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Impact of Liberalization and Improved Connectivity and Facilitation in ASEAN

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Abstract

This study attempts to evaluate the potential economic effects of liberalization and improved connectivity and facilitation of trade in goods and services among the ASEAN member states (AMSs) by applying economy-wide simulation analysis based on a recursively dynamic computable general equilibrium (CGE) model. We conduct a set of simulations to capture the effects of establishing free trade agreements (FTAs) in which the AMSs participate. Three key components affecting the impacts of FTAs are reduction of tariffs on goods, lowering of barriers to trade in services, and saving time-costs arising from logistics.

Simulation results revealed that reducing trade barriers has a significantly positive impact on economic welfare. Although there are differences in the magnitude of positive contributions to welfare, all of the FTAs in which the AMSs participate tend to raise welfare. Among the FTAs examined in this study, the Regional Comprehensive Economic Partnership (RCEP) leads to the largest positive effects on real GDP for most of the AMSs.

***JEL Classification*:** F15, F17

***Keywords*:** ASEAN; FTA; CGE model

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1. Introduction

This study attempts to evaluate the potential economic effects of liberalization and improved connectivity and facilitation of trade in goods and services among the ASEAN member states (AMSs) by applying economy-wide simulation analysis. The subjects of regionally interconnected liberalizations encompass reforms that have been implemented and will be implemented in the AMSs and neighboring countries. Impacts of liberalization of trade in goods and services arise from lowering barriers to trade: for example, reducing import tariffs, ameliorating custom procedures, removing barriers to trade in services, and improving logistics. Collecting information and estimates of tariffs and trade costs associated with liberalization is an essential part of this study to conduct quantitative evaluation. We relied on a number of databases and estimates obtained from international organizations, national research institutions, and researchers in this field of study.

The liberalization reforms will have economy-wide effects covering all of the AMSs for sectors including agriculture, natural resources, manufacturing, and service industries. To capture these economy-wide impacts of free trade agreements (FTAs), it is desirable to use a multi-country, multi-sector computable general equilibrium (CGE) model of international trade capable of handling changes in tariffs and trade costs for quantitative evaluation. There are a number of studies on applying CGE models to study FTAs in the ASEAN region. Kawai and Wignaraja (2008) examined FTAs such as the ASEAN-China FTA, ASEAN-Japan FTA, ASEAN-Korea FTA, ASEAN+3 (China, Japan, Korea) FTA and the Regional Comprehensive Economic Partnership (RCEP)[1]. Lee and Plummer (2011), Lee and van der Mensbrugghe (2008), and Lee et al. (2009; 2004) provided quantitative analysis of the ASEAN Economic Community (AEC), ASEAN-China, ASEAN-Japan, ASEAN-Korea, ASEAN+3 and RCEP, by applying a dynamic CGE model of global trade. Petri et al. (2012) examined the effect on the AEC of deepening integration from the ASEAN Free Trade Area (AFTA) through expansion of the measures of liberalization.

These studies considered the liberalization effects of reducing and/or removing non-tariff barriers to trade, in addition to tariff-cuts in FTAs. They found that gains from liberalization would become larger if we incorporated the non-tariff components into evaluation. This draws

[1] Because the AMSs and six countries, China, Japan, Korea, India, Australia, and New Zealand, launched negotiations for the RCEP in November 2012, we refer to ASEAN+6 FTA as RCEP.

attention to the degree of liberalization effect. However, except for Petri et al. (2012), there seems to be not enough information to infer the degree to which the non-tariff components of liberalization contribute to the total gain. Our study can shed some light on this quantitative evaluation as well as examine a number of AMSs' FTAs.

The next section provides an explanation of the database and some of the key estimates used in this study, and an overview of the recursively dynamic computable general equilibrium (CGE) model is given in section 3. A brief description of the simulation design and policy scenarios is provided in section 4, followed by simulation results in section 5. The final section offers a summary of the paper.

2. Database and Estimates

2.1. GTAP Database

In this paper, we utilized the GTAP Data Base version 7.1 (Narayanan & Walmsley, 2008) as a fundamental input to our analysis. The GTAP Data Base version 7.1 covers 112 countries/regions and 57 sectors in production, international trade, protection, and consumption. Thus, this database can serve as a bird's-eye view of the world economy corresponding to the year of 2004. We aggregated the GTAP Data Base to 22 countries/regions and 23 sectors, and the regional aggregation and sectoral aggregation mappings from the original data are reported in [Table and [Table , respectively. Among the ASEAN member states (AMSs), the GTAP Data Base has detailed economic data covering Singapore, Indonesia, Malaysia, the Philippines, Thailand, Viet Nam, Lao PDR, and Cambodia. Due to the data limitation, however, Brunei and Myanmar are included in the "Rest of Southeast Asia" along with Timor Leste.

[Table 1 around here]

[Table 2 around here]

[**Table** 3 reports the summary of GDP components computed from the aggregated GTAP Data Base. There are significant variations in the size of GDP and corresponding GDP components among AMSs; for example, Lao PDR's GDP is 2.5 billion US$ compared to the larger GDP of 255 billion US$ in Indonesia. It is interesting to see that the total GDP of ASEAN as a whole in 2004 becomes a considerable size, exceeding India, Korea, and Mexico.

[Table 3 around here]

[Table 4 reports the ASEAN's sectoral imports (US$ billion) and corresponding average applied tariff rates, reported in percent (%). Electric Equipment, the largest sectoral import in ASEAN, amounts to US$ 122 billion, followed by Machinery (US$ 88 billion), Chemical (almost US$ 60 billion), and Energy (about US$ 50 billion). Among the average applied tariff rates aggregated for ASEAN, relatively high tariff rates are observed in food and agricultural sectors such as Sugar Crops and Beets (33.3%) and Rice (17.7%). Import tariff on Automobiles (22.5%) is outstanding among manufacturing sectors, and tariffs on services sectors are reported as zero according to the GTAP Data Base.

[Table 4 around here]

We should note first that the average tariff rates reported in [Table 4 are based on the aggregates of the ASEAN rather than each member state's disaggregated applied tariff data, which records different applied rates on goods with information on source and destination countries. Secondly, zero import tariffs on services trade do not necessarily mean that the service sectors are free of impediments to trade, but simply there is a lack of information regarding the barriers in services trade expressed in ad valorem tariff equivalents. Lastly, the applied tariff rates are based on the benchmark year of 2004. Changes in average applied tariff rates since 2004 is in our interest of study, but it turned out to be a very challenging and complex task to update the rates recorded in the GTAP Data Base beyond 2004. To understand the reason, we will describe admirable work on the average applied tariff rates in the next sub-section.

2.2. Market Access Maps Database

The applied tariff rates recorded in the GTAP Data Base version 7.1 originate from the Market Access Maps (MacMapHS6v2) database version 2, which was improved and updated by Boumellassa et al. (2009) over the prior release of the database (International Trade Centre, 2006). The Market Access Maps database compiled ad valorem equivalents of tariffs and tariff rate quotas from fine-detailed 6-digits level of the Harmonized System, with more than 5,000 products for 163 importing countries with 208 sourcing countries. Specific duties and tariff rate quotas found in the original data from national custom agencies are converted into ad valorem

equivalents, and then they are aggregated up to the regional and sectoral classification of the GTAP Data Base. Thus, this is not a task easily replicated or updated by other researchers. Horridge and Laborde (2010) released a software program named TASTE, a tool for accessing the Market Access Maps database (Boumellassa et al., 2009), and users can aggregate ad valorem equivalents to their specification. Inferring from the size and scope of the Market Access Maps database, it seems very challenging and complex to update the aggregated applied tariff rates beyond 2004. In the next sub-section, however, we describe our attempt to obtain partial information of more recent applied tariff rates.

2.3. WTO's Tariff Download Facility

Information about changes in applied tariff rates beyond 2004 is helpful for our simulation analysis. WTO (2011) provides a web facility allowing anyone to access the database containing Most Favored Nation applied and bound tariff rates for the WTO member countries at the 6-digits level of the Harmonized System (HS). Among the 22 countries / regions used in this paper, there are 12 countries / regions that have both updated MFN applied tariff rates and import data. The 2009 data are available for Japan, Korea, Taiwan, Indonesia, Thailand, New Zealand, USA, Canada, Mexico, Chile, and EU 27, and the 2008 data are available for China and Australia. MFN applied tariff rates from more than 5,000 products are extracted from the HS07 classification, then converted into HS96 definition to match the GTAP Data Base's 57 sector classification for further aggregation to our 22-region specification.

For the ASEAN member states (AMSs), changes in applied tariff rates are computed for Indonesia and Thailand only because the necessary data are only available for these two ASEAN countries. [Table 5 reports the changes in MFN average applied tariff rates from 2004 to 2009. There are several caveats on the results. Specific tariffs and tariff rate quotas are not included in these import-weighted averages, so there might exist downward bias in resulting figures. If a rate in 2004 is zero or missing, change in the corresponding product is dropped from computation for obvious reasons. For services sectors, there was not much information recorded in the original WTO (2011).

Because of the limited data availability for the ASEAN member countries in WTO (2011), we repeated this exercise of data collection, aggregation, and computing changes in applied tariff rates, using the World Integrated Trade Solution (WITS) software.[2] WITS is a very rich source of tariff data, and benefitted us with additional information gains, especially on

[2]WITS is available at the World Bank's web site, http://wits.worldbank.org/wits/index.html

preferential tariff rates for trading partners. However, we could not cover more than Indonesia and Thailand even with WITS as of this writing.[3]

[Table 5 around here]

2.4. Estimates on Trade Cost Equivalents of Services Trade Barriers

In addition to the difficulty in obtaining changes in average applied tariff rates, it is a formidable task to estimate tariffs or trade cost equivalents of services trade barriers to trade. Adopting the methodology in Thelle et al. (2008) and Copenhagen Economics & Francois (2007), Wang et al. (2009) estimated the tariff equivalents of services trade barriers. Their estimating equation is based on a sector specific gravity model:

$$M_{i,j} = \mathrm{a}_i + \mathrm{a}_j + \mathrm{a}_1 \ln GDP_j + \mathrm{a}_2 \ln PCI_j + \varepsilon_j.$$

Imports of sector *i* in country *j* is regressed upon sector dummy a_i, country dummy a_j, *GDP*, and per capita income *PCI*, utilizing the GTAP Data Base version 7. The country average of trade-cost equivalent (T_j) is then computed with the import substitution elasticity parameter (σ) extracted from the GTAP Data Base.

$$\mathrm{a}_j = -\sigma \ln T_j (\bullet)$$
$$T_j = \exp(-\mathrm{a}_j/\sigma)$$

Accordingly, the tariff equivalents of services trade barriers for the AMSs are obtained as in Table A1. Because Hong Kong, Singapore, and the U.S. are used as benchmarks of free trade in the country dummy term, the estimates are not available for Singapore among the AMSs.

2.5. Time Cost on Trade

Minor and Hummels (2011) have made available their estimates of the average costs of time delays in trade. They considered shipping delays caused by regulatory procedures and inadequate infrastructure as one of the most significant trade barriers to trade in goods. Additionally, Minor and Hummels (2011) provide time information based on the World Bank Doing Business, which can be used in combination with their ad valorem equivalents of time

[3]Most recently in February 2013, the latest GTAP Data Base version 8.1 was released with multiple benchmark years of 2004 and 2007. This dual reference year of GTAP Data Base will provide us with average applied tariff rates for computing changes between 2004 and 2007. However, it does not reach the year 2009, so we decided not to adopt the latest GTAP for this study.

costs for our simulation analysis. For example, if we assumed 20% improvements in logistics associated with importing goods, then the resulting time-savings would be about half a day in Singapore and more than two and a half days in Indonesia. This example is reported in Table A2. The time savings can have varying effects on different goods because ad valorem equivalents of time costs differ from one good to the others. These variations in potential effects are captured in our simulation analysis.

2.6. Dynamic GTAP Data Base and Macro Projections

By incorporating international capital mobility and capital accumulation as well as foreign income payments and receipts, the GTAP Data Base version 7.1 is extended to the Dynamic GTAP Data Base. This extended database is used in our simulations with macroeconomic projections published by various international organizations. Projections on population growth are obtained from the U.S. Census Bureau (2011) and aggregated to match our 22-region specification. Projections on real GDP growth rates are from IMF (2011), and growth rates of labor are based on the estimates of the economically active population by the ILO (2011).

3. Overview of Dynamic GTAP Model

For all of the simulation analyses in this paper, we applied the Dynamic GTAP model developed by Ianchovichina and McDougall (2001). At the Center for Global Trade Analysis, Purdue University, the Dynamic GTAP model has been improved and maintained for further development.[4] Ianchovichina and McDougall (2001) extend the comparative static framework of the standard GTAP model developed by Hertel (1997) and improvements made by McDougall (McDougall, 2003) to incorporate international capital mobility and capital accumulation. In the standard comparative static GTAP model, capital can move across sectors within a region, but not across borders. For the long run analysis, the model needs to capture cross-border investment, hence allowing international capital mobility and capital accumulation.

The Dynamic GTAP model preserves all of the main features of the standard GTAP model, such as constant return to scale production technology, perfectly competitive markets, and product differentiation by origin, which is known as the Armington assumption (Armington,

[4]Information and the source code of the Dynamic GTAP model is available from the GTAP project Homepage (https://www.gtap.agecon.purdue.edu/models/Dynamic/model.asp). A book was recently published to summarize the development of the Dynamic GTAP model (Walmsley & Ianchovichina, 2012).

1969). The Dynamic GTAP model also uses the GTAP Data Base (Narayanan and Walmsley, 2008) supplemented with foreign income data from the IMF's Balances of Payments Statistics to track international capital ownership and foreign wealth.

In the Dynamic GTAP model, each region is endowed with fixed physical capital stock owned by domestic firms. The physical capital is accumulated over time with new investments. This dynamic is driven by the net investment, which is sourced from regional households' savings. Regional households own indirect claims on the physical capital in the form of equity. There are two types of equities: equity in domestic firms and equity in foreign firms. The household directly owns the domestic equity but only indirectly the foreign equity. To access foreign equities, the household needs to own shares in a portfolio of foreign equities provided by a "global trust" that is assumed to be the sole financial intermediary for all foreign investments. The values of the household's equity holdings in domestic firms and in the global trust change over the time, and the household allocates savings for investment. Collecting such investment funds across regions, the global trust re-invests the funds in firms around the world and offers a portfolio of equities to households. The sum of the household's equity holdings in the global trust is equal to the global trust's equity holdings in firms around the world.

In theory, incentives for investments or equity holdings are governed by rates of return, which will be equalized across regions if capital is perfectly mobile. However, this equalization of rates of return seems unrealistic, at least in the short-run. Further, there exists well-known empirical observations of so-called "home bias" in savings and investment, equity holdings by households, and capital flows. Home bias refers to empirical observations that domestic markets are preferred to foreign markets. These empirical observations suggest that capital is not perfectly mobile, leading to varying rates of return across regions. The dynamic GTAP model allows inter-regional differences in rates of return in the short run, which will be eventually equalized in the very long run. Differences in rates of return are attributed to the errors in investors' expectations about the future rate of returns. However, the errors in expectation are gradually adjusted to the actual rate of return. Eventually the errors are eliminated, and the unique rate of return across regions can be attained. Therefore, we assume perfect capital mobility applies only in the very long run.

Participating in FTA could lead to more investment from abroad. Trade liberalization often makes prices of goods from a participating country cheaper due to removal of tariffs, creating an increase in demand for the goods. Responding to the increased demand, production of the goods may expand in the exporting country. To increase the production, more intermediate goods, labor, capital, and other primary factors are demanded. These increased demands for production

inputs raise the corresponding prices, wage rates, and rental rates. Higher rental rates can be translated into higher rate of return, attracting more investment from both home and foreign countries.

4. Simulation Design and Policy Scenarios

This section describes our simulation design and policy scenarios. To conduct simulations with the Dynamic GTAP model, we begin by establishing the baseline scenario, a base of comparison with policy scenarios. The baseline scenario from 2004 to 2015 is built on the past data and projections of population (U.S. Census Bureau, 2011), real GDP (International Monetary Fund, 2011), and labor (International Labour Organization, 2011), so that the Dynamic GTAP model closely tracks these projections. In the baseline scenario, we did not incorporate policy changes caused by existing and ongoing FTAs for tractable comparison of the policy scenarios listed below. Absence of the policy changes in the baseline may affect simulation results of the policy scenarios.

Policy Scenarios:

• (A1): ASEAN (2011) Tariff
• (A5): ASEAN (2011–2015) Tariff
• (AS): ASEAN (2011–2015) Tariff+Services
• (AT): ASEAN (2011–2015) Tariff+Services+Time

The policy scenarios below implement Tariff+Services+Time over the 2011–2015 period, unless otherwise specified.

• (C): ASEAN–China FTA
• (J): ASEAN–Japan FTA
• (K): ASEAN–Korea FTA
• (N): ASEAN–India FTA
• (U): ASEAN–Australia and New Zealand FTA

• (Ax5): Five ASEAN+1s;
ASEAN–China, –Japan, –Korea, –India, –Australia and New Zealand
with additional costs of compliance with divergent rules of five FTAs
• (Ax5+CJK): Five ASEAN+1s and China–Japan–Korea (CJK) FTA
• (CJK): China–Japan–Korea FTA

• (A+3): ASEAN+3 (China, Japan, Korea) FTA
• (A+3t): ASEAN+3 (China, Japan, Korea) FTA, Tariff only
• (RCEP): RCEP (ASEAN+3, and India, Australia, New Zealand) FTA
• (RCEPt): RCEP (ASEAN+3, and India, Australia, New Zealand) FTA, Tariff only

In the policy scenarios, we assumed (a: Tariff) complete elimination of the tariffs over the specified period of time, and (b: Services) reduction of ad valorem equivalents of services trade barriers by 20% and (c: Time) improvements in logistics cutting the ad valorem time cost by 20%. All of the three liberalization components are applied to all FTA partner countries. Policy scenarios from A1 to AT focus on the ASEAN FTA with different FTA settings of duration of implementation and liberalization components. Scenario A1 assumes FTA implementation to be completed within one year. Although such an assumption is unrealistic given that many FTAs have been accomplished gradually over a period of multiple years, scenario A1 reveals effects of gradual implementation assumed in A5. Scenarios AS and AT distinguish the contributions of reducing services trade barriers and of improving logistics, respectively.

Five pairs of ASEAN+1 FTA are considered in scenarios C to U; C for China, J for Japan, K for Korea, N for India, and U for Australia and New Zealand. All of the liberalization components are implemented over the 2011-2015 period. Scenario Ax5 assumes that all of the five ASEAN+1s are concurrently implemented in the 2011-2015 period. Each of the five ASEAN+1 maintains its own rules and regulations regarding to liberalization, for example the rule of origins. Complying with different rules and regulations would incur additional costs, which effectively diminish the benefits of freer trade in goods and services. For this additional cost of compliance to be highlighted, the degree of reduction in services trade barriers and improvement in logistics are halved in this scenario. Scenarios CJK are for the implementation of China-Japan-Korea FTA in which no AMSs take part. Scenario Ax5+CJK is a combination of the two scenarios and aims to make a contrast with the scenario RCEP.

Scenario A+3 and A+3t simulate ASEAN+3 (China, Japan, Korea) FTA with and without reduction of services trade barriers and enhancement of logistics, respectively. Similarly, RCEP and RCEPt are simulation settings for the FTA between AMSs, China, Japan, Korea, India, Australia, and New Zealand. RCEP and RCEPt are different from the scenario Ax5, where the bilateral FTAs are not implemented among the 6 countries.

5. Simulation Results

For all of the policy scenarios, [Table 6 summarizes the simulation results as economic impacts of various FTAs on the welfare of AMSs. The impacts are measured in a percentage point deviation from the baseline, accumulated to 2015. At a glance of Table 6 it is clear that most of the figures show positive impact, indicating that the FTAs of AMSs' participation would lead to higher economic welfare. China–Japan–Korea FTA do not include AMSs at all, so adverse effects are expected, and the simulation results reported in CJK agree with such anticipation.

Policy scenarios from A1 to AT simulate trade liberalization among the AMSs, with different specifications of duration of implementation and components of liberalization, such as removal of tariffs, reduction in services trade barriers, and lowering trade cost of time. Comparing A1 with A5 in [Table 6, we can see the difference in welfare effects caused by the difference in the duration of FTA implementation, within one year (A1) or for a five-year period (A5). Shorter implementation of FTA tends to have larger welfare results, except for Viet Nam. There are small negative welfare impacts observed in the Philippines and Lao PDR for scenarios A1 and A5. The terms of trade in Philippines and Lao PDR became worse under these two scenarios of tariff removal. Brown (1987) noted that the monopoly power implicit in the trade models implementing the Armington assumption was the source of strong terms of trade effects resulting from tariff changes. The fact that the Dynamic GTAP model implements the Armington assumption can explain the negative welfare results due to worsening terms of trade in the Philippines and Lao PDR. With respect to the FTA components of "tariff," "services," and "time," the more one country commits to areas of liberalization, the more economic welfare gains accrue to that country. This point can be confirmed for all AMSs by comparing the welfare results of A5 (tariff), AS (tariff+services), and AT (tariff+services+time) in Table 6. The degree of welfare gains becomes considerably large as services trade liberalization enters into the FTA components (for example, AS over A5).

Policy scenarios from C to U compare five partners for ASEAN+1 FTAs in terms of economic welfare gain. China (C), Japan (J), Korea (K), India (N), Australia and New Zealand (U) are the five partners in comparison. It is clear that the AMSs' welfare gains are significantly larger when FTA with China is simulated. India and Japan tend to bring the second largest welfare gain, but its degree differs among the AMSs. Having considered five ASEAN+1 FTAs separately, policy scenario Ax5 simulates the five ASEAN+1 FTAs all at once, with additional costs caused by maintaining different rules and regulations adopted by each of the five

ASEAN+1 FTAs. For example, there would be diverse regulations regarding the rule of origin adopted by ASEAN+1s. As expected, welfare gains from Ax5 exceed any of the individual ASEAN+1 FTA. Because AMSs are not involved in the CJK policy scenario, the China-Japan-Korea FTA negatively affects AMSs' welfare, but the magnitudes of the negative effect are not significantly large except in the case of Viet Nam. The China-Japan-Korea FTA makes their goods and services more attractive for each other by reducing trade costs, while leaving AMSs out of the FTA. This leads to reductions in AMSs' trade with China, Japan and Korea, generating a trade diversion effect. Because of this adverse effect, the combined impact of Ax5 and CJK (Ax5+CJK) is less than the impact resulting from the Ax5 policy scenario.

ASEAN+3 (China, Japan, Korea) FTA and RCEP (AMSs, China, Japan, Korea, India, Australia, New Zealand) are considered in policy scenarios A+3 to RCEPt in Table 6. Additionally, "tariff" is singled out from the liberalization components in scenario A+3t and RCEPt, to distinguish the impact of abolishing tariffs from the impact of reducing services trade barrier and trade cost of time. For all of the AMSs except Lao PDR, the welfare gain from RCEP is larger than in ASEAN+3 (A+3). The impact of tariff elimination alone is small for most AMSs in both policy scenarios of A+3t and RCEPt, compared with full implementation of FTA with tariff removal and reductions of services trade barrier and trade cost of time.

[Table 6 around here]

[Table 7 reports the simulation results on real GDP for AMSs from the FTA policy scenarios in terms of cumulative percentage point deviation from the baseline in 2015. Except for the CJK scenario, all of the ASEAN member states are positively affected by all of the FTAs that are part of the liberalization. Among the FTA scenarios, the RCEP scenario leads to the largest gains in real GDP for most AMSs. Among the contributions to the GDP gains, the "services" component of liberalization remains significant for the AMSs, while the "time" component is more important for Lao PDR and Cambodia in improving their logistics.

[Table 7 around here]

6. Summary

In this study, we conducted policy simulations to capture the impacts of broader regional

trade liberalization, such as ASEAN FTA, ASEAN+1s with various trading partner countries, ASEAN+3, and RCEP, with a recursively dynamic CGE model of global trade, namely, the Dynamic GTAP model. The three main components driving the FTAs are reduction of average applied tariffs on goods, lowering barriers to trade in services, and saving time-costs associated with logistics.

Overall, the simulation results reveal that welfare from gradual implementation of tariff removal tends to be dominated by faster FTA implementation and that reducing ad valorem equivalents of services trade barriers has significant positive impacts on economic welfare. With respect to time saving due to improvements in shipping goods, there are steady contributions to welfare gains for many ASEAN member states (AMSs). Although there are differences in the magnitude of positive contributions to welfare, all of the FTAs in which the AMSs participate tend to raise welfare. Among the FTA policy scenarios, RCEP leads to the highest positive gain on real GDP for most of the AMSs.

Given the dynamic nature of ASEAN member states' economic activities, policy simulation results, which depend on underlining databases and estimates, are subject to further improvements and updates. As an area of continuing study, we would like to construct an efficient way to incorporate more recent economic information into our database, estimates, and simulation models. Once the latest inputs become available, it will be desirable to conduct similar studies as updates.

Table 1: Regional Aggregation of the GTAP Data Base

No.	Region	GTAP 112 regions
1	Japan	Japan
2	China	China; Hong Kong
3	Korea	Korea
4	Taiwan	Taiwan
5	Singapore	Singapore
6	Indonesia	Indonesia
7	Malaysia	Malaysia
8	Philippines	Philippines
9	Thailand	Thailand
10	VietNam	Viet Nam
11	Lao PDR	Lao People's Democratic Republic
12	Cambodia	Cambodia
13	RoSEAsia	Rest of Southeast Asia
14	India	India
15	AusNzl	Australia; New Zealand
16	USA	United States of America
17	Canada	Canada
18	Mexico	Mexico
19	ChilePeru	Chile; Peru
20	Russia	Russian Federation
21	EU_27	Austria; Belgium; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Poland; Portugal; Slovakia; Slovenia; Spain; Sweden; United Kingdom; Bulgaria; Romania
22	RestofWorld	Rest of the GTAP 112 regions

Source: GTAP Data Base version 7.1.

Table 2: Sectoral Aggregation of the GTAP Data Base

No.	Sector	GTAP 57 sectors
1	Rice	Paddy rice; Processed rice
2	GrainOthFood	Wheat; Cereal grains nec; Food products nec
3	VegeFruit	Vegetables, fruit, nuts
4	VegeSeedsOil	Oil seeds; Vegetable oils and fats
5	SugarCropBt	Sugar cane, sugar beet; Crops nec; Sugar; Beverages and tobacco products
6	FiberTex	Plant-based fibers; Wool, silk-worm cocoons; Textiles
7	MeatDairy	Cattle, sheep, goats, horses; Animal products nec; Raw milk; Meat: cattle, sheep, goats, horses; Meat products nec; Dairy products
8	WoodPaper	Forestry; Wood products; Paper products, publishing
9	Fishery	Fishing
10	Energy	Coal; Oil; Gas; Petroleum, coal products
11	Minerals	Minerals nec; Mineral products nec
12	Apparel	Clothing apparel
13	Chemical	Chemical, rubber, plastic prods
14	Metal	Ferrous metals; Metals nec; Metal products
15	Auto	Motor vehicles and parts
16	Machinery	Transport equipment nec; Machinery and equipment nec
17	ElecEquip	Electronic equipment
18	OthMnfct	Leather products; Manufactures nec
19	Utilities	Electricity; Gas manufacture, distribution; Water
20	Trade	Trade
21	TransComm	Transport nec; Sea transport; Air transport; Communication
22	FinsBusi	Financial services nec; Insurance; Business services nec
23	CnstOthSrv	Construction; Recreation and other services; Public Administration, Defense, Health, Education; Dwellings

Source: GTAP Data Base version 7.1.

Table 3: Summary Macro Variables (US$, billion)

	GDP	C	I	G	EXP	IMP
Lao PDR	2.5	1.8	0.7	0.3	0.7	-0.9
Cambodia	4.9	2.5	0.9	0.4	4.2	-3.2
RoSEAsia	13.3	6.9	2.6	1.2	7.6	-5.0
VietNam	43.0	29.1	15.1	2.8	32.7	-36.6
Philippines	84.5	58.9	14,1	8.7	51.5	-48.8
Singapore	106.8	55.3	31.4	13.9	166.9	-160.7
Malaysia	114.9	37.4	17.3	11.6	154.9	-106.3
ChilePeru	158.3	98.4	31.2	17.0	51.5	-39.8
Thailand	161.7	86.9	40.3	16.1	121.2	-102.8
Indonesia	254.7	174.8	49.3	20.0	87.5	-76.9
Taiwan	305.3	171.8	54.9	34.1	222.5	-178.0
Russia	569.8	289.8	106.5	96.9	204.9	-128.3
India	641.3	434.0	156.4	74.0	104.2	-127.3
Korea	676.5	339.9	194.8	89.0	308.9	-256.1
Mexico	683.2	462.3	139.4	78.7	191.3	-188.4
AusNzl	734.2	438.3	177.8	131.3	136.4	-149.6
ASEAN	773.0	446.6	169.2	74.0	619.5	-536.3
Canada	979.1	560.8	205.5	198.2	327.9	-313.3
China	1,837.1	789.5	722.0	206.9	826.1	-707.3
RestofWorld	4,371.8	2,589.7	916.5	728.3	1,559.1	-1,421.8
Japan	4,658.7	2,628.9	1,095	818.7	655.7	-539.5
USA	1,1673.4	8,233.0	2,198.5	1,809.9	1,088.9	-1,656.9
EU_27	12,895.4	7,680.0	2,530.1	2,742.2	4,185.6	-4,242.5

Source: GTAP Data Base version 7.1.

Table 4: ASEAN's Sectoral Imports (US$, billion) and Average Applied Tariff Rates(%)

	Import	Tariff
Rice	0.9	17.7
GrainOthFood	10.4	11.0
VegeFruit	2.2	9.1
VegeSeedsOil	5.0	6.8
SugarCropBt	5.7	33.3
FiberTex	16.9	13.2
MeatDairy	4.9	4.5
WoodPaper	11.4	6.5
Fishery	0.6	4.6
Energy	49.5	2.0
Minerals	8.0	5.1
Apparel	3.3	9.9
Chemical	59.6	4.8
Metal	41.7	5.1
Auto	17.5	22.5
Machinery	88.0	3.6
ElecEquip	122.0	1.1
OthMnfct	9.5	6.7
Utilities	0.8	0.0
Trade	12.3	0.0
TransComm	19.3	0.0
FinsBusi	33.3	0.0
CnstOthSrv	13.3	0.0

Source: GTAP Data Base version 7.1.

Table 5: Changes in MFN Average Applied Tariff Rates in Indonesia and Thailand (2009)

	Indonesia	Thailand
Rice	n.a.	n.a.
GrainOthFood	0.62	1.21
VegeFruit	1.52	1.72
VegeSeedsOil	1.41	0.49
SugarCropBt	0.47	2.27
FiberTex	1.07	0.78
MeatDairy	0.87	1.08
WoodPaper	1.37	0.96
Fishery	1.1	0.94
Energy	0.18	0.96
Minerals	0.84	0.92
Apparel	1.05	0.92
Chemical	0.71	0.81
Metal	0.58	0.58
Auto	0.95	0.9
Machinery	0.85	0.61
ElecEquip	0.26	0.51
OthMnfct	1.38	1.38
Utilities	1.42	n.a.
Trade	n.a.	n.a.
TransComm	n.a.	n.a.
FinsBusi	n.a.	n.a.
CnstOthSrv	n.a.	n.a.

Note: 2004 = 1.0
Source: Computed from WTO (2011)

Table 6: Impact on Welfare (2015)

	Indonesia	Malaysia	Philippines	Thailand	Viet Nam	Lao PDR	Cambodia	RoSEAsia	Singapore
A1	0.05	0.08	-0.02	0.52	0.19	-0.23	1.84	0.32	1.33
A5	0.02	0.07	-0.05	0.46	0.26	-0.38	1.61	0.27	1.18
AS	1.36	0.62	0.50	1.53	2.23	0.13	2.69	0.25	4.01
AT	1.65	0.93	0.69	1.90	2.90	1.62	3.87	0.64	4.87
C	4.26	4.01	2.74	7.91	7.94	2.94	7.27	0.60	11.64
J	2.47	1.28	0.72	4.97	4.74	1.47	4.24	0.77	4.59
K	1.97	1.15	0.82	2.38	4.40	1.65	4.23	0.81	5.28
N	2.74	1.94	0.96	2.71	4.17	1.89	4.15	1.10	7.25
U	1.98	1.17	0.86	2.29	3.48	1.63	3.99	0.64	4.82
Ax5	4.75	5.20	2.37	10.80	11.14	1.80	6.68	1.08	11.22
Ax5+CJK	4.32	4.54	1.91	9.22	9.50	1.48	5.31	0.68	8.68
CJK	-0.32	-0.40	-0.35	-0.75	-1.19	-0.28	-0.65	-0.48	-0.74
A+3	4.57	4.23	2.40	9.69	10.31	2.53	6.42	0.51	8.48
A+3t	-0.18	1.04	-0.63	4.27	2.80	-0.80	0.33	-0.04	2.00
RCEP	5.39	5.19	2.44	10.03	11.19	2.49	6.44	0.81	9.21
RCEPt	0.24	1.55	-0.72	4.12	2.80	-0.99	0.29	0.20	2.34

Note: percentage point cumulative deviation from the baseline
A1: tariff (2011), A5: tariff (2011-15), AS: tariff + services, AT: tariff + services + time
C: China, J: Japan, K: Korea, N: India, U: Australia and New Zealand
Ax5: five ASEAN+1s, with compliance costs, Ax5+CJK: Ax5 and China-Japan-Korea (CJK) FTA, with compliance costs
A+3: ASEAN+3, A+3f: ASEAN+3(tariff only), RCEP: RCEP, RCEPt: RCEP(tariff only)
Source: Simulation results

Table 7: Impact on GDP (2015)

	Indonesia	Malaysia	Philippines	Thailand	Viet Nam	Lao PDR	Cambodia	RoSEAsia	Singapore
A1	0.3	0.3	0.5	0.7	1.3	1.2	3.6	1.3	0.6
A5	0.2	0.1	0.3	0.4	0.8	0.7	2.2	0.9	0.3
AS	1.6	0.6	0.8	1.2	2.7	0.8	2.9	0.9	1.4
AT	2.0	0.9	1.0	1.5	3.5	2.3	4.4	1.5	1.6
C	4.5	2.7	2.7	5.7	8.9	2.9	8.3	1.8	3.6
J	3.4	2.2	1.6	4.3	6.3	2.4	5.7	2.0	1.7
K	2.4	1.4	1.2	1.9	5.4	2.4	4.7	1.7	1.9
N	2.4	1.4	1.2	1.9	4.5	2.4	4.6	1.8	2.4
U	2.4	1.2	1.3	2.0	4.2	2.5	4.7	1.6	1.6
Ax5	4.8	4.5	3.0	8.0	12.1	2.2	8.6	2.3	3.6
Ax5+CJK	4.5	4.2	2.7	7.3	11.2	2.0	8.1	2.0	2.7
CJK	-0.3	-0.3	-0.3	-0.7	-0.7	-0.1	-0.4	-0.2	-0.5
A+3	5.4	4.4	3.1	7.8	12.5	2.9	9.3	2.1	2.7
A+3t	0.4	1.4	0.5	3.0	4.7	0.5	2.9	1.2	0.3
RCEP	5.8	5.0	3.3	8.3	13.4	3.0	9.5	2.3	2.9
RCEPt	0.4	1.6	0.5	3.0	4.7	0.6	3.0	1.4	0.4

Note: percentage point cumulative deviation from the baseline
A1: tariff (2011), A5: tariff (2011-15), AS: tariff + services, AT: tariff + services + time
C: China, J: Japan, K: Korea, N: India, U: Australia and New Zealand
Ax5: five ASEAN+1s, with compliance costs, Ax5+CJK: Ax5 and China-Japan-Korea (CJK) FTA, with compliance costs
A+3: ASEAN+3, A+3f: ASEAN+3(tariff only), RCEP: RCEP, RCEPt: RCEP(tariff only)
Source: Simulation results

Appendix

Table A1. Tariff Equivalents of Services Trade Barriers (%)

	Utilities	Trade	TransComm	FinsBusi	CnstOthSrv
ASEAN	36.1	81.0	52.5	72.4	75.2
Indonesia	178.8	185.0	167.4	159.9	181.0
Malaysia	63.6	67.5	54.0	53.1	63.6
Philippines	138.0	143.4	126.6	123.2	140.2
Thailand	97.3	110.0	96.0	93.0	107.4
Viet Nam	152.2	157.9	138.4	136.7	154.6
Lao PDR	52.9	58.9	46.6	46.1	58.8
Cambodia	80.7	89.1	78.4	77.4	87.0

Source: Computed from Wang et al. (2009).

Table A2. Time saving from Logistic Improvement on Imports (in number of days)

	Days
Indonesia	2.8
Malaysia	1.4
Philippines	1.2
Thailand	1.6
Viet Nam	2.4
Lao PDR	4.4
Cambodia	2.4

Source: Computed from Minor and Hummels (2011).

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