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An Analysis of the Potential Economic Effects of Bilateral, Regional, and Multilateral Free Trade

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Abstract

This paper presents a computational analysis of the potential economic effects of trade liberalization in various regional and bilateral free trade agreements (FTAs) that have been negotiated in recent years and the negotiations currently in process, as well as the effects of global (multilateral) free trade. The analysis is based on the Michigan Model of World Production and Trade. The major findings are summarized as follows. First, the effects of regional FTA are larger than those of bilateral FTA. Second, among FTA member countries, small countries have larger benefits (in terms of the percentage of GDP) than large countries. Finally, the effects of multilateral free trade are significantly larger than those of bilateral and regional FTAs.

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1. Introduction

This paper presents a computational analysis of the potential economic effects of trade liberalization in various regional and bilateral free trade agreements (FTAs) that have been negotiated in recent years and the negotiations currently in process, as well as the effects of global (multilateral) free trade. The analysis is based on the Michigan Model of World Production and Trade. The Michigan Model is a multi-country/multi-sector computational general equilibrium (CGE) model of the global trading system that has been designed to analyze the economic effects of multilateral, regional, and bilateral trade negotiations and a variety of other changes in trade and related policies.

In this paper, we examine following six bilateral FTAs, four regional FTAs, and multilateral free trade.

Bilateral FTA
- Australia – New Zealand
- Japan – Singapore
- Japan – Mexico
- Chile – Korea
- Australia – United States
- Singapore – United States

Regional FTA
- ASEAN Free Trade Area (AFTA)
- AFTA – China
- European Union (EU) – Mexico
- North American Free Trade Area (NAFTA)

Multilateral free trade

In what follows, Section 2 briefly discusses the key issues in understanding the results of CGE studies: "rules of thumb," coverage, and the evaluation of CGE models. Section 3 examines the potential economic effects of trade liberalization in various regional and bilateral FTAs that have been negotiated in recent years and the negotiations currently in process, as well as the effects of global (multilateral) free trade. Section 4 summarizes major findings and discusses policy implications.

2. Key Issues in Understanding the Results of CGE Studies: "Rules of Thumb," Coverage, and Evaluation

A number of CGE studies have examined the potential economic effects of FTAs. Since different models yielded different results, it is sometimes not easy to understand what is going on in the models.[1] Before going into the analysis, it is useful to discuss the key issues in understanding the results of CGE studies. Specifically, we discuss "rules of thumb," coverage, and evaluation of the model.

2.1. "Rules of Thumb" of the CGE Models

Although CGE studies are regarded as one of the useful ways to compute the potential benefits of free trade, the complex interrelationships of the functions in the model sometimes make it difficult to identify which factors drives the results. Before going into the analysis, therefore, this section summarizes the "rules of thumb" of CGE models. There are three key aspects to interpret the results of CGE model.

First aspect is the simulation scenario. Recent CGE studies such as Harrison, Rutherford, and Tarr (2003) and Brown, Kiyota, and Stern (2006) found that countries included in an FTA almost always gain. This is because of the trade creation effect. However, the effects on countries excluded from an FTA are not clear. The complex production and trade patterns of intermediate goods sometimes offset the trade diversion effects, which results in the gains to the non-member countries. In this connection, it is also confirmed that the gains from multilateral trade liberalization to the world were significantly larger than those from a network of bilateral and regional FTA.[2]

Second aspect is concerning trade externalities, or exogenous shocks other than trade liberalization such as productivity growth associated with trade liberalization. Robinson and Thierfleader (2002) pointed out that the gains from an FTA tended to be large if the model incorporated trade externalities.[3] Note, however, that there is no consensus on the channels and scales of externalities and, therefore, it is difficult to tell how much productivity gains we have with the trade liberalization. The productivity

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[1] Piermartini and Teh (2005) provided a literature review on the recent CGE studies of multilateral trade negotiations.

[2] See, for instance, Harrison, Rutherford, and Tarr (2003) and Brown, Kiyota, and Stern (2006).

[3] For instance, Ando and Urata (2005, Table 7) found that the effects of ASEAN plus Three (China, Japan, and Korea) FTA on real gross domestic output (GDP) of Japan were 0.01 percent if the simulation incorporated trade liberalization only. They also found that the effects amounted to 0.31 percent once the simulation includes trade externalities (i.e., various facilitations and coordination) in addition to trade liberalization and capital accumulation.

growth is tended to incorporate into models as "ad-hoc" exogenous shock.[4] Similarly, the exogenous shocks of capital accumulation sometimes bring large gains from trade liberalization. In order to provide reliable numbers, sensitivity analysis of trade externalities and/or exogenous shocks should be presented if such mechanisms are incorporated into the simulation. The abuse of exogenous trade externalities should be avoided, especially when the study is used to design policies.

Third aspect is the model structure. In particular, the expected results sometimes depend on whether the model is static or not. The welfare gains of dynamic model tend to be larger than those of static model (Robinson and Thierfleader, 2002). However, Harrison, Rutherford, and Tarr (2003) claimed that the dynamic models did not reverse the conclusions obtained from the static models.

Some studies also claimed that the results depended on whether the model assumes perfect competition or not. For instance, Robinson and Thierfleader (2002) argued that the welfare gains become large if the model used in the study is "sophisticated." In other words, the larger welfare gains will be obtained from the model with imperfect competition than the model with perfect competition, which is also found by Roland-Holst, Reinert, and Shiells (1994) and Francois and Roland-Holst (1997). Note, however, that a model has to introduce the Armington assumption in order to model perfect competition and describe intra-industry trade at the same time. Since the Armington assumption means that every country has some market powers, it sometimes generates large terms-of-trade effects. Therefore, the larger gains can be attributable to the abolition of the Armington assumption rather than the introduction of imperfect competition although it is difficult to distinguish these two effects.

2.2. Coverage of the CGE Model

2.2.1. Merchandise Trade

Most of CGE models and data cover both merchandise trade and its tariff barriers. One of the most popular data is GTAP database of Purdue University. The trade data of GTAP database are constructed from the United Nation's COMTRADE database.[5] GTAP also constructed tariff- and non-tariff barriers of merchandise trade. Specifically, the GTAP constructs the data of average import tariff rates, average export subsidy rates, and agricultural domestic support (i.e., output subsidies, intermediate input subsidies, land-based payments). Other protection measures such as anti-dumping

[4] Some more "sophisticated" treatments are to assume that productivity is a simple function of "something" such as exports (DeMelo and Robinson, 1992).

[5] Accordingly, the input-output tables in GTAP database are "updated" to maintain the internal consistency.

duties, price undertaking, and voluntary export restrains (VERs) are not available in the GTAP version 5.4. For more detail about GTAP database, see Dimaranan and McDougall (2002).

2.2.2. Services Trade

There are several studies that try to examine the effects of services trade liberalization. There are two problems to be overcome. First, how do we capture services trade? CGE studies overcome this problem by using input-output table. If input-output table reports the services trade as well as merchandise trade, the first problem does not seem to be a problem. Note, however, that definition and coverage of input-output table are different from those of GATS/WTO. For instance, input-output table does not cover the transaction of patent payments.

Second, how do we quantify the barriers to trade in services? According to Stern (2002), there are four types of the measurement of barriers to trade in services: frequency measures, price-based measures, quantity-based measures, and financial-based measures.[6] Since the price data on service types are difficult to obtain, existing studies often use frequency measures, quantity-based measures, or financial-based measures.

One of the most commonly used frequency measure is the frequency ratio that is constructed on the basis of the number of commitments scheduled in the GATS by each country.[7] The frequency ratio is consistent with the schedules of the GATS, but there are some pitfalls.[8] First, the frequency ratio does not mean absolute *ad valorem* tariff equivalents but means the relative degree of restriction. This makes it difficult to compare the ratios across sectors. Second, the equal weight is given to the different types of restrictions. Finally, the absence of positive country commitments in the GATS schedule is sometimes assumed to indicate the presence of restriction.

Quantity-based measures are typically based on residuals generated by econometric models. Specifically, the barriers in quantity-based measures are defined as the difference between observed trade and predicted trade. However, the residuals can depend upon the specification.[9] Moreover, Whalley (2004) pointed out that "barrier estimates obtained in this way could be negative even when no trade restricting

[6] For a more detailed explanation of these measures, see Stern (2002).
[7] This yields 1240 total commitments on market access and national treatment (155 sectors and subsectors × 4 modes of supply × 2 commitment categories).
[8] For the detailed discussion of pitfalls in the measurement of services trade barriers, see Stern (2002) and Whalley (2004).
[9] Leamer (1988) argued that the difference between actual and predicted trade might not necessarily reflect barriers of trade.

interventions apply. Also, quantity-based measures can be positive even when frequency indices are zero."

Financial-based measures use financial data on gross operating margins calculated by sector and country. Since the financial-based measures are indirect measures to capture services barriers, it is difficult to take account of the differences in the quality and variety of services for different sectors and countries. Nonetheless, Stern (2002) has stressed that the financial-based measures are promising because these measures can be constructed for many sectors and countries and are therefore useful as a first approximation of the cost-raising effects of services. Hoeckman (2000) also suggested that financial-based measures could provide some sense of the relative magnitude of barriers to entry/exit that may exist.

2.2.3. Foreign Direct Investment (FDI)

Another important issue is foreign direct investment (FDI) since FDI related issues are sometimes discussed in the negotiation of FTA. Although previous studies recognize the importance, most of them did not incorporate the effects of FDI. The difficulty is in the data availability. If FDI data were available like trade data, FDI can be incorporated into a CGE model like international trade. In reality, however, it is difficult to identify both source and destination at the industry level.

Despite the limited availability of FDI data, Hanslow, Phamduc, and Verikios (2000) constructed the CGE model that incorporates the FDI. This study follows the framework proposed by Petri (1997) where product varieties are assumed to be differentiated by firms headquartered in different regions.[10] Capital is assumed to less than perfectly mobile across countries and sectors and allocated according to the rate of return to capital. FDI stock data are estimated from various sources while barriers of FDI are modeled as taxes on capital.[11] A reduction in FDI barriers thus means the increases in rate of return to capital, which leads to an increase in inward FDI flows (and accordingly, FDI stock) in that country.

Although this approach looks attractive, there are some limitations. One of the biggest limitations might be the limited number of industries. Lack of the FDI sectoral data limits the number of industries is only three (agriculture, manufacturing, and services), which is not enough information in designing the policy.[12]

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[10] Lee and van der Mensbrugghe (2001) also employed similar framework although they did not provide detailed explanation about the source of FDI data.

[11] For more detail about the FDI data in FTAP model, see Hanslow, Phamduc, and Verikios (2000).

[12] There are some studies that incorporate FDI as exogenous shocks such as increases in capital stock with FTA. However, such use of FDI shocks causes similar problems to trade externalities.

2.2.4. Safe Guard (SG) and Rules of Origin (ROO)

Although many scholars recognize that safe guard (SG) and the rules of origin (ROO) are important issues to be included in the CGE model, no studies have been tackled these problems. One of the main reasons is the availability of the data. For instance, in order to examine the effects of SG, the detailed commodity level trade, production, and consumption data are needed. Even if trade data are available, corresponding production and consumption data are difficult to obtain.

The ROO is much more difficult to incorporate into the model since, first of all, it is not easy to define the "origin." The "origin" can be defined as the country where the specific process is made, where the largest value is added, or where the final change of harmonized system (HS) code is made. Indeed, there is no consensus on the definition of "origin" and, therefore, various definitions are used in different FTAs. Besides, it is impossible to trace the "origin" of the products by an input-output table, once the imported products used as intermediate inputs of some products.

2.3. Evaluation of the Performance of the CGE Models

Despite the large number of CGE studies, only a few studies evaluate the performance of the previous studies. Gelhar (1997) evaluated the performance of the GTAP model. He first *backcasted* the export shares from 1992 to 1982, and checked the correlation between predicted and actual changes in export shares. The result suggested that the model under-predicted changes in export shares of some regions (i.e. East Asian countries), but the model predicted the direction of changes well.

Fox (2004) evaluated the performance of the Michigan Model. Conducting the NAFTA simulation by the Michigan Model, Fox (2004) calculated the correlation between predicted and actual imports. He concluded that the Michigan Model predicted the general patterns of trade relatively well although it under-predicted the magnitude of changes in trade flows.

Kehoe (2005) evaluated the performance of the Michigan Model as well as other two models that examined the NAFTA. He examined the correlation between predicted and actual changes in exports and found that all models including the Michigan Model did not present a good performance. He criticized that all models rely on the "New Trade Theory," which in turn means that trade is driven by the Dixit-Stiglitz type utility or

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Besides, the exogenous increases in domestic capital stock tend to have tremendously large positive impacts on production and thus welfare. Since it is difficult to expect how much FDI is caused by FTA, the introduction of FDI as an exogenous shock is not easy to justify.

production functions. As Yi (2003) suggested, Dixit-Stiglitz type variety functions cannot explain the recent growth of international trade.

With the limited availability of the evaluation studies, it is difficult to conclude the reliability of the CGE models. But previous evaluation studies suggest that the CGE models at least predicted the direction and the pattern of trade relatively well. Since the scale largely depends upon the functional forms and elasticities, the development of new functional forms and estimation of more reliable elasticities are necessary steps to increase the reliabilities.

3. Potential Economic Effects of Bilateral, Regional, and Multilateral Free Trade

3.1. The Michigan Model of World Production and Trade

3.1.1. Overview of the Michigan Model

The modeling framework to be used largely depends upon the availability of comprehensive data on services trade and FDI. For instance, Dee and Hanslow (2001) and Brown and Stern (2001) explicitly link parents and affiliates. But the lack of detailed FDI data makes it difficult to disaggregate sectors, which in part is why these authors used a 3-sector CGE model (agriculture, manufacturing, and services). But perhaps more binding constraint was that these services/FDI models proved very difficult to disaggregate and were difficult to show computationally.

The other group of studies treats services like goods and thus cannot take into account important aspects of FDI. But these studies typically disaggregate sectors and are well grounded in "standard" trade theory.

The version of the Michigan Model used in this paper is in the spirit of this second group of models. It analyzes services trade liberalization in response to the removal of services barriers. The model covers 18 economic sectors in each of 22 countries/regions, in Table 1. The distinguishing feature of the Michigan Model is that it incorporates some aspects of trade with imperfect competition, including increasing returns to scale, monopolistic competition, and product variety. A more complete description of the formal structure and equations of the model can be found on line at www.Fordschool.umich.edu/rsie/model/.[13] The detailed description of the Michigan Model is presented in the Technical Appendix.

=== Table 1 ===

3.1.2. Sectors and Market Structure

[13] See also Deardorff and Stern (1990, pp. 9-46) and Brown, Kiyota, and Stern (2006).

As mentioned, the version of the model to be used here consists of 18 production sectors and 22 countries/regions (plus rest-of-world). The sectoral and country/region coverage are indicated in the tables below. Agriculture is modeled as perfectly competitive with product differentiation by country of origin, and all other sectors covering manufactures and services are modeled as monopolistically competitive. Each monopolistically competitive firm produces a differentiated product and sets price as a profit-maximizing mark-up of price over marginal cost. Free entry and exit of firms then guarantees zero profits.

3.2. Data

3.2.1. Base Data

Apart from numerous share parameters, the model requires various types of elasticity measures. Like other CGE models, most of my data come from published sources. The main data source used in the model is the GTAP-5.4 Database of the Purdue University Center for Global Trade Analysis Project (Dimaranan and McDougall, 2002). The reference year for this GTAP database is 1997. From this source, we have extracted the following data, aggregated to my sectors and countries/regions:[14]

- Bilateral trade flows among 22 countries/regions, decomposed into 18 sectors. Trade with the rest-of-world (ROW) is included to close the model.
- Input-output tables for the 22 countries/regions, excluding ROW.
- Components of final demand along with sectoral contributions for the 22 countries/regions, excluding ROW.
- Gross value of output and value added at the sectoral level for the 22 countries/regions, excluding ROW.
- Bilateral import tariffs by sector among the 22 countries/regions.
- Elasticity of substitution between capital and labor by sector.
- Bilateral export-tax equivalents among the 22 countries/regions, decomposed into 18 sectors.

The monopolistically competitive market structure in the nonagricultural sectors of the model imposes an additional data requirement of the numbers of firms at the sectoral level, and there is need also for estimates of sectoral employment. The employment data, which have been adapted from a variety of published sources, will be noted in tables below.

The GTAP-5.4 1997 database has been projected to the year 2005, which is when the Uruguay Round liberalization will have been fully implemented. In this

[14] The country/region and sectoral mappings are indicated in Appendix Tables 1 and 2.

connection, we extrapolated the labor availability in different countries/regions by an average weighted population growth rate of 1.2 percent per annum. All other major variables have been projected, using an average weighted growth rate of GDP of 2.5 percent.

The 2005 data have been adjusted to take into account two major developments that have occurred in the global trading system since the mid-1990s. These include: (1) implementation of the Uruguay Round negotiations that were completed in 1993-94 and were to be phased in over the following decade; and (2) the accession of Mainland China and Taiwan to the WTO in 2001.[15] We have made allowance for the foregoing developments by readjusting the 2005 scaled-up database for benchmarking purposes to obtain an approximate picture of what the world may be expected to look like in 2005. In the computational scenarios to be presented below, we use these re-adjusted data as the starting point to carry out my liberalization scenarios for the U.S. bilateral FTAs and for the accompanying unilateral and global free trade scenarios.

The GTAP-5.4 1997 database for tariffs is broken down by sector on a global basis and bilaterally for existing and prospective FTA partners of Japan in Table 2. The post-Uruguay Round tariff rates on agriculture, mining, and manufactures are applied rates and are calculated in GTAP by dividing tariff revenues by the value of imports by sector.[16]

=== Table 2 ===

3.2.2. Measurement of Trade Barriers in Services

The GTAP-5.4 1997 database does not report any trade barriers in services. In this paper, services barriers are based on financial data on average gross (price-cost) margins. The data were constructed initially by Hoekman (2000) and adapted for modeling purposes in Brown, Deardorff, and Stern (2002) and Brown, Kiyota, and Stern (2006). The gross operating margins are calculated as the differences between total revenues and total operating costs. Some of these differences are presumably attributable to fixed costs. Given that the gross operating margins vary across countries,

[15] The tariff data for the WTO accession of China and Taiwan have been adapted from Ianchovichina and Martin (2004).

[16] Note that the barriers are measured at year 2005, not at the initial year of negotiation. The simulation can examine how much effects are expected from the removal of these (current) barriers but cannot do how much effects are expected from the FTA. If the process of free trade has already been started, we might underestimate the effects of FTA. For instance, the large "potential" effects are not expected from the NAFTA since the removal of trade barriers has already been completed between Canada, Mexico, and the United States.

a portion of the margin can also be attributed to barriers to FDI. For this purpose, a benchmark is set for each sector in relation to the country with the smallest gross operating margin, on the assumption that operations in the benchmark country can be considered to be freely open to foreign firms. The excess in any other country above this lowest benchmark is then taken to be due to barriers to establishment by foreign firms.

That is, the barrier is modeled as the cost-increase attributable to an increase in fixed cost borne by multinational corporations attempting to establish an enterprise locally in a host country. This abstracts from the possibility that fixed costs may differ among firms because of variations in market size, distance from headquarters, and other factors. It is further assumed that this cost increase can be interpreted as an *ad valorem* equivalent tariff on services transactions generally.[17] It can be seen in Table 2 that the constructed services barriers are considerably higher than the import barriers on manufactures. While possibly subject to overstatement, it is generally acknowledged that many services sectors are highly regulated and thus restrain international services transactions.

3.3. Results

Table 3 presents the simulation results. This table indicates the expected welfare gains relative to GDP, by country. We also examine the difference of the impacts on member and non-member countries. The effects on member (and non-member) countries are computed from the sum of the welfare gains of member (non-member) countries divided by the sum of the GDP of member (non-member) countries. Shaded cells mean the member countries of each FTA.

=== Table 3 ===

The results of bilateral FTA indicate that the potential benefits for member countries are the largest in Korea-Singapore FTA (KOR-SGP FTA), followed by the Australia-U.S. FTA (AUS-USA FTA). The expected welfare gains of member countries are 0.27 percent of GDP for Korea and Singapore and 0.23 percent for United States and Australia. The bilateral FTA sometimes causes negative welfare effects on non-member countries but the negative effects are small, indicating less than 0.03 percent of GDP (in absolute values).

[17] Note that these margins are not related to the government revenues. In that sense, the margins are interpreted as rents and there are entry barriers in services sectors before the liberalization. The liberalization in services sectors can thus be interpreted as the removal of entry barriers for both domestic and foreign firms to ensure market access.

The effects of regional FTA present larger figures than those of bilateral FTA. Expected effects of AFTA, AFTA-China (AFTA-CHN), and EU-Mexico (EU-MEX) for member countries are 2.25 percent, 1.93 percent, and 0.32 percent, respectively. The expected effects of AFTA are larger than those of AFTA-China because of the size of Chinese economy. Although the effects of regional FTA on non-member countries are generally larger than those of bilateral FTA, the effects are still very small, indicating less than 0.1 percent of GDP (in absolute values).

Note that the potential effects of NAFTA are almost equal to zero. This does not mean that the NAFTA did not have any contribution to the increases in welfare. As discussed above, the simulation is based on the removal of trade barriers in 2005. The negligible effects of NAFTA are thus attributed to the fact that the process of free trade in NAFTA has already completed in 2005.

It is also interesting to note that the potential economic benefits become large (in terms of the percentage of GDP) if the size of the country become small relative to other member countries. This result suggests that the small countries tend to have large benefits from free trade. Since the size of developing countries is small in general, the developing countries might have large gains from the FTA between developed and developing countries if developed country open its markets without any exception.

Finally, the effects of multilateral free trade are significantly larger than those of bilateral and regional FTAs. The average welfare effects are 7.0 percent of GDP. Developing countries tend to have larger welfare gains (e.g., 9.6 percent for China and Indonesia, 17.1 percent for the Philippines, 14.8 percent for Central America and Caribbean countries, and 10.9 percent for Morocco). The welfare effects of multilateral free trade tend to be smaller for developed countries but are significantly larger than those of bilateral and regional FTAs (e.g., 7.4 percent for Japan, 5.3 percent for the United States, and 7.3 percent for European Union). As Harrison, Rutherford, and Tarr (2003) and Brown, Kiyota, and Stern (2006) indicated, the potential gains from the currently negotiated bilateral and regional FTA networks cannot overwhelm the effects of multilateral free trade. These results suggest the importance of free trade through multilateral negotiations.

3.4. Discussion

The results presented in Table 3 are much larger than the results obtained in previous studies. For instance, DeRosa and Gilbert (2004) examined that the effects of various U.S. FTAs based on the standard GTAP model and the GTAP database. Their results indicated that the effects of Australia-U.S. FTA on equivalent variation would be

0.02 percent of GDP for Australia and 0.01 percent of GDP for the United States. Similarly, the welfare effects of Singapore-U.S. FTA would be 0.43 percent for Singapore and 0.0 percent for the United States. Although the Michigan Model is different from the GTAP model in various aspects such as model structure, main reasons of the different results can be attributable to whether the model incorporates services trade liberalization or not.[18]

Tables 4 and 5 indicate the decomposition of the welfare effects. Table 4 indicates that the effects of liberalization in agricultural protection and manufactures tariffs combined are comparable to the results of DeRosa and Gilbert (2004). The effects of Australia-U.S. FTA are 0.10 percent of GDP for Australia and 0.03 percent of GDP for the United States. Similarly, the welfare effects of Singapore-U.S. FTA are 0.39 percent for Singapore and 0.0 percent for the United States.

=== Tables 4 and 5 ===

It is also interesting to note that the large part of welfare gains is attributable to the liberalization in either manufactures tariffs or services barriers. While developed countries mainly gain from the liberalization in services barriers, the major source of welfare gains in developing countries is in the removal of manufactures tariffs. The result implies that a key issue in trade liberalization is in the market access for developed countries while in the removal of barriers in manufacture products for developing countries.

4. Concluding Remarks

This paper discusses the key issues of CGE studies and examined the potential effects of bilateral, regional, and multilateral free trade. The literature review suggests that we should be careful in interpreting the simulation results since some of the results are driven by the characteristics of the model rather than the effects of the trade liberalization itself. Although there are many limitations in CGE studies, some of the previous CGE models such as the Michigan Model perform well in predicting the direction of trade.

To examine the potential effects of bilateral, regional, and multilateral free trade, we thus use the Michigan Model of World Production and Trade. The scenarios cover

[18] As we discussed in Section 3.2.2, the GTAP-5.4 1997 database does not report any trade barriers in services. DeRosa and Gilbert (2004) thus acknowledged that "the simulation should be interpreted as representing the potential impacts of preferential tariff liberalization in merchandise goods only." (p.389 and p.393).

six bilateral FTAs (Australia – New Zealand; Japan – Singapore; Japan – Mexico; Korea – Chile; United States – Australia; United States – Singapore), four regional FTAs (AFTA; AFTA – China; EU – Mexico; NAFTA), and multilateral free trade. The major findings of my simulation analysis are summarized as follows. First, among these six scenarios, the potential economic effects of bilateral FTAs are the largest in Korea – Singapore FTA. Second, the effects of regional FTA are larger than those of bilateral FTA. Third, the potential effects become large if the size of the country is small relative to other FTA member countries. Finally, the effects of multilateral free trade are significantly larger than those of bilateral and regional FTAs.

My results clearly indicate that the best policy option is to pursue the multilateral free trade. The potential benefits from the multilateral free trade are overwhelming. Bilateral and regional FTAs can be alternative options to precede the free trade when multilateral negotiations are deadlocked. But we should note that it is not clear whether bilateral and regional FTAs become building blocks of the global free trade or stumbling blocks. Moreover, the expected results are based on the assumption that all member countries remove all trade barriers without any exceptions. Adding exception might make it complex the customs clearance. The accumulation of such burdens through the increases in FTA networks might offset the benefits of free trade.

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Technical Appendix: The Structure of the Michigan Model

Expenditure

Consumers and producers are assumed to use a two-stage procedure to allocate expenditure across differentiated products. In the first stage, expenditure is allocated across goods without regard to the country of origin or producing firm. At this stage, the utility function is Cobb-Douglas, and the production function requires intermediate inputs in fixed proportions. In the second stage, expenditure on monopolistically competitive goods is allocated across the competing varieties supplied by each firm from all countries. In the perfectly competitive agricultural sector, since individual firm supply is indeterminate, expenditure is allocated over each country's sector as a whole, with imperfect substitution between products of different countries.

The aggregation function in the second stage is a Constant Elasticity of Substitution (CES) function. Use of the CES function and product differentiation by firm imply that consumer welfare is influenced both by any reduction in real prices brought about by trade liberalization, as well as increased product variety. The elasticity of substitution among different varieties of a good is assumed to be three, a value that is broadly consistent with available empirical estimates. The parameter for the sensitivity of consumers to the number of product varieties is set at 0.5.[19]

Production

The production function is separated into two stages. In the first stage, intermediate inputs and a primary composite of capital and labor are used in fixed proportion to output.[20] In the second stage, capital and labor are combined through a CES function to form the primary composite. In the monopolistically competitive sectors, additional fixed inputs of capital and labor are required. It is assumed that fixed capital and fixed labor are used in the same proportion as variable capital and variable labor so that production functions are homothetic. The elasticities of substitution between capital and labor vary across sectors and were derived from a literature search of empirical estimates of sectoral supply elasticities. Economies of scale are determined

[19] If the variety parameter is greater than 0.5, it means that consumers value variety more. If the parameter is zero, consumers have no preference for variety. This is the same as the Armington assumption according to which consumers view products as distinguished by country of production. For the sensitivity tests of alternative parameter values, see Brown, Kiyota, and Stern (2005).

[20] Intermediate inputs include both domestic and imported varieties.

endogenously in the model.[21]

Supply Prices

To determine equilibrium prices, perfectly competitive firms operate such that price is equal to marginal cost, while monopolistically competitive firms maximize profits by setting price as an optimal mark-up over marginal cost. The numbers of firms in sectors under monopolistic competition are determined by the zero profits condition. The free entry condition in this context is also the basic mechanism through which new product varieties are created (or eliminated). Each of the new entrants arrives with a distinctly different product, expanding the array of goods available to consumers.

Free entry and exit are also the means through which countries are able to realize the specialization gains from trade. In this connection, it can be noted that in a model with nationally differentiated products, which relies on the Armington assumption, production of a particular variety of a good cannot move from one country to another. In such a model, there are gains from exchange but no gains from specialization. However, in the Michigan Model with differentiated products supplied by monopolistically competitive firms, production of a particular variety is internationally mobile. A decline in the number of firms in one country paired with an expansion in another essentially implies that production of one variety of a good or services is being relocated from the country in which the number of firms is declining to the country in which the number of firms is expanding. Thus, we have both an exchange gain and a specialization gain from international trade.[22]

Capital and Labor Markets

Capital and labor are assumed to be perfectly mobile across sectors within each country. Returns to capital and labor are determined so as to equate factor demand to an exogenous supply of each factor. The aggregate supplies of capital and labor in each country are assumed to remain fixed so as to abstract from macroeconomic considerations (e.g., the determination of investment), since my microeconomic focus is

[21] Note that, in the monopolistic competition model, average cost increases with the increases in the number of firms in the industry while it declines with the increases in market size (i.e., economies of scale). Since the entry of firms continues as long as there is a positive profits (i.e., price is greater than average cost), the equilibrium is determined once the market size is determined.

[22] The international relocation of a particular variety of a good can be understood in the context of the ongoing outsourcing debate. Domestic firms require intermediate inputs, in addition to capital and labor. To the extent that tariff reduction leads a firm to substitute toward traded intermediate inputs, domestic firms can be thought of as outsourcing some component of production. This is particularly the case if there is a decline in the number of domestic firms in the sector from which intermediate inputs are purchased and an expansion in the supplier country.

on the inter-sectoral allocation of resources.

World Market and Trade Balance

The world market determines equilibrium prices such that all markets for goods and services clear. Total demand for each firm or sector's product must equal total supply of that product. It is also assumed that trade remains balanced for each country/region, that is, any initial trade imbalance remains constant as trade barriers are changed. This is accomplished by permitting aggregate expenditure to adjust to maintain a constant trade balance. Thus, we abstract away from the macroeconomic forces and policies that are the main determinants of trade imbalances on goods and services. Further, it should be noted that there are no nominal rigidities in the model. As a consequence, there is no role for a real exchange rate mechanism.

Trade Policies and Rent/Revenues

We have incorporated into the model the import tariff rates and export taxes/subsidies as policy inputs that are applicable to the bilateral trade of the various countries/regions with respect to one another. These have been computed using the "GTAP-5.4 Database" provided in Dimaranan and McDougall (2002). The export barriers have been estimated as export-tax equivalents. we assume that revenues from both import tariffs and export taxes, as well as rents from NTBs on exports, are redistributed to consumers in the tariff- or tax-levying country and are spent like any other income.

Tariff liberalization can affect economic efficiency through three main channels. First, in the context of standard trade theory, tariff reductions both reduce the cost of imports for consumers and for producers purchasing traded intermediate inputs, thus producing an exchange gain. Second, tariff removal leads firms to direct resources toward those sectors that have the greatest value on the world market. That is, we have the standard specialization gain. Third, tariff reductions have a pro-competitive effect on sellers. Increased price pressure from imported varieties force incumbent firms to cut price. Surviving firms remain viable by expanding output, thereby moving down their average total cost (ATC) curve. The consequent lower ATC of production creates gains from the realization of economies of scale.

Model Closure and Implementation

We assume in the model that aggregate expenditure varies endogenously to hold aggregate employment constant. This closure is analogous to the Johansen closure

rule (Deardorff and Stern, 1990, pp. 27-29). The Johansen closure rule consists of keeping the requirement of full employment while dropping the consumption function. This means that consumption can be thought of as adjusting endogenously to ensure full employment. However, in the present model, we do not distinguish consumption from other sources of final demand. That is, we assume instead that total expenditure adjusts to maintain full employment.

The model is solved using GEMPACK (Harrison and Pearson, 1996). When policy changes are introduced into the model, the method of solution yields percentage changes in sectoral employment and certain other variables of interest. Multiplying the percentage changes by the absolute levels of the pertinent variables in the database yields the absolute changes, positive or negative, which might result from the various liberalization scenarios.

Table 1. List of Country/Region and Industry

Country/Region		Industry
Japan	JPN	Agriculture
United States	USA	Mining
Canada	CAN	Food, Beverages & Tobacco
Australia	AUS	Textiles
New Zealand	NZL	Wearing Apparel
EU and EFTA	EUN	Leather Products & Footwear
Hong Kong	HKG	Wood & Wood Products
China	CHN	Chemicals
Korea	KOR	Non-metallic Min. Products
Singapore	SGP	Metal Products
Taiwan	TWN	Transportation Equipment
Indonesia	IDN	Machinery & Equipment
Malaysia	MYS	Other Manufactures
Philippines	PHL	Elec., Gas & Water
Thailand	THA	Construction
Rest of Asia	ROA	Trade & Transport
Chile	CHL	Other Private Services
Mexico	MEX	Government Services
Central America and the Carribean (CAC)	CAC	
South America	SAM	
Morocco	MCC	
Southern African Customs Union (SACU)	SAC	

Table 2. Post-Uruguay Round Tariff Rates by Sector for Selected Countries

(Percent)

	JPN	HKG	CHN	KOR	SGP	TWN	IDN	MYS	PHL	THA	CHL	MEX
Agriculture	38.1	0.0	3.6	48.0	3.1	4.4	3.7	13.1	12.0	16.7	5.1	-2.7
Mining	-0.2	0.0	0.2	3.9	0.0	3.6	0.3	0.2	0.0	0.1	9.1	1.5
Food, Beverages & Tobacco	25.2	0.0	10.6	21.4	4.3	10.5	6.0	12.7	16.6	26.6	8.2	-4.7
Textiles	2.8	0.0	8.9	7.0	0.0	5.0	13.9	14.9	12.7	23.8	10.2	3.3
Wearing Apparel	6.5	0.0	14.9	7.5	0.0	11.2	24.2	18.5	22.7	25.2	10.4	2.5
Leather Products & Footwear	8.9	0.0	8.4	5.8	0.0	3.0	3.5	9.4	13.1	14.6	10.8	5.3
Wood & Wood Products	0.4	0.0	7.5	5.2	0.0	2.4	4.5	7.9	11.3	11.2	9.6	0.9
Chemicals	1.8	0.0	7.1	5.6	0.0	2.9	5.7	4.9	6.4	15.3	9.6	2.0
Non-metallic Min. Products	1.0	0.0	5.7	7.3	0.0	1.5	5.6	8.2	10.4	16.2	9.9	4.4
Metal Products	0.5	0.0	5.7	4.2	0.0	1.3	7.7	5.7	8.1	11.8	10.2	2.7
Transportation Equipment	0.0	0.0	11.6	4.3	0.0	9.7	19.8	12.2	8.9	30.9	10.2	2.6
Machinery & Equipment	0.0	0.0	2.3	7.9	0.0	0.3	4.7	2.3	4.0	9.2	10.4	2.6
Other Manufactures	0.7	0.0	6.6	6.6	0.0	2.0	16.0	6.8	14.3	9.0	10.8	4.2
Elec., Gas & Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Construction	3.0	3.0	31.0	4.0	0.0	10.0	12.0	8.0	30.0	27.0	58.0	15.0
Trade & Transport	15.0	8.0	28.0	16.0	5.0	20.0	24.0	9.0	34.0	34.0	24.0	27.0
Other Private Services	12.0	8.0	57.0	26.0	6.0	35.0	43.0	7.0	35.0	34.0	20.0	32.0
Government Services	28.0	21.0	60.0	21.0	11.0	21.0	21.0	11.0	21.0	26.0	21.0	21.0

Note: Figures for agriculture, mining and manufacturing are weighted by trade. Barriers of services are common across countries.

Sources: Adapted from Francois and Strutt (1999); Brown, Deardorff, and Stern (2002); and Diamaranan and McDougall (2002).

Table 3. Potential Welfare Effects of Bilateral, Regional, and Multilateral Free Trade

(Percent of GDP)

	Bilateral free trade agreement							Regional free trade agreement				Multilateral free trade
	AUS-NZL	JPN-SGP	JPN-MEX	CHL-KOR	KOR-SGP	AUS-USA	SGP-USA	AFTA	AFTA-CHN	EU-MEX	NAFTA	WTO
JPN	0.00	0.09	0.15	0.00	0.00	-0.01	0.02	0.00	0.01	-0.01	0.00	7.40
USA	0.00	0.00	-0.01	0.00	0.00	0.19	0.16	0.01	0.02	-0.01	0.00	5.35
CAN	0.00	0.00	-0.01	0.00	0.00	-0.01	0.01	0.02	0.02	-0.02	0.00	6.24
AUS	0.02	0.01	0.00	0.00	0.00	1.08	0.02	0.03	0.06	0.00	0.00	6.01
NZL	0.14	0.00	0.00	0.00	0.00	0.04	0.03	0.00	0.01	0.00	0.00	13.94
EUN	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.02	0.23	0.00	7.29
HKG	0.00	0.00	0.00	0.00	0.01	-0.02	-0.02	0.07	0.06	0.00	0.00	10.19
CHN	0.00	0.01	0.00	0.00	0.01	-0.01	0.01	0.04	1.11	0.00	0.00	9.63
KOR	0.00	0.01	0.00	0.12	0.19	-0.02	0.03	-0.02	-0.04	-0.01	0.00	13.24
SGP	0.00	0.68	-0.01	0.00	0.76	-0.02	2.61	4.67	5.99	0.00	0.00	21.04
TWN	0.00	0.01	0.00	0.00	0.01	-0.03	0.02	1.47	-0.05	-0.01	0.00	15.92
IDN	0.00	0.01	0.00	0.00	0.01	0.00	0.03	1.76	2.17	0.00	0.00	9.64
MYS	0.00	-0.02	-0.01	0.00	0.06	-0.03	0.05	2.17	3.26	-0.02	0.00	13.66
PHL	0.00	0.01	0.00	0.00	0.02	-0.03	0.02	2.51	3.23	-0.01	0.00	17.05
THA	0.00	0.01	0.00	0.00	0.03	-0.02	0.04	1.66	2.68	0.00	0.00	13.66
ROA	0.00	0.00	0.00	0.00	0.00	-0.01	0.01	0.02	0.05	0.01	0.00	5.80
CHL	0.00	0.00	0.00	0.49	0.00	0.01	0.02	0.05	0.06	0.02	0.00	11.25
MEX	0.00	0.00	0.67	0.00	0.00	-0.01	0.00	0.00	0.01	2.25	0.01	6.75
CAC	0.00	0.01	0.00	0.00	0.01	-0.01	0.01	0.03	0.07	0.01	0.00	14.81
SAM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	5.34
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	10.94
SAC	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.08	0.02	0.00	8.45
Member	0.03	0.10	0.19	0.18	0.27	0.23	0.18	2.25	1.93	0.32	0.00	7.04
Non-member	0.00	0.00	0.00	0.00	0.00	-0.01	0.02	0.03	0.02	-0.01	0.00	

Table 4. Decomposition of the Effects of Bilateral and Regional FTAs

(Percent of GDP)

Bilateral free trade agreement	Agricultural Protection	Manufactures Tariffs	Services Barriers	All barriers
AUS-NZL				
Australia	0.00	0.00	0.02	0.02
New Zealand	0.00	0.00	0.14	0.14
JPN-SGP				
Japan	0.00	0.01	0.08	0.09
Singapore	0.01	0.25	0.43	0.68
JPN-MEX				
Japan	0.01	0.05	0.09	0.15
Mexico	-0.01	0.21	0.47	0.67
CHL-KOR				
Chile	-0.01	0.32	0.18	0.49
Korea	0.03	0.05	0.04	0.12
KOR-SGP				
Korea	0.01	0.00	0.18	0.19
Singapore	0.00	0.30	0.46	0.76
AUS-USA				
Australia	0.00	0.10	0.98	1.08
United States	0.00	0.03	0.17	0.19
SGP-USA				
Singapore	0.01	0.38	2.22	2.61
United States	0.00	0.00	0.16	0.16

Regional free trade agreement	Agricultural Protection	Manufactures Tariffs	Services Barriers	All barriers
AFTA				
Indonesia	0.00	0.79	0.97	1.76
Malaysia	0.31	1.06	0.81	2.17
Philippines	0.05	0.93	1.53	2.51
Singapore	0.05	3.04	1.58	4.67
Thailand	0.01	0.55	1.11	1.66
CAFTA				
China	0.01	0.65	0.45	1.11
Indonesia	0.04	1.09	1.04	2.17
Malaysia	0.46	1.82	0.97	3.26
Philippines	0.10	1.38	1.76	3.23
Singapore	0.07	4.01	1.92	5.99
Thailand	0.00	1.33	1.34	2.68
EU-MEX				
EU	0.00	0.06	0.17	0.23
Mexico	0.01	1.07	1.18	2.25
NAFTA				
Canada	0.00	0.00	0.00	0.00
Mexico	0.01	0.00	0.00	0.01
United States	0.00	0.00	0.00	0.00

Table 5. Decomposition of the Effects of Multilateral Free Trade

(Percent of GDP)

Multilateral free trade	Agricultural Protection	Manufactures Tariffs	Services Barriers	All barriers
JPN	0.52	3.39	3.50	7.40
USA	0.00	0.75	4.60	5.35
CAN	-0.05	1.43	4.86	6.24
AUS	-0.02	2.23	3.80	6.01
NZL	0.04	6.70	7.21	13.94
EUN	-0.04	1.51	5.81	7.29
HKG	0.13	3.28	6.78	10.19
CHN	0.70	4.46	4.46	9.63
KOR	1.38	6.31	5.56	13.24
SGP	0.34	7.54	13.16	21.04
TWN	0.16	9.08	6.69	15.92
IDN	0.12	4.79	4.74	9.64
MYS	1.26	5.48	6.92	13.66
PHL	0.43	6.75	9.88	17.05
THA	0.58	4.48	8.60	13.66
ROA	0.99	1.76	3.05	5.80
CHL	0.14	5.51	5.60	11.25
MEX	-0.03	2.68	4.09	6.75
CAC	0.40	6.46	7.95	14.81
SAM	0.09	1.79	3.46	5.34
MCC	0.82	4.38	5.74	10.94
SAC	0.16	4.50	3.79	8.45

Appendix Table 1. Country Mapping

Country/Region	GTAP-5.4
1 Japan	5 Japan
2 United States	19 United States
3 Canada	18 Canada
4 Australia	1 Australia
5 New Zealand	2 New Zealand
6 EU and EFTA	31 Austria
	32 Belgium
	33 Denmark
	34 Finland
	35 France
	36 Germany
	37 United Kingdom
	38 Greece
	39 Ireland
	40 Italy
	41 Luxembourg
	42 Netherlands
	43 Portugal
	44 Spain
	45 Sweden
	46 Switzerland
	47 rest of EFTA
	51 Czech Republic
	52 Hungary
	53 Malta
	54 Poland
	56 Slovakia
	57 Slovenia
	58 Estonia
	59 Latvia
	60 Lithuania
	63 Cyprus
7 Hong Kong	4 Hong Kong
8 China	3 China
9 Korea, Republic of	6 Korea, Republic of
10 Singapore	11 Singapore
11 Taiwan	7 Taiwan
12 Indonesia	8 Indonesia
13 Malaysia	9 Malaysia
14 Philippines	10 Philippines
15 Thailand	12 Thailand
16 Rest of Asia	13 Viet Nam
	14 Bangladesh
	15 India
	16 Sri Lanka
	17 rest of South Asia
17 Chile	28 Chile
18 Mexico	20 Mexico
19 Cent. America and Carribean	21 Central America and Caribbean
20 South America	22 Colombia
	23 Peru
	24 Venezuela
	25 rest of Andean Pact
	26 Argentina
	27 Brazil
	29 Uruguay
	30 rest of South America
21 Morocco	66 Morocco
22 South African Customs Union	68 Botswana

Note: Rest of the world (ROW) includes all countries that are not listed in this Table.

Appendix Table 2. Industry Mapping

Industry	GTAP-5.4
1 Agriculture	1 paddy rice
	2 wheat
	3 cereal grains nec
	4 vegetables, fruit, nuts
	5 oil seeds
	6 sugar cane, sugar beet
	7 plant-based fibers
	8 crops nec
	9 bovine cattle, sheep and goats, horses
	10 animal products nec
	11 raw milk
	12 wool, silk-worm cocoons
	13 forestry
	14 fishing
2 Mining	15 coal
	16 oil
	17 gas
	18 minerals nec
3 Food, Beverages & Tobacco	19 bovine cattle, sheep and goat meat products
	20 meat products
	21 vegetable oils and fats
	22 dairy products
	23 processed rice
	24 sugar
	25 food products nec
	26 beverages and tobacco products
4 Textiles	27 textiles
5 Wearing Apparel	28 wearing apparel
6 Leather Products & Footwear	29 leather products
7 Wood & Wood Products	30 wood products
	31 paper products, publishing
8 Chemicals	32 petroleum, coal products
	33 chemical, rubber, plastic products
9 Non-metallic Min. Products	34 mineral products nec
10 Metal Products	35 ferrous metals
	36 metals nec
	37 metal products
11 Transportation Equipment	38 motor vehicles and parts
	39 transport equipment nec
12 Machinery & Equipment	40 electronic equipment
	41 machinery and equipment nec
13 Other Manufactures	42 manufactures nec
14 Elec., Gas & Water	43 electricity
	44 gas manufacture, distribution
	45 water
15 Construction	46 construction
16 Trade & Transport	47 trade
	48 transport nec
	49 water transport
	50 air transport
17 Other Private Services	51 communication
	52 financial services nec
	53 insurance
	54 business services nec
	55 recreational and other services
	57 ownership of dwellings
18 Government Services	56 public admin. and defense, education, health