	5,227.6	11,451.8	0.20	3.61	7.97	360.9	5,422.9	11,894.5
Nonmembers												
Argentina	0.00	-0.01	-0.03	-15.4	-171.4	-370.8	0.00	0.03	0.07	-19.7	68.4	181.0
Brazil	0.00	-0.01	-0.03	-95.9	-897.8	-1,923.0	0.00	0.02	0.06	-123.6	91.7	366.9
Cambodia	-0.01	-0.06	-0.14	-5.5	-51.0	-109.2	-0.03	-0.09	-0.17	-5.0	-20.0	-39.1
China	0.00	-0.03	-0.06	-111.4	-5,856.9	-13,202.5	0.00	-0.02	-0.05	-69.7	-4,014.0	-9,056.7
India	0.00	-0.02	-0.05	26.0	-967.6	-2,237.8	0.00	0.02	0.04	45.7	-54.5	-182.6

Indonesia	0.00	-0.02	-0.05	-96.6	-1,310.7	-2,862.9	0.00	-0.01	-0.01	-103.5	-645.5	-1,338.5
Korea	0.00	0.00	0.00	11.9	-1,312.5	-3,005.7	0.00	-0.04	-0.09	32.9	-1,099.9	-2,548.3
Lao PDR	0.00	0.00	0.00	-0.3	-4.9	-10.8	0.01	0.00	-0.02	0.2	-1.7	-4.2
Paraguay	0.00	-0.01	-0.03	-1.3	-14.0	-30.3	0.00	0.02	0.06	-1.7	-1.9	-2.2
Philippines	0.00	-0.02	-0.05	-20.6	-406.8	-900.6	-0.01	-0.10	-0.23	-24.2	-348.0	-761.9
Thailand	0.00	-0.08	-0.18	-37.4	-1,324.4	-2,969.9	0.00	-0.30	-0.68	-20.4	-1,218.3	-2,749.8
Uruguay	0.00	-0.01	-0.02	-1.7	-8.0	-16.1	-0.01	0.06	0.15	-2.6	21.3	51.9
Venezuela	0.00	0.00	-0.01	7.1	-3.0	-15.9	0.00	0.04	0.09	4.8	92.6	204.9
USA	0.00	0.00	-0.01	-1,458.2	-9,423.6	-19,607.1	-0.01	0.00	0.00	-1,371.4	-4,432.3	-8,345.6
EU_27	0.00	0.00	-0.01	-31.1	-2,962.0	-6,709.0	0.00	-0.04	-0.10	-143.3	4,046.0	9,401.9
Row	0.00	-0.02	-0.03	-864.8	-8,056.9	-17,251.9	-0.01	-0.03	-0.07	-1,149.3	-2,157.0	-3,445.3

Appendix Table 5. Effects of FTAAP on Major Countries

	Static Model						Capital Accumulation Model					
	Real GDP (% Deviation)			Welfare (Deviation, Million USD)			Real GDP (% Deviation)			Welfare (Deviation, Million USD)		
	Bilateral	Diagonal	Full	Bilateral	Diagonal	Full	Bilateral	Diagonal	Full	Bilateral	Diagonal	Full
Members												
Australia	-0.06	1.02	2.46	-3,850.1	16,150.7	41,867.0	-0.28	2.26	5.70	-4,821.5	29,306.6	75,538.4
Brunei	-0.02	1.54	3.45	-108.4	379.1	954.4	-0.94	5.54	13.65	-227.2	1,076.1	2,765.9
Canada	0.04	1.74	3.98	-66.3	39,534.0	90,505.1	-0.09	3.44	8.12	-1,158.9	59,599.9	139,698.9
Chile	-0.02	1.57	3.73	-653.6	5,075.0	12,644.5	-0.52	4.63	11.70	-1,493.9	10,911.5	27,949.3
China	0.17	1.70	3.86	17,813.8	130,563.1	283,544.9	0.49	3.69	8.31	31,937.2	227,752.4	506,120.2
Hong Kong	0.00	3.45	7.83	705.2	11,839.6	25,398.3	0.17	9.36	21.94	1,471.8	21,783.4	49,650.9
Indonesia	-0.01	1.51	3.55	-1,050.3	13,827.6	33,332.4	-0.05	3.83	9.17	-1,096.1	30,010.6	73,234.3
Japan	0.14	0.99	2.12	32,681.9	102,539.1	192,950.4	0.78	3.31	6.76	47,469.4	168,039.3	330,662.7
Korea	-0.21	2.76	6.61	-3,220.0	43,675.0	102,330.1	0.01	8.19	19.49	-1,741.4	81,909.4	196,455.3
Malaysia	-0.10	4.62	10.78	-1,259.4	16,613.0	39,282.8	0.09	14.47	36.01	-949.3	33,326.3	83,769.0
Mexico	0.11	2.06	4.60	-12.0	28,642.2	65,592.7	0.19	9.27	21.58	1,088.8	95,245.1	224,378.6
New Zealand	0.06	1.53	3.46	1,258.7	4,448.6	8,385.6	0.61	5.12	11.18	1,877.4	9,046.8	18,526.8
Peru	0.01	1.01	2.46	-223.9	2,108.4	5,379.2	-0.16	1.83	4.68	-344.5	3,131.4	8,148.4
Philippines	0.00	2.51	5.71	-235.7	7,188.7	16,367.3	0.02	11.43	28.22	-181.4	20,421.3	50,230.2
Russia	0.23	0.88	1.86	1,929.2	15,385.2	36,078.9	0.84	2.76	5.70	9,939.1	42,932.7	94,777.7
Singapore	-0.01	4.02	9.29	-615.2	16,449.5	38,195.3	-0.63	13.17	33.64	-1,276.1	29,642.0	74,721.0
Taiwan	0.04	3.51	7.97	290.0	22,109.7	49,296.2	0.56	10.17	23.51	1,986.1	43,016.8	99,079.5

Thailand	-0.08	4.13	9.55	-701.8	18,192.1	41,950.2	0.17	15.62	39.40	-35.2	41,631.6	104,283.4
USA	0.01	0.83	1.98	8,126.7	145,003.8	331,935.2	0.01	1.56	3.76	9,020.1	200,568.4	471,035.1
Vietnam	1.01	8.23	16.61	3,945.3	19,735.3	38,287.9	3.16	19.47	42.80	3,474.5	21,263.1	46,452.9
Nonmembers												
EU_27	-0.01	-0.08	-0.15	-13,547.9	-67,359.8	-126,344.4	-0.25	-0.49	-0.73	-36,824.7	-92,360.5	-147,022.4
Row	-0.03	-0.16	-0.30	-21,388.0	-99,072.3	-188,552.0	-0.34	-0.76	-1.19	-50,203.9	-131,103.9	-218,399.6