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Economic Effects of a Korea-U.S. Free Trade Agreement

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Foreword

The Korea Economic Institute (KEI) is pleased to issue the fourth volume of its Special Studies series. In contrast with KEI's other publications, which generally take the form of a compilation of relatively short articles on analytical and policy issues by a number of authors, this series affords individual authors an opportunity to explore in depth a particular topic of current interest relating to Korea.

In their study, Dr. Robert Stern and Dr. Kozo Kiyota, both of the University of Michigan, utilize the Michigan Model of World Production and Trade to assess the economic effects of liberalization of trade barriers by Korea and the United States. In addition to computing the static effects of liberalization under several scenarios, they also model some dynamic scenarios that allow for changes in foreign direct investment and capital formation. As a result of these computations and their analysis of other free trade agreements entered into by both countries, they draw conclusions regarding both a Korea-U.S. free trade agreement and the potential impact of the unilateral removal of trade barriers by the two countries and also by all countries included in the model.

KEI is dedicated to objective, informative analysis. We welcome comments on this and our other publications. We seek to expand contacts with academic and research organizations across the country and would be pleased to entertain proposals for other Special Studies.

—Charles L. (Jack) Pritchard
President, Korea Economic Institute
April 2007

Preface

This study presents an analysis of the bilateral free trade agreement (FTA) that is being negotiated between Korea and the United States. The bilateral FTA negotiations were notified to the U.S. Congress by the United States Trade Representative in February 2006, and formal negotiations began in May 2006.[1] It is anticipated that the negotiations may be completed and the agreement signed before mid-2007, which is when the current U.S. presidential negotiating authority expires. Once signed, the implementing legislation can be introduced in the U.S. Congress at any time.

In Chapter 1, we set out what appear to be the primary objectives of the United States and Korea in their pursuit of an FTA. In Chapter 2, we review the existing studies of a Korea-U.S. FTA that have been done to date. Chapter 3 is devoted to comparative static and dynamic analyses of the FTA. We first provide an overview of the features and benchmark data of the Michigan Model of World Production and Trade, which is the computational general equilibrium (CGE) modeling framework that we use to analyze the economic effects of a Korea-U.S. FTA. Thereafter, we present the comparative static modeling results for the bilateral removal of tariffs and other trade barriers for agricultural products, manufactures, services, and all of these combined. This is followed by presentation of results of some dynamic computational scenarios that are specially

1. Details on the periodic bilateral meetings involving the negotiation of a Korea-U.S. free trade agreement are available on the official Web sites of the Office of the U.S. Trade Representative (www.ustr.gov) and the Korean Ministry of Foreign Affairs and Trade (www.mofat.go.kr/me/me_a005/me_b022/me05_04.jsp).

constructed to take into account possible changes in capital formation that may be generated by the Korea-U.S. FTA. We then draw together the main conclusions from the review of previous studies and our own computational work.

In Chapter 4, we provide a broader perspective on a Korea-U.S. FTA that takes into account alternative negotiating options for the two nations. These options include computational analyses of the other FTAs that each nation has concluded in recent years and that are currently in process. We also calculate the potential effects of the unilateral removal of trade barriers by the United States and Korea and the effects of global free trade in which all countries or regions covered in the model are assumed to remove their existing trade barriers on a multilateral basis. In Chapter 5, we present conclusions and implications for further research and policy.

We wish to thank James Lister and the Korea Economic Institute for providing the opportunity to undertake this study. Helpful comments on an earlier version of the study were provided by Hojin Lee, Keith Maskus, and Jeffrey Schott. We wish also to thank Judith Jackson for editorial and typing assistance.

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Objectives and Main Features of a Korea-U.S. Free Trade Agreement

In what follows, we set out what appear to be the major U.S. objectives in seeking a Korea-U.S. free trade agreement (FTA) and indicate the principal issues to be addressed in the negotiations. We then discuss Korea's objectives with regard to the FTA.

U.S. Objectives

On 2 February 2006, United States Trade Representative Rob Portman notified the U.S. House of Representatives and the U.S. Senate that the George W. Bush administration intended to initiate free trade negotiations with the Republic of Korea. Some of the key points in the notification were that an FTA with Korea would:

- Help foster economic growth and create higher-paying jobs in the United States and enable U.S. companies to increase their exports of goods and services to Korea and promote bilateral investment;
- Level the playing field for U.S. exports in Korea by providing U.S. products treatment comparable with that which Korea has offered its other FTA partners;
- Provide a unique opportunity to improve further the protection that Korea affords to intellectual property, including strengthened measures in Korea against the illegal online distribution and transmission of copyrighted works;

- Provide for regulatory transparency in trade and investment matters, including a public comment period, the publication of general administrative actions, and other appropriate provisions;
- Help strengthen Korea's cooperation with the United States in multilateral and regional trade forums; and
- Further enhance the strong U.S.-Korea regional partnership, which is a force for stability and development in Asia, and cooperation on military and security matters as well as bolster strategic interests in the region.

In pursuing bilateral FTAs, the United States uses a common framework covering the issues to be negotiated with the partners involved. This framework, which is patterned after the North American Free Trade Agreement (NAFTA) negotiated in 1992–93, has been updated and adapted for the new FTAs negotiated in recent years and currently in process. Issues covered include:

- Trade in goods;
- Customs matters, rules of origin, and enforcement cooperation;
- Sanitary and phytosanitary measures;
- Technical barriers to trade;
- Intellectual property rights;
- Trade in services;
- Investment;
- Electronic commerce;
- Government procurement;
- Transparency, anticorruption, regulatory reform;
- Competition;
- Trade remedies;
- Environment;
- Labor; and
- State-to-state dispute settlement.

It is evident from the foregoing that a Korea-U.S. FTA reflects a myriad of U.S. objectives, with a focus on expanding market access in Korea for U.S. goods and services and shaping the regulatory environment in Korea to conform to U.S. principles and institutions.

Korea's Objectives

Choi Seok-young (2006), minister for economic affairs at the embassy of Korea in Washington, has stated that an FTA between Korea and the United States would:

- Be commercially significant in terms of trade and foreign direct investment (FDI) and serve to further the long-standing regional and bilateral political and strategic interests of both countries;
- Broaden Korea's position to avoid the opportunity cost of exclusion from the general trends of FTAs, achieve a level playing field in Korea's dealings in foreign markets, and enhance Korea's international competitiveness;
- Keep Korea on a multitrack approach in terms of trade strategy and work toward comprehensive FTAs in terms of coverage and content and broad geographic coverage with trading partners;
- Contribute significantly to bilateral trade; increase economic welfare and employment; provide more secure market access; lock in a variety of domestic reforms; and generate greater efficiency, productivity, and economic growth, possibly motivating other countries to pursue preferential trading arrangements with Korea and the United States; and
- Allow Korea to seek longer implementation periods for vulnerable sectors, particularly agriculture and services, and develop domestic programs for adjustment assistance.

Choi Seok-young stressed that time is of the essence in completing and signing the FTA before the mid-2007 expiration of the U.S. president's trade promotion authority. The overall package of the FTA must be balanced in order to receive the necessary domestic approval in both countries. A high level of political will is therefore needed throughout the negotiation and ratification processes.

Korea's objectives in seeking an FTA thus reflect a variety of considerations, including a desire to avoid being left out of the general trend of FTAs, to secure access to foreign markets and achieve the static and dynamic benefits of trade liberalization, to enhance Korea's global competitiveness, and to strengthen Korea's political and strategic alliances.[1]

1. See Lee and Lee (2005, 44–45) and Schott, Bradford, and Moll (2006, 2–3) for an elaboration of Korean and U.S. mutual objectives in seeking a Korea-U.S. FTA.

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Literature Review of Previous Studies of a Korea-U.S. FTA

A number of studies of a Korea-U.S. FTA have been carried out previously.[2] These studies relied on computational general equilibrium (CGE) models, which provide an economywide framework for analysis that takes into account the interdependencies that exist both within and between countries. The framework is essentially microeconomic in character. When the CGE models incorporate data covering the sectoral production, trade, and employment of the component countries together with measures of import tariffs and other forms of trade barriers, it is possible to simulate the economic effects of various patterns of trade liberalization. The computational results based on the model simulations will then provide estimates of the effects of trade liberalization on aggregate economic welfare for individual countries together with the impacts on production, trade, and employment at the sectoral levels.

It is important to understand that the CGE modeling simulation results provide indications of the potential economic changes involved. In this respect, they are not meant to be empirical forecasts or predictions of the changes because they are not derived from econometric methods that can yield statistically based estimations. Further, because they are microeconomic in character, CGE models of necessity abstract from the macroeconomic forces at work at the aggregate level in individual countries. As a consequence, it may be very difficult to compare CGE

2. See Barfield (2003, 51–58 and 64–67) for a discussion of the effects of proposed bilateral and regional FTAs involving Korea vis-à-vis Japan, the United States, the Association of Southeast Asian Nations (ASEAN), Asia-Pacific Economic Cooperation (APEC), and other selected regions.

modeling results with the actual changes that occur in the economic variables over given periods of time. A further important consideration is that CGE models used to analyze the effects of trade liberalization may differ because of the assumptions that characterize their framework. In any event, CGE modeling results are therefore to be interpreted as the potential effects of trade liberalization at the microeconomic level, holding macroeconomic influences constant. The magnitudes and directions of change indicated by the CGE models are thus very useful in their own right, subject to the caveats just mentioned.

In the review that follows, the existing studies of a Korea-U.S. FTA to be noted have relied on what is commonly referred to as a GTAP (Global Trade Analysis Project) model, using different versions of the GTAP database and different base years. Typical GTAP models rely on a structure of perfect competition with constant returns to scale, and they assume that products can be distinguished by national origin. This latter assumption is often called the Armington assumption, and, conceptually, it affords countries elements of monopoly power that are reflected in their tariff rates. As a result, when tariffs are reduced in this framework, there may be large terms-of-trade effects as the assumed monopoly power is eroded. In our judgment, GTAP models may therefore yield results that are not altogether plausible because of their reliance on the Armington assumption of national product differentiation. As we note below, the Michigan Model, which we will use for our computational analysis in Chapter 3, contains features of imperfect competition and product differentiation at the firm level that are not captured by typical GTAP-based models. The Michigan Model thus does not exhibit the often large terms-of-trade effects associated with GTAP-based models.

Cheong and Wang (1999)

Cheong and Wang (1999) use a GTAP-type model with 11 regions and 14 sectors, with apparently version 4 of the GTAP database and a base year of 1995. They carry out computational scenarios of a Korea-U.S. FTA with 100 percent and 50 percent tariff removal for agriculture products and manufactures as well as for a Korea-Japan FTA and a situation in which Korea would join NAFTA. For complete tariff removal for agricultural products and manufactures, Cheong and Wang estimate that Korea's welfare would increase by $4.8 billion (1.7 percent of GDP) and U.S. welfare would increase by $3.7 billion (0.7 percent).

McDaniel and Fox (2001)

This comprehensive investigation of a U.S.-Korea FTA was mandated by the U.S. Senate Committee on Finance and was carried out by staff members of the United States International Trade Commission, Office of Economics and Office of Industries. The investigation contains an overview of the Korean economy, a description of bilateral trade and investment relations, an assessment of trading patterns and comparative advantages, detailed sectoral analyses, a review of each nation's barriers to trade, and analyses of the effects of eliminating existing bilateral barriers. The Korean barriers of greatest concern to the United States include domestic taxes, customs procedures, and nontariff barriers (NTBs); sectoral regulations involving agricultural and food products, pharmaceuticals and medical equipment, cosmetics, automobiles, professional and financial services, broadcast advertising, and labeling; and intellectual property rights protection. The U.S. barriers of greatest concern to Korea relate to trade remedy laws (antidumping and countervailing duties), labeling and maritime regulations, visas, and government procurement.

The effects of eliminating bilateral barriers are analyzed using a GTAP-type model, a partial equilibrium analysis applied to trade in selected agricultural products, and a qualitative assessment of removing certain NTBs and regulations. Our interest is in the CGE modeling. The USITC staff constructed a CGE model comprising 5 regions and 10 sectors, using the GTAP version 4 database and a base year of 1995. To capture some of the dynamic aspects of the FTA, they assumed that the removal of barriers would commence in 2001. The model was then solved sequentially through 2009. As of 2005, it was estimated that U.S. economic welfare would increase by $19.6 billion (0.23 percent of GDP) and Korean economic welfare would increase by $3.9 billion (0.69 percent of GDP). Detailed results are provided for the changes in total and bilateral trade for the United States and Korea, changes in sectoral trade and output, changes in wages and prices, changes in selected agricultural products trade, and the qualitative changes of removing selected Korean NTBs and regulations.

Choi and Schott (2001, 2004)

These studies explore the issues and potential economic benefits and costs of an FTA between Korea and the United States. The authors review the historical background of Korea-U.S. international economic relations and efforts to develop a bilateral trade agreement. They examine

bilateral trade and investment flows and how frictions in the bilateral relationship might be resolved with an FTA. The chief U.S. complaints against Korea relate to import policies, including standards, testing, labeling, and certification; government procurement; intellectual property rights; services barriers; investment barriers; anticompetitive practices; and electronic commerce. The United States has singled out a number of sectoral problems of market access with Korea especially in agricultural products, automobiles, telecommunications, pharmaceuticals, steel, and cosmetic products. Korea's main complaints against the United States relate to U.S. antidumping and countervailing duties.

The authors use a gravity model approach to estimate the potential for greater mutual trade and also a CGE modeling approach to assess the welfare and related implications of a bilateral FTA.[3] The CGE modeling was done by John Gilbert, based on a GTAP-type model consisting of 10 regions and 10 sectors, using version 4 of the GTAP database and a base year of 1995. Two computational scenarios were run: a comparative static scenario (medium run) in which product and factor markets clear; and a scenario (long run) in which the capital stock is permitted to adjust to reflect changes in the level and allocation of the capital stock through increased investment in response to changes in the real rate of interest caused by trade liberalization. The assumed liberalization covers the removal of trade barriers affecting agricultural products and manufactures and manufactures only. Services liberalization is not included because of the lack of data.

The results are summarized in ***Table 1.*** It can be seen that Korea's economic welfare would rise by $4.1 billion (0.91 percent of GDP) or $10.9 billion (2.41 percent of GDP) in the two scenarios. The results are considerably smaller when agricultural liberalization is excluded. U.S. economic welfare would rise by $3.8 billion (0.03 percent of GDP) or $8.9 billion (0.13 percent of GDP). There is evidence of trade diversion for all of the other countries or regions shown. The welfare effects are decomposed in ***Table 2.*** It can be seen that the comparative static (medium run) results reflect sizable changes in the terms of trade, which, as mentioned above, are characteristic of GTAP models that rely on the Armington assumption of national product differentiation. The long-run

3. A gravity model seeks to explain the determinants of bilateral trade at the aggregate level in terms of variables measuring gross national product, population, and other forces that drive bilateral trade and variables such as transport costs, trade barriers, and cultural and language differences that inhibit trade. Gravity models thus do not provide detailed estimates of the effects of trade liberalization at the sectoral level as is the case for CGE models.

Table 1: **Estimated Welfare Effects of a Korea-U.S. Free Trade Agreement, by Country or Region**

Country or region	Full liberalization		Excluding agriculture	
	Medium run	Long run	Medium run	Long run
Australia and New Zealand	-296.3	-409.8	-17.6	10.6
	(-0.07)	(-0.10)	(0.00)	(0.00)
Japan	-2,231.7	-3,581.9	-1,170.7	-1,941.2
	(-0.04)	(-0.07)	(-0.02)	(-0.04)
Korea	4,099.6	10,860.7	1,712.2	4,923.4
	(0.91)	(2.41)	(0.38)	(1.09)
China and Hong Kong	-486.5	-927.8	-427.3	-666.0
	(-0.06)	(-0.11)	(-0.05)	(-0.08)
ASEAN	-519.8	-850.4	-278.7	-509.3
	(-0.08)	(-0.14)	(-0.05)	(-0.08)
Taiwan	-267.3	-467.6	-83.9	-157.0
	(-0.10)	(-0.17)	(-0.03)	(-0.06)
United States	3,783.4	8,934.6	1,532.4	4,186.1
	(0.05)	(0.13)	(0.02)	(0.06)
Canada	-293.4	-324.3	-193.3	-253.7
	(-0.05)	(-0.06)	(-0.03)	(-0.04)
Mexico	-138.7	-379.7	-94.1	-306.1
	(-0.05)	(-0.14)	(-0.03)	(-0.11)
Rest of world	-2,223.1	-3,813.9	-1,169.2	-1,689.7
	(-0.02)	(-0.03)	(-0.01)	(-0.01)
Sum of world	1,426.2	9,030.9	-190.3	3,597.3
	(0.01)	(0.03)	(0.00)	(0.01)

Source: Choi and Schott (2001, 56).

ASEAN = Association of Southeast Asian Nations

Notes: Mean equivalent variation in millions of 1995 dollars. Percentage of GDP in parentheses.

results reflect especially the growth effect caused by the inclusion of capital accumulation.[4]

4. To clarify the treatment of capital accumulation in the GTAP framework, a hypothetical "global bank" is introduced to incorporate international capital flows. Because of the limited availability of statistics on the bilateral FDI flows across countries, international capital flows are first pooled in the hypothetical global bank in the GTAP framework. The pooled capital is then redistributed from the global bank to each country, according to the rental rate. Because the global bank does not maximize anything, the international capital mobility in the GTAP framework is equivalent to introducing a hypothetical international capital market. This in turn means that the GTAP model does not capture the bilateral FDI flows. In other words, the international capital mobility in the GTAP model simply means that the investment-savings balance is endogenously determined (through the hypothetical global bank). Therefore, for instance, even though the capital stock of Korea increases after the implementation of the Korea-U.S. FTA in the GTAP framework, this does not necessarily result in FDI flows from the United States to Korea. That is, there is a possibility that FDI may flow, for example, from China to Korea in

Table 2: **Decomposition of Welfare Effects of a Korea-U.S. Free Trade Agreement**

Source	Full liberalization		Excluding agriculture	
	Medium run	Long run	Medium run	Long run
United States				
Allocative efficiency	1.8	501.9	94.2	363.5
Terms of trade	3,781.4	2,772.6	1,438.2	866.6
Marginal utility of income	0.2	0.5	0.0	0.0
Growth effect	0.0	5,658.6	0.0	2,956.0
Total	3,783.4	8,934.6	1,532.4	4,186.1
Korea				
Allocative efficiency	2,634.1	3,902.3	266.5	879.9
Terms of trade	1,509.5	-120.1	1,445.9	646.4
Marginal utility of income	-44.0	-85.8	-0.2	-1.4
Growth effect	0.0	7,164.3	0.0	3,398.5
Total	4,099.6	10,860.7	1,712.2	4,923.4

Source: Choi and Schott (2001, 57).

Note: Mean equivalent variation in millions of 1995 dollars.

There are positive output effects for Korea (Choi and Schott 2001, 116), especially in the medium run for processed food, textiles and apparel, chemicals, rubber, and plastics, and negative output effects in agriculture, forestry and fisheries, and durable manufactures. For the United States (Choi and Schott 2001, 117), the largest output increases are in agriculture, forestry and fisheries, and processed food, and negative output effects especially in textiles and apparel. Because services liberalization is not included, the results noted can be interpreted as a lower bound for the effects of liberalization. The authors also note that there may be other potential benefits of an FTA owing to increasing returns to scale, greater security of market access, removal of nontrade regulatory barriers, and the strengthening of international security relations. The authors conclude that there might be greater potential benefits from a broader degree of trade liberalization on the basis of the open regionalism of the Asia Pacific Economic Cooperation (APEC) forum and from multilateral liberalization undertaken under World Trade Organization (WTO) auspices.

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the context of the Korea-U.S. FTA. Hence, although the GTAP model ostensibly introduces international capital mobility, it does not say (or cannot say) anything about bilateral FDI flows.

In Choi and Schott (2004), the potential for a Korea-U.S. FTA is reevaluated in a more favorable light in the context of the problems that have been encountered in moving ahead with the WTO Doha Development Agenda negotiations. In the appendix by DeRosa and Gilbert (2004) in Schott (2004), Gilbert has undertaken computational analyses of the potential economic effects of 14 prospective bilateral FTAs, with a modeling framework consisting of 23 countries and 19 sectors. He used version 5 of the GTAP database and a base year of 1997. For the medium run, Korea's economic welfare is estimated to increase by $1.6 billion (0.37 percent of GDP) and U.S. welfare to increase by $2.7 billion (0.03 percent of GDP). These results are smaller than those noted above in Choi and Schott (2001), and there is a sizable terms-of-trade improvement for the United States.

A final point of interest is that Gilbert (DeRosa and Gilbert 2004, 402) has carried out a scenario for multilateral free trade for agriculture and manufactures in which the United States is shown to experience a decline in economic welfare of $254 million (0.0 percent of GDP) compared with an increase in Korea's economic welfare of $9.6 billion (2.16 percent of GDP). This is a rather surprising result, which may be due in large measure to changes in terms of trade, although no information is provided in the text about such changes. In contrast, in Chapter 4, we show that multilateral free trade, including agriculture, may increase U.S. economic welfare by $624.5 billion (3.5 percent of GDP) and Korea's economic welfare by $94.2 billion (12.8 percent of GDP).

Lee and Lee (2005)

This is a comprehensive study from a Korean perspective of the issues and potential economic and noneconomic benefits that may be derived from a Korea-U.S. FTA. The authors analyze the U.S. trade negotiating strategy and process for FTA negotiations, the characteristics of U.S. FTAs, and Korea's FTA strategy. They also discuss issues of bilateral Korea-U.S. economic relations and competitiveness and the international political economy of a Korea-U.S. FTA. Further, and of direct concern for our study, they use a version of the GTAP CGE model to calculate the welfare effects and a partial equilibrium model to determine the trade effects of a Korea-U.S. FTA.

The authors construct a GTAP CGE model that consists of 13 sectors and 5 countries or regions plus the rest of world (ROW). They use the GTAP database, version 6, which refers to 2001. For purposes of analyzing a Korea-U.S. FTA, in a comparative static framework, they

Table 3: **Effects on Korea of a Korea-U.S. Free Trade Agreement**

Effects	Static model		Dynamic model	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
GDP (%)	0.42	0.59	1.99	2.27
Consumption expenditure (%)	0.57	0.65	1.64	1.85
Welfare (millions of dollars)	2,374	2,717	6,815	7,698

Source: Lee and Lee (2005, 86).

assume 80 percent liberalization in agriculture, full liberalization in manufactured goods, and reduction in services barriers by 20 percent (scenario 1) and also a 50 percent reduction in services barriers (scenario 2). They allow for capital accumulation in an effort to capture some dynamic effects.

The results for the percentage changes in GDP and consumption and the absolute changes in economic welfare are summarized in ***Table 3.*** In the static model, there is a 0.42–0.59 percent increase in GDP and an increase of $2.4–2.7 billion in economic welfare. Taking capital accumulation into account, there is a 1.99–2.27 percent increase in GDP and an increase of $6.8–7.7 billion in economic welfare. The changes in sectoral production and employment in manufacturing caused by the FTA are noted in ***Table 4*** and ***Table 5.*** The most notable increases in production are in garments and leather, textiles, automobiles and parts, and chemicals, and there are declines in other transport equipment, electronics, and machinery. The changes in sectoral employment mirror the changes in production. Total manufacturing employment is estimated to increase by 28,000–171,000 workers, which corresponds to 0.89–5.36 percent of the total manufacturing labor force. It is unclear, however, what the basis is for the increase in employment noted because, conceptually in the GTAP model being used, factor supplies are assumed to remain unchanged.

Services liberalization is modeled using the guesstimates of services barriers constructed by Hoekman (1995). Assuming the barriers are reduced by 50 percent, it is estimated that services output would rise by 0.31 percent in the short run and by 3.3 percent in the long term. Total services employment is estimated to rise by 50,000–78,000 workers, which corresponds to 0.45-0.69 percent of the total services labor force. Again, the conceptual basis for the increase in services employment remains unclear, and it is also not clear how reliable the guesstimates of the services barriers may be.

Table 4: **Changes in Sectoral Production in Korea**

Industry	Effect of free trade agreement	
	Short term (%)	Long term (%)
Total manufacturing	-0.1	1.6
Processed food	-0.9	-0.14
Sugar	2.2	2.9
Textiles	6.7	8.2
Garments and leather	13.1	13.9
Petrochemistry	0.3	1.7
Metals	-1.3	0.56
Automobiles and parts	2.8	4.1
Other transport equipment	-4.2	-2.2
Electronics	-2.5	0.02
Machinery	-2.2	0.09
Other manufacture	-0.05	1.33

Source: Lee and Lee (2005, 89).

The authors discuss at length the noneconomic issues that in their view reinforce the case for a Korea-U.S. FTA. These issues include questions of international security that are important for the two nations in East Asia and the momentum and example that an FTA might provide for greater economic openness and integration in the region and multilaterally. A Korea-U.S. FTA is also argued to be important to stimulate Korea's international competitiveness and its economic growth and to ensure that Korea is not left behind vis-à-vis other preferential arrangements that the United States may negotiate.

Schott, Bradford, and Moll (2006)

This policy brief builds upon the previous analyses of Choi and Schott (2001, 2004) noted above and addresses the issues involved in a Korea-U.S. FTA. The authors review the objectives of the United States and Korea in pursuing an FTA, document recent developments in their bilateral trade in goods and services and FDI, and review the bilateral disputes in the WTO. They then report the results of a CGE modeling analysis of the FTA. For this purpose, they have updated their earlier modeling effort with construction of a new GTAP model, with perfect competition and constant returns, and with 22 sectors, 4 regions (Korea, United States, Japan, and ROW), and 5 factors of production (unskilled labor, skilled labor, capital, land, and natural resources). The factor supplies are assumed to remain fixed in the basic version of the model, and growth in the capital stock is permitted in a second version.

Two scenarios are run, the first assuming complete bilateral free trade in agricultural products and manufactures and complete free trade, excluding rice. Services liberalization is not included. The comparative

Table 5: **Changes in Sectoral Employment in Korea, Before and After a Free Trade Agreement**

Industry	Before FTA	After FTA			
		Short-run effects		Long-run effects	
	Number of employed	Number of employed	Number of increase (growth rates, %)	Number of employed	Number of increase (growth rates, %)
Total manufacturing	3,915,100	3,223,561	28,461	3,366,460	171,360
			(0.89)		(5.36)
Processed food	281,718	262,256	-19,462	278,819	-2,899
			(-6.9)		(-1.03)
Sugar	1,473	1,548	75	1,570	97
			(5.1)		(6.59)
Textiles	236,687	268,529	31,842	275,669	38,982
			(13.5)		(16.5)
Garments and leather	274,082	337,880	63,798	341,733	67,651
			(23.3)		(24.7)
Petro-chemistry	341,928	344,880	2,952	358,951	17,023
			(0.86)		(5.0)
Metals	337,087	326,140	-10,947	341,731	4,644
			(-3.3)		(1.4)
Automobiles and parts	212,473	238,101	25,628	249,652	37,179
			(12.1)		(17.5)
Other transport equipment	98,465	88,947	-9,396	93,341	-5,002
			(-9.6)		(-5.1)
Electronics	559,465	523,099	-36,366	559,551	290
			(-6.5)		(0.05)
Machinery	372,780	353,592	-19,188	373,551	771
			(-5.2)		(0.21)
Other manufacture	479,064	478,589	-475	491,688	12,624
			(-0.1)		(2.6)

Source: Lee and Lee (2005, 90).

static results for economic welfare are noted in ***Table 6.*** For the pure FTA, Korea's welfare is shown to increase by $27.6 billion (3.5 percent of GDP) and by $20.2 billion (2.6 percent of GDP) with rice excluded. Making allowance for an increase in the capital stock, Korea's welfare increases by $51.8 billion (6.6 percent of GDP) for the pure FTA and by $40.9 billion (5.2 percent of GDP) with rice excluded. For the United States, welfare is increased by $0.8 billion (0.01 percent of GDP) for the pure FTA and by $6.3 billion (0.05 percent of GDP) with rice excluded. With the increase in the capital stock, U.S. welfare is increased to $8.8 billion (0.07 percent of GDP) for the pure FTA and by $13.7 billion (0.10 percent of GDP) with rice excluded. The smaller welfare effects for the United States for the pure FTA that includes liberalizing trade in rice are attributed to the modeling assumption made about U.S. subsidies to its rice producers. Japan's welfare is shown to increase

Table 6: **Overall Welfare Results (Change in Equivalent Variation)**

Country		Medium run: Capital stock fixed		Long run: Capital grows	
		Rice excluded	Pure free trade agreement	Rice excluded	Pure free trade agreement
Korea	Billions of dollars	20.220	27.582	40.887	51.799
	Percentage of GDP	2.58	3.51	5.21	6.60
United States	Billions of dollars	6.325	0.766	13.693	8.835
	Percentage of GDP	0.05	0.01	0.10	0.07
Japan	Billions of dollars	0.478	1.676	0.702	1.962
	Percentage of GDP	0.01	0.03	0.01	0.04
Rest of world	Billions of dollars	-5.512	-4.153	-9.390	-7.483
	Percentage of GDP	-0.02	-0.02	-0.04	-0.03

Source: Schott, Bradford, and Moll (2006, 26).

only marginally, and there are welfare reductions for ROW, presumably caused by trade diversion.

The percentage returns to labor and capital are seen to increase considerably for Korea in ***Table 7,*** while the returns to land and natural resources fall. For the United States, there are negligible effects on the returns to capital and labor and increases in the returns to land and natural resources. Changes in sectoral output are noted in ***Table 8.*** For the pure FTA, in Korea, there are reductions in output in rice, other primary products, durable manufactures, and business services. For the United States, with the pure FTA, there is a very large percentage increase in rice output and declines in most other sectors, as resources are apparently shifted to producing additional rice. With rice excluded, the output effects for Korea do not change very much while there are small percentage reductions in output in most U.S. sectors. The numbers of Korean jobs gained or lost by sector are recorded in ***Table 9.*** It appears that, with the pure FTA, Korea's rice employment is shown to be decimated, with the decline in employment indicated to be larger than the initial employment. By the same token, several of the employment changes in other sectors also appear to be very substantial.[5] Taken at

5. There is apparently a rounding error in Table 9, which shows net changes in overall employment. Such net changes are ruled out because the labor market is supposed to clear in the model.

Table 7: **Change in Real Factor Prices**

Factor of production	Medium run: Capital stock fixed		Long run: Capital grows	
	Rice excluded (%)	Pure free trade agreement (%)	Rice excluded (%)	Pure free trade agreement (%)
Korea				
Unskilled labor	11.4	11.4	16.8	16.2
Skilled labor	12.8	13.1	17.0	17.9
Capital	11.9	12.4	7.0	6.7
Land	-11.4	-45.3	-5.1	-40.9
Natural resources	-74.0	-57.8	-73.6	-57.1
United States				
Unskilled labor	0.0	0.1	0.0	0.1
Skilled labor	-0.1	-0.1	0.0	0.0
Capital	0.0	0.0	-0.1	-0.1
Land	5.8	12.7	6.3	13.6
Natural resources	8.7	8.6	9.2	9.3

Source: Schott, Bradford, and Moll (2006, 26).

face value, the calculations suggest that Korea would experience major disruptions in its labor market with a pure FTA.

Following their computational analysis results, the authors seek to identify the key issues in the FTA negotiations. For the United States, the key issues include Korea's policies regarding market access for automobiles and beef, pharmaceutical pricing, and insurance regulations for reimbursements. Key issues for Korea include the U.S. resolution of steel antidumping problems, access to the U.S. visa waiver program, and duty-free coverage of labor-intensive products produced in the Kaesong industrial complex that involves participation with North Korea. A final concern that is raised is whether a Korea-U.S. FTA would spur further efforts to forge other bilateral and regional trading arrangements in East and Southeast Asia, especially and more broadly in APEC, and also provide an impetus multilaterally to revive the WTO Doha Development Agenda negotiations.

Conclusions

In this chapter, we have reviewed a number of studies of the economic issues and potential effects of a Korea-U.S. FTA. The economic issues have been addressed using a standard GTAP model that assumes perfect competition, constant returns to scale, and products distinguished by place of production. This latter (Armington) assumption gives countries some degree of monopoly power in their trade, with the effect that

Table 8: **Change in Output**

Category	Share of output		Medium term				Long term			
			Rice excluded		Pure free trade agreement		Rice excluded		Pure free trade agreement	
	Korea (%)	United States (%)	Korea (%)	United States (%)	Korea (%)	United States (%)	Korea (%)	United States (%)	Korea (%)	United States (%)
Paddy rice	0.0078	0.0001	-0.7	-3.1	-98.5	641.8	1.9	-3.0	-98.7	673.3
Wheat	0.0013	0.0004	21.7	-6.1	57.1	-12.0	24.4	-5.9	62.9	-14.1
Vegetables and fruits	0.0091	0.0015	10.3	-0.9	34.5	-2.8	13.5	-0.9	39.5	-2.8
Other primary products	0.0149	0.0168	-75.4	6.5	-52.1	5.5	-76.0	6.9	-52.7	5.9
Beef	0.0020	0.0048	110.4	-0.6	110.1	-0.8	120.9	-0.6	121.9	-0.8
Other meat	0.0044	0.0039	95.3	-0.7	95.6	-1.0	105.2	-0.7	106.5	-1.0
Dairy	0.0032	0.0047	23.9	-0.1	22.7	-0.2	32.5	0.0	32.3	-0.1
Processed rice	0.0067	0.0001	8.2	0.0	363.1	-21.1	12.0	0.1	386.0	-20.9
Other food products	0.0283	0.0280	19.3	0.3	24.6	0.1	26.0	0.4	32.5	0.3
Textiles	0.0236	0.0081	12.4	-1.4	13.8	-1.4	16.7	-1.3	18.9	-1.4
Wearing apparel	0.0082	0.0061	27.6	-0.8	28.9	-1.0	30.1	-0.7	31.8	-0.8
Leather products	0.0042	0.0009	62.1	-1.3	64.6	-1.5	61.5	-1.2	64.2	-1.4
Chemicals, rubber, and plastic products	0.0669	0.0399	-0.4	-0.4	0.5	-0.4	4.5	-0.4	6.1	-0.4
Iron, steel, and nonferrous metals	0.0426	0.0141	8.9	-0.9	9.9	-1.0	15.3	-0.9	17.4	-1.1
Motor vehicles	0.0444	0.0260	-3.2	-0.3	-2.6	-0.4	-0.8	-0.4	0.0	-0.4
Other transport	0.0128	0.0108	-15.5	-0.5	-14.1	-0.7	-13.4	-0.6	-11.5	-0.7
Electronic equipment	0.0715	0.0196	-15.7	-0.5	-15.2	-0.7	-10.4	-0.7	-9.5	-0.9
Other machinery and equipment	0.0773	0.0439	-13.6	-0.5	-12.8	-0.5	-8.7	-0.5	-7.2	-0.6
Other manufactured goods	0.0800	0.0694	34.3	-0.7	35.6	-0.7	39.3	-0.7	41.4	-0.7
Trade and transport services	0.1142	0.1741	0.6	0.0	1.9	0.0	5.9	0.0	8.0	0.0
Business services	0.1282	0.2133	-2.4	0.0	-2.4	0.0	2.4	0.0	3.1	0.0
Other services	0.2485	0.3137	0.7	0.0	0.7	0.0	4.3	0.1	4.8	0.1

Source: Schott, Bradford, and Moll (2006, 27).

trade liberalization may result in substantial terms-of-trade effects that may not be altogether plausible. The studies use different versions of the GTAP database, with varying coverage of the numbers of countries or regions and sectors. While the standard GTAP model assumes that endowments of labor and capital are fixed, it was noted that one of the GTAP studies provides estimates of overall changes in employment. This is not altogether plausible in the comparative static framework. Finally, several GTAP studies make allowance for increases in capital stocks in order to capture presumably some of the long-run, dynamic changes that may occur. However, the mechanism for introducing increased capital stocks does not identify the sources and destinations of the capital flows that are generated within the GTAP framework.

The modeling results for changes in economic welfare from the GTAP studies reviewed are summarized in ***Table 10.*** The positive

Table 9: **Number of Korean Jobs Gained or Lost in the Medium-Term Scenario**

Category	Initial employment	Rice excluded	Pure free trade agreement
Paddy rice	215,880	-27,633	-213,721
Wheat	21,000	1,491	1,323
Vegetables and fruits	219,960	-6,819	-20,016
Other primary products	177,360	-144,548	-116,703
Beef	4,080	4,500	4,561
Other meat	15,240	14,463	14,783
Dairy	22,800	5,404	5,381
Processed rice	2,160	173	7,938
Other food products	141,840	26,950	36,027
Textiles	236,160	28,812	34,243
Wearing apparel	103,680	28,719	30,586
Leather products	56,280	34,837	36,695
Chemical, rubber, and plastic products	407,640	-2,446	4,892
Iron, steel, and nonferrous metals	216,960	18,442	22,998
Motor vehicles	344,400	-11,021	-6,544
Other transport	152,280	-23,756	-20,710
Electronic equipment	319,800	-51,488	-46,691
Other machinery and equipment	666,720	-91,341	-80,673
Other manufactured goods	639,000	217,899	233,235
Trade and transport services	2,024,040	10,120	50,601
Business services	2,145,120	-53,628	-34,322`
Other services	3,867,360	23,204	54,143
Total net change		2,335	-1,975

Source: Schott, Bradford, and Moll (2006, 29).

welfare gains for Korea range from 0.4 percent to 3.5 percent of GDP in the different studies assuming complete bilateral tariff removal. The results are larger if allowance is made for increases in the capital stock, with increases varying from 1.99 percent to 6.6 percent of GDP in the different studies. What stands out in Table 10 is that the results obtained by Schott, Bradford, and Moll (2006) are several times larger than all of the other studies noted. It is difficult to understand what the sources of the differences may be because all of the studies have used the same GTAP modeling framework and a common database.

In all studies, the welfare effects of a Korea-U.S. FTA on the United States are very small, ranging from 0.01 percent of GDP to 0.23 percent of GDP for complete bilateral tariff removal and from 0.07 percent to 0.13 percent of GDP with allowance for an increase in the capital stock. Except for Lee and Lee (2005), none of the other studies cited include

Table 10: **Comparison of GTAP Modeling Results for Economic Welfare in the Korea-U.S. Free Trade Agreement (billions of dollars and percentage of GDP)**

Research	Comparative static results No FDI	Comparative static results Including FDI
Cheong and Wang (1999)		
Korea	$4.8 billion (1.7 % of GDP)	
United States	$3.7 billion (0.7% of GDP	
McDaniel and Fox (2001)		
Korea	$3.9 billion (0.69% of GDP)	
United States	$19.6 billion (0.23% of GDP)	
Choi and Schott (2001)		
Korea	$4.1 billion (0.91% of GDP)	$10.9 billion (2.41% of GDP)
United States	$3.8 billion (0.03% of GDP)	$8.9 billion (0.13% of GDP)
Choi and Schott (2004)		
Korea	$1.6 billion (0.37% of GDP)	
United States	$2.7 billion (0.03% of GDP)	
Lee and Lee (2005)		
Korea	$2.4 billion (0.42% of GDP)	$6.8 billion (1.99% of GDP)
Schott, Bradford, and Moll (2006)		
Korea	$27.6 billion (3.5% of GDP)	$51.8 billion (6.6% of GDP)
United States	$0.8 billion (0.01% of GDP)	$8.8 billion (0.07% of GDP)

Source: Authors' data.

FDI = foreign direct investment

liberalization of services barriers, allowance for the effects of imperfect competition, and a clear determination of the employment shifts that a Korea-U.S. FTA may engender. It is in this light that we now turn to our analysis using the Michigan Model of World Production and Trade that makes allowance for a number of important relationships that are not included in the studies based on the GTAP framework. It is hoped this model will expand the understanding of the economic forces at play in evaluating the effects of a Korea-U.S. FTA.

3

Comparative Static and Dynamic Analysis of a Korea-U.S. FTA

We first discuss the main features of the Michigan Model of World Production and Trade that has been used for computational purposes. We then discuss the benchmark data used in the model and thereafter present the results of our comparative static and dynamic computational scenarios.

Overview of the Michigan Model of World Production and Trade

The version of the Michigan Model that we use in this study covers 27 economic sectors, including agriculture, manufactures, and services, in each of 30 countries or regions. 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. Some details follow.[6] A more complete description of the formal structure and equations of the model can be found online.[7]

6. See also Deardorff and Stern (1990, 9–46) and Brown and Stern (1989a, 1989b). Some readers may wish to skip the technical discussion and move directly to the section on interpreting the model results.

7. See the Michigan Model of World Production and Trade, University of Michigan, School of Public Policy, Department of Economics, www.Fordschool.umich.edu/rsie/model/.

Sectors and Market Structure

As mentioned, the version of the model to be used in this study consists of 27 production sectors and 30 countries or regions (plus ROW). The sectoral and country or 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 markup of price over marginal cost. Free entry and exit of firms then guarantees zero profits.

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, because 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 by any reduction in real prices brought about by trade liberalization as well as by increased product variety. The elasticity of substitution among different varieties of a good is assumed to be 3, 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.[8]

8. 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. Sensitivity tests of alternative parameter values are included in the Appendix.

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.[9] 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 endogenously in the model.

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 markup 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 is being relocated from the country in which the number of firms is declining to the country in which the number of firms

9. Intermediate inputs include both domestic and imported varieties.

is expanding. Thus, we have both an exchange gain and a specialization gain from international trade.[10]

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 (for example, the determination of investment), because our microeconomic focus is on the intersectoral allocation of resources.

World Market and Trade Balance

The world market determines equilibrium prices such that all markets clear. Total demand for each firm's or sector's product must equal total supply of that product. It is also assumed that trade remains balanced for each country or 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. 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 or Revenues

We have incorporated into the model the import tariff rates and export taxes or subsidies as policy inputs that are applicable to the bilateral trade of the various countries or regions with respect to each other. These have been computed using the GTAP-6.0 2001 Database provided in Dimaranan and McDougall (2005). The export barriers have been estimated as export-tax equivalents. We assume that revenues from both

10. 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.

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 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 forces 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, 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, that might result from the various liberalization scenarios.

Interpreting the Modeling Results

To help the reader interpret the modeling results, it is useful to review the features of the model that serve to identify the various economic effects to be reflected in the different applications of the model. Although the model includes the aforementioned features of imperfect competition,

it remains the case that markets respond to trade liberalization in much the same way that they would with perfect competition. That is, when tariffs or other trade barriers are reduced in a sector, domestic buyers (both final and intermediate) substitute toward imports, and the domestic competing industry contracts production while foreign exporters expand. Thus, in the case of multilateral liberalization that reduces tariffs and other trade barriers simultaneously in most sectors and countries, each country's industries share in both of these effects, expanding or contracting depending primarily on whether their protection is reduced more or less than in other sectors and countries.

Worldwide, these changes cause increased international demand for all sectors. World prices increase most for those sectors where trade barriers fall the most.[11] This in turn causes changes in countries' terms of trade that can be positive or negative. Those countries that are net exporters of goods with the greatest degree of liberalization will experience increases in their terms of trade, as the world prices of their exports rise relative to their imports. The reverse occurs for net exporters in industries where liberalization is slight, perhaps because it may already have taken place in previous trade rounds.

The effects on the welfare of countries arise from a mixture of these terms-of-trade effects, together with the standard efficiency gains from trade and also from additional benefits owing to the realization of economies of scale. Thus, we expect on average that the world will gain from multilateral liberalization, as resources are reallocated to those sectors in each country where there is a comparative advantage. In the absence of terms-of-trade effects, these efficiency gains should raise national welfare measured by the equivalent variation for every country,[12] although some factor owners within a country may lose, as will be noted below. However, it is possible for a particular country whose net imports are concentrated in sectors with the greatest liberalization to lose overall, if the worsening of its terms of trade swamps these efficiency gains.

11. The price of agricultural products supplied by the rest of the world is taken as the numeraire in the model, and there is a ROW against which all other prices can rise.

12. The equivalent variation is a measure of the amount of income that would have to be given or taken away from an economy before a change in policy in order to leave the economy as well off as it would be after the policy change has taken place. If the equivalent variation is positive, it is indicative of an improvement in economic welfare resulting from the policy change.

In contrast, although trade with imperfect competition is perhaps best known for introducing reasons why countries may lose from trade, actually its greatest contribution is to expand the list of reasons for gains from trade. Thus, in the Michigan Model, trade liberalization permits all countries to expand their export sectors at the same time that all sectors compete more closely with a larger number of competing varieties from abroad. As a result, countries as a whole gain from lower costs owing to increasing returns to scale, lower monopoly distortions owing to greater competition, and reduced costs or increased utility (or both) owing to greater product variety. All of these effects make it more likely that countries will gain from liberalization in ways that are shared across the entire population.[13]

The various effects just described in the context of multilateral trade liberalization will also take place when there is unilateral trade liberalization, although these effects will depend on the magnitudes of the liberalization in relation to the patterns of trade and the price and output responses involved between the liberalizing country and its trading partners. Similarly, many of the effects described will take place with the formation of bilateral or regional FTAs. But in these cases, there may be trade creation and positive effects on the economic welfare of FTA member countries together with trade diversion and negative effects on the economic welfare of nonmember countries. The net effects on economic welfare for individual countries and globally will thus depend on the economic circumstances and policy changes implemented.[14]

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13. In perfectly competitive trade models such as the Heckscher-Ohlin Model, one expects countries as a whole to gain from trade, but the owners of one factor—the "scarce factor"—are expected to lose through the mechanism first explored by Stolper and Samuelson (1941). The additional sources of gain from trade caused by increasing returns to scale, competition, and product variety, however, are shared across factors, and we routinely find in our CGE modeling that both labor and capital gain from multilateral trade liberalization.

14. It may be noted that, in a model of perfect competition, bilateral trade liberalization should have the effect of contracting trade with the excluded countries, thereby improving the terms of trade for the FTA members vis-à-vis the ROW. But in a model with scale economies, the pro-competitive effect of trade liberalization can generate a cut in price and increase in supply to excluded countries. The terms of trade of FTA members may therefore deteriorate in this event. It should also be mentioned that rules of origin may offset some of the potential welfare benefits of FTAs insofar as they may lead to higher input costs and consequent reduction of FTA preference margins (Krishna 2006).

In the real world, all of the various effects occur over time, some of them more quickly than others. However, the Michigan Model is static in the sense that it is based upon a single set of equilibrium conditions rather than relationships that vary over time.[15] The model results therefore refer to a time horizon that depends on the assumptions made about which variables do and do not adjust to changing market conditions, and on the short- or long-run nature of these adjustments. Because the supply and demand elasticities used in the model reflect relatively long-run adjustments and it is assumed that markets for both labor and capital clear within countries,[16] the modeling results are appropriate for a relatively long time horizon of several years—perhaps two or three at a minimum. On the other hand, the model does not allow for the very long-run adjustments that could occur through capital accumulation, population growth, and technological change. The modeling results should therefore be interpreted as being superimposed upon longer-run growth paths of the economies involved. To the extent that these growth paths themselves may be influenced by trade liberalization, therefore, the model does not capture such effects.

Benchmark Data

Needless to say, the data needs of this model are immense. Apart from numerous share parameters, the model requires various types of elasticity measures. As for other CGE models, most of our data come from published sources.

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15. As noted above, macroeconomic closure in the model involves the equivalent of having expenditure equal to the sum of earned incomes plus redistributed net tax revenues. However, the actual solution is attained indirectly, but equivalently, by imposing a zero change in the trade balance. Because the model allows for all net tax and tariff revenues to be redistributed to consumers, when tariffs are reduced with trade liberalization, the model implicitly imposes a nondistorting tax to recoup the loss in tariff revenues.

16. The analysis in the model assumes throughout that the aggregate, economy-wide level of employment is held constant in each country. The effects of trade liberalization are therefore not permitted to change any country's overall rates of employment or unemployment. This assumption is made because overall employment is determined by macroeconomic forces and policies that are not contained in the model and would not themselves be included in a negotiated trade agreement. The focus instead is on the composition of employment across sectors as determined by the microeconomic interactions of supply and demand resulting from the liberalization of trade.

The main data source used in the model is the GTAP-6.0 Database of the Purdue University Center for Global Trade Analysis Project (Dimaranan and McDougall 2005). The reference year for this GTAP database is 2001. From this source, we have extracted the following data, aggregated to our sectors and countries or regions:

- Bilateral trade flows among 30 countries or regions, decomposed into 27 sectors. Trade with ROW is included to close the model;
- Input-output tables for the 30 countries or regions, excluding ROW;
- Components of final demand along with sectoral contributions for the 30 countries or regions, excluding ROW;
- Gross value of output and value added at the sectoral level for the 30 countries or regions, excluding ROW;
- Bilateral import tariffs by sector among the 30 countries or regions;
- Elasticity of substitution between capital and labor by sector; and
- Bilateral export-tax equivalents among the 30 countries or regions, decomposed into 27 sectors.

The monopolistically competitive market structure in the nonagricultural sectors of the model imposes an additional data requirement of employment and the numbers of firms at the sectoral level. These data have been adapted from a variety of published sources, as will be noted below.

The GTAP-6.0 2001 database has been projected to the year 2020, which is when we assume that the Doha Round currently under way will have been completed and fully implemented. In this connection, we extrapolated the labor availability in different countries or regions by an annual average weighted population growth rate that varies by country or region.[17] All other major variables have been projected, using an average weighted growth rate of GDP of 3.1 percent. In the computational scenarios to be presented below, we use these extrapolated data as the

17 The growth projection of labor force from 2001 to 2020 is obtained from U.S. Census Bureau, International Data Base Summary Demographic Data for Taiwan and United Nations; and World Population Prospects (the 2004 revision, medium variant, http://esa.un.org/unpp) for other countries or regions. For a more elaborate and detailed procedure for calculating data extrapolations, see van der Mensbrugghe (2005) and related documents.

starting point to carry out our liberalization scenarios for the bilateral Korea-U.S. FTA and for the accompanying unilateral and global free trade scenarios.

In the GTAP-6.0 2001 database, the barriers on agricultural products consist of import tariffs, export subsidies or taxes, and domestic support. Tariffs on food and agriculture come from the WTO Agricultural Trade Policy Database, which is based on the Agricultural Market Access Database. Domestic support data are based on the producer support estimates for Organization for Economic Cooperation and Development (OECD) countries and input-output tables for non-OECD countries if data are available. Tariffs on merchandise come from the World Integrated Trade Solutions system of the World Bank and United Nations Conference on Trade and Development (UNCTAD). To incorporate the implementation of the Doha Round, the GTAP-6.0 2001 database has been adjusted using the tariff-cutting scenario provided by GTAP.[18] The implementation of the Doha Round means that developed countries cut agricultural protection by the percentages specified in the Doha Development Agenda, and all countries are assumed to adopt 50 percent tariff cuts for nonagricultural goods and manufactures.

The services barriers are based on financial data on average gross (price-cost) margins constructed initially by Hoekman (2000) and adapted for modeling purposes in Brown, Deardorff, and Stern (2002, 2003). The gross operating margins are calculated as the differences between total revenues and total operating costs and are presumed to reflect the barriers on the various modes of services transactions. Some of these differences are presumably attributable to fixed costs. Given that the gross operating margins vary across countries, a portion of the margin can be attributed in particular 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

18. For more detail, see "GTAP 6 Data Base with Doha Scenarios Data," Purdue University, GTAP, https://www.gtap.agecon.purdue.edu/databases/v6/V6_dohascen.asp.

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. The services barriers based on Hoekman (2000) are considerably higher than the import barriers on manufactures and reflect the fact that many services sectors are highly regulated and therefore may restrain international services transactions considerably. Nonetheless, as noted, because of the variations that exist in fixed costs, it is possible that the Hoekman services barriers may be overstated. We have accordingly reduced these barriers by 50 percent for modeling purposes. These services barriers for the United States and Korea are shown in ***Table 11*** and ***Table 12.***

Employment data, defined as labor force (LF_i), were obtained from Ministry of Home Affairs (2003) for India, Council for Economic Planning and Development (2006) for Taiwan, and World Bank (2006) for other countries or regions. Because employment data are not available at the sectoral level, we estimated the sectoral employment share, using the latest available data from UNIDO (2006) for manufacturing and from ILO (2006) for nonmanufacturing sectors. Multiplying the share by the total labor force (that is, $LF_i \times s_{ij}$), we estimated the sectoral employment data. Employment in the agricultural sector was further decomposed into 10 detailed agricultural sectors, using the labor endowment data in the GTAP-6.0 2001 database (that is, the employment was decomposed by the labor endowment shares).

Data on the number of firms were obtained from UNIDO (2006). If the number of firms was not available, we used the data for the number of establishments. Because the latest available years are different among countries and regions, we adjusted the number of firms, using the per capita GDP growth rate. For instance, if the latest available year was 2000, we multiplied the per capita GDP growth rate from 2000 to 2001 by the number of firms. For Taiwan, Brazil, and Uruguay, the number of firms was not available. We thus first estimated the total number of firms in the manufacturing sectors and then decomposed this total to the sectoral level, using the sectoral employment shares. For Taiwan, the total number of firms was estimated from the number of firms in Japan multiplied by the relative per capita GDP between Japan and Taiwan. Similarly, for Brazil and Uruguay, the total number of firms was estimated from the number of firms in Argentina multiplied by the relative per capita GDP between Argentina and Brazil (or Uruguay).

The value and shares of U.S. exports and imports of goods and services for 2001 in total and vis-à-vis Korea are broken down by sector in Table 11. U.S. total exports were $888.8 billion in 2001 and exports to

Table 11: Post-Doha Round Tariff Rates, Trade, and Employment by Sector for the United States

	Tariff		Exports (million $)		Exports (%)		Imports (million $)		Imports (%)		Employment	
	Global	Korea	World	Korea	World	Korea	World	Korea	World	Korea	%	Workers
Rice	2.0	0.0	286	4	0.0	0.0	35	0	0.0	0.0	0.0	34,933
Wheat	0.1	0.0	3,828	224	0.4	0.8	332	0	0.0	0.0	0.1	145,523
Other grains	0.0	1.4	5,779	284	0.7	1.0	509	1	0.0	0.0	0.3	399,575
Vegetables and fruits	0.4	0.4	5,091	88	0.6	0.3	7,549	26	0.6	0.1	0.4	545,326
Oil seeds	1.7	0.0	5,810	227	0.7	0.8	275	0	0.0	0.0	0.2	345,877
Sugar	0.3	0.0	2	0	0.0	0.0	6	0	0.0	0.0	0.0	61,612
Plant-based fibers	0.8	0.0	2,259	167	0.3	0.6	96	0	0.0	0.0	0.1	127,826
Other crops	2.2	0.7	3,085	132	0.3	0.4	6,544	22	0.5	0.1	0.6	875,698
Livestock	0.1	0.6	3,843	689	0.4	2.3	3,647	1	0.3	0.0	0.5	810,536
Other natural resources	0.1	0.0	1,505	66	0.2	0.2	1,651	3	0.1	0.0	0.2	265,358
Mining	0.0	0.0	4,260	144	0.5	0.5	77,530	2	6.0	0.0	0.4	625,009
Food, beverages, and tobacco	2.1	3.0	29,107	1,150	3.3	3.9	34,790	245	2.7	0.6	1.6	2,334,900
Textiles	4.5	6.2	12,625	165	1.4	0.6	30,961	1,607	2.4	4.2	0.5	798,191
Wearing apparel	5.7	8.7	5,116	34	0.6	0.1	50,788	1,805	3.9	4.7	0.4	533,082
Leather products and footwear	7.0	6.3	1,930	95	0.2	0.3	22,480	211	1.7	0.5	0.1	85,619
Wood and wood products	0.1	0.3	28,075	560	3.2	1.9	63,362	516	4.9	1.3	1.6	2,312,250
Chemicals	0.9	1.5	104,495	2,831	11.8	9.6	117,226	2,423	9.0	6.3	1.9	2,810,960
Nonmetallic mineral products	2.0	1.1	13,890	461	1.6	1.6	20,054	191	1.5	0.5	0.5	738,414
Metal products	0.7	1.2	33,490	1,013	3.8	3.4	64,781	2,138	5.0	5.5	2.1	3,103,481
Transportation equipment	0.6	1.2	110,075	3,029	12.4	10.3	191,656	7,403	14.7	19.2	1.5	2,196,211
Machinery and equipment	0.3	0.3	279,309	12,131	31.4	41.3	373,201	17,704	28.7	45.8	3.7	5,465,322
Other manufactures	0.6	2.1	14,710	245	1.7	0.8	57,287	972	4.4	2.5	0.4	532,360
Construction	0.0	0.0	1,416	27	0.2	0.1	1,766	5	0.1	0.0	1.0	1,552,050
Electricity, gas, and water	4.5	4.5	2,739	4	0.3	0.0	764	3	0.1	0.0	7.1	10,561,217
Trade and transport	13.5	13.5	62,203	2,057	7.0	7.0	82,987	1,333	6.4	3.4	26.7	39,685,306
Other private services	15.5	15.5	109,632	2,793	12.3	9.5	69,873	1,304	5.4	3.4	12.3	18,374,378
Government services	12.5	12.5	44,252	780	5.0	2.7	20,736	739	1.6	1.9	36.0	53,571,085
Total			888,812	29,403	100.0	100.0	1,300,886	38,654	100.0	100.0	100.0	148,892,100

Sources: Tariff and trade data are adapted from Brown, Deardorff, and Stern (2002) and Dimaranan and McDougall (2005) and adjusted using the tariff-cutting scenario provided by GTAP. For more detail, see main text. Employment data are adapted from ILO (2006); UNIDO (2006); and World Bank (2006).

Table 12: Post-Doha Round Tariff Rates, Trade, and Employment by Sector for Korea

	Tariff		Exports (million $)		Exports (%)		Imports (million $)		Imports (%)		Employment	
					Total = 100	World = 100			Total = 100	World = 100		
	Global	U.S.	World	U.S.	World	U.S.	World	U.S.	World	U.S.	%	Workers
Rice	903.4	932.1	0	0	0.0	0.0	29	5	0.0	0.0	3.6	816,381
Wheat	1.8	1.8	0	0	0.0	0.0	562	236	0.3	0.8	0.3	66,712
Other grains	375.6	376.3	1	1	0.0	0.0	924	299	0.6	1.0	0.1	20,323
Vegetables and fruits	72.8	34.1	253	23	0.1	0.1	273	105	0.2	0.3	3.6	826,501
Oil seeds	462.9	471.7	1	0	0.0	0.0	375	239	0.2	0.8	0.1	20,468
Sugar	1.7	12.5	0	0	0.0	0.0	1	0	0.0	0.0	0.0	1
Plant-based fibers	1.0	1.0	5	0	0.0	0.0	485	176	0.3	0.6	0.0	4,317
Other crops	15.4	29.6	264	20	0.1	0.1	790	161	0.5	0.5	0.9	209,642
Livestock	3.0	2.8	51	1	0.0	0.0	1,164	727	0.7	2.4	0.8	173,388
Other natural resources	6.0	3.3	112	2	0.1	0.0	887	72	0.5	0.2	0.6	148,253
Mining	3.6	1.2	46	1	0.0	0.0	23,747	166	14.6	0.5	0.1	19,156
Food, beverages, and tobacco	16.3	17.5	1,970	228	1.1	0.6	5,375	1,231	3.3	4.1	1.4	314,460
Textiles	7.9	7.3	13,627	1,516	7.7	4.0	3,967	179	2.4	0.6	1.6	363,128
Wearing apparel	9.9	10.9	3,424	1,725	1.9	4.6	1,773	35	1.1	0.1	1.0	235,212
Leather products and footwear	5.9	4.1	2,271	196	1.3	0.5	1,192	100	0.7	0.3	0.4	82,490
Wood and wood products	3.9	2.7	2,513	476	1.4	1.3	3,525	621	2.2	2.1	1.6	367,588
Chemicals	4.6	4.4	22,632	2,274	12.8	6.1	17,599	2,979	10.8	9.9	2.4	550,869
Nonmetallic mineral products	6.8	6.9	1,576	164	0.9	0.4	3,086	503	1.9	1.7	0.6	147,018
Metal products	3.3	3.2	11,992	1,991	6.8	5.3	12,116	1,081	7.5	3.6	2.2	500,209
Transportation equipment	3.2	1.3	25,338	7,251	14.3	19.3	6,571	3,066	4.0	10.1	2.3	533,709
Machinery and equipment	2.7	2.1	70,605	17,360	39.8	46.2	49,271	12,340	30.3	40.8	6.0	1,371,734
Other manufactures	8.5	14.7	2,735	926	1.5	2.5	1,573	257	1.0	0.8	0.3	74,695
Construction	0.0	0.0	26	5	0.0	0.0	110	27	0.1	0.1	0.3	61,726
Electricity, gas, and water	2.0	2.0	94	3	0.1	0.0	56	4	0.0	0.0	7.3	1,686,820
Trade and transport	8.0	8.0	7,080	1,333	4.0	3.6	12,431	2,057	7.6	6.8	33.4	7,658,271
Other private services	13.0	13.0	8,260	1,304	4.7	3.5	13,173	2,793	8.1	9.2	10.6	2,437,110
Government services	10.5	10.5	2,302	739	1.3	2.0	1,524	780	0.9	2.6	18.6	4,268,667
Total			177,179	37,540	100.0	100.0	162,579	30,240	100.0	100.0	100.0	22,958,850

Sources: See Table 11.

Table 13: **U.S. Exports and Imports by Major Trading Countries, 2003 and 2004 (millions of dollars and percentage)**

Country	2003 exports		2004 exports		2003 imports		2004 imports	
	Amount	Share and rank	Amount	Share and rank	Amount	Share and rank	Amount	Share and rank
Canada	169,923.7	23.4	189,879.9	23.5	221,594.7	17.6	256,359.8	17.4
		(1)		(1)		(1)		(1)
Mexico	97,411.8	13.4	110,935	13.7	138,060	11.0	155,901.5	10.6
		(2)		(2)		(3)		(3)
China	28,367.9	3.9	34,744.1	4.3	152,436.1	12.1	196,682	13.4
		(6)		(5)		(2)		(2)
Japan	52,004.3	7.2	54,243.1	6.7	118,036.6	9.4	129,805.2	8.8
		(3)		(3)		(4)		(4)
Germany	28,831.9	4.0	31,415.9	3.9	68,112.7	5.4	77,265.6	5.2
		(5)		(6)		(5)		(5)
England	33,827.9	4.7	36,000	4.5	42,795	3.4	46,273.8	3.1
		(4)		(4)		(6)		(6)
Korea	24,072.6	3.3	26,412.5	3.3	37,229.4	3.0	46,167.9	3.1
		(7)		(7)		(7)		(7)
Taiwan	1,747.9	2.4	21,744.4	2.7	31,599.4	2.5	34,623.6	2.4
		(9)		(9)		(8)		(8)
France	17,053	2.4	21,263.3	2.6	29,219.3	2.3	31,605.7	2.1
		(10)		(10)		(9)		(9)

Source: U.S. Census Bureau as reported in Lee and Lee (2005, 51).
Note: Number in parentheses indicates rank.

Korea were $29.4 billion, or 3.3 percent of total exports. Some additional detail on U.S. exports by major trading country for 2003 and 2004 is given in ***Table 13.*** Korea ranks seventh in the group of countries shown. The sectoral shares of U.S. exports to Korea that are indicated in Table 11 show that 73.9 percent of these exports are concentrated in manufactures, especially transportation equipment and machinery and equipment, nearly 20 percent in services, and approximately 6 percent in agricultural products. U.S. total imports were $1,300.9 billion in 2001, and imports from Korea totaled $38.7 billion, or 3.0 percent of total imports. As noted in Table 13, Korea ranked seventh in the group of importing countries shown. The sectoral shares of U.S. imports from Korea are predominantly in manufactures (91.1 percent), especially in transportation equipment and machinery and equipment, and 8.7 percent in services.

As noted in Table 12, Korea's exports totaled $177.2 billion and total imports were $162.6 billion in 2001. The United States accounted for 21.2 percent of total Korean exports and 18.6 percent of total Korean imports. The sectoral shares of Korea's exports of manufactures to the United States were 90.8 percent of the total and were concentrated especially in transportation equipment and machinery and equipment, and 9.1 percent in services. The sectoral shares of Korea's imports of

Table 14: **Value of Korea's Bilateral Trade with the United States: 1980–2005**

Year	Korean exports to the United States		Korean imports from the United States		Trade balance
	Value	Share	Value	Share	
1980	4,606.6	26.3	4,890.2	21.9	-283.6
1985	10,754.1	35.5	6,489.3	20.8	4,264.8
1990	19,360.0	29.8	16,942.5	24.3	2,417.5
1995	24,131.5	19.3	30,403.5	22.5	-6,272.0
2000	37,610.6	21.8	29,421.6	18.2	8,189.0
2002	32,780.2	20.2	23,008.6	15.1	9,771.6
2003	34,219.4	17.7	24,814.1	13.9	9,405.3
2004	42,849.0	16.9	28,783.0	12.8	14,066.0
2004(1–9)	30,129.0	14.5	22,779.0	12.0	7,350.0

Sources: Korea International Trade Association as reported in Lee and Lee (2005, 52).

manufactures from the United States were 74.1 percent of the total, 6.4 percent for agricultural products, and 18.7 percent for services. The value of Korea's bilateral trade with the United States for 1980–2005 is shown in ***Table 14.*** It is evident that the U.S. shares of this trade have declined considerably in the period shown, from 26.3 percent of Korean exports to the United States in 1980 to 14.5 percent in 2005. Similarly, the U.S. share of Korean imports declined from 21.9 percent in 1980 to 12 percent in 2005. These changes can be seen more clearly in ***Table 15*** with changes in Korea's exports and imports by major trading partners between 2000 and 2005. What stands out is the increased importance of Korea's trade with China, which accounted for 10.7 percent of Korean exports in 2000 and 21.8 percent in 2005. Similarly, Korean imports from China were 8.0 percent of total imports in 2000 and 18.5 percent in 2005.

Employment by sector is indicated in the last two columns of Tables 11 and 12. The U.S. total labor force in 2001 was 148.9 million workers, with more than 80 percent of employment in the services sectors, 2.2 percent in agriculture, and 14.3 percent in manufacturing. The Korean labor force was 23.0 million in 2001, with 9.4 percent of employment in agriculture (3.6 percent in both rice and vegetables and fruits), 19.8 percent in manufactures, and 70.2 percent in services.

Information on the stock of inward and outward U.S. FDI abroad for 2005 is indicated in ***Table 16.*** Inward FDI for the United States totaled $1,635.3 billion and outward FDI totaled $2,070 billion. Inward FDI from Korea was $6.2 billion, or 0.4 percent of the total; 9.3 percent of the total from Korea was in manufacturing and the remainder in services-related sectors. U.S. outward FDI to Korea was $18.8 billion, or 9.0 percent of the U.S. total. U.S. FDI in Korean manufacturing was

Table 15: **Korea: Major Trading Partners (billions of dollars, percentage share of world total in parentheses)**

Country	2000	2001	2002	2003	2004	2005
Korean exports to						
United States	37.6	31.2	32.8	34.2	42.9	41.3
	(21.8)	(20.7)	(20.2)	(17.6)	(16.9)	(14.5)
Japan	20.5	16.5	15.1	17.3	21.7	24.0
	(11.9)	(11.0)	(9.3)	(8.9)	(8.6)	(8.4)
China, excluding Hong Kong	18.5	18.2	23.8	35.1	49.8	61.9
	(10.7)	(12.1)	(14.6)	(18.1)	(19.6)	(21.8)
European Union	23.4	19.6	21.7	24.9	37.8	43.7
	(13.6)	(13.0)	(13.4)	(12.8)	(14.9)	(15.4)
Subtotal	100.0	85.5	93.4	111.5	152.2	170.9
	(58.0)	(56.8)	(57.5)	(57.5)	(60.0)	(60.1)
World total	172.3	150.4	162.5	193.8	253.8	284.4
Korean imports from						
United States	29.2	22.4	23.0	24.8	28.8	30.6
	(18.2)	(15.9)	(15.1)	(13.9)	(12.8)	(11.7)
Japan	31.8	26.6	29.9	36.3	46.1	48.4
	(19.8)	(18.9)	(19.7)	(20.3)	(20.5)	(18.5)
China, excluding Hong Kong	12.8	13.3	17.4	21.9	29.6	38.7
	(8.0)	(9.4)	(11.4)	(12.2)	(13.2)	(14.8)
European Union	15.8	14.9	17.1	19.4	24.2	27.3
	(9.8)	(10.6)	(11.2)	(10.9)	(10.8)	(10.5)
Subtotal	89.6	77.2	87.4	102.4	128.7	145.0
	(55.8)	(54.7)	(57.5)	(57.3)	(57.3)	(55.5)
World total	160.5	141.1	152.1	178.8	224.5	261.2

Source: Korea Ministry of Finance and Economy, Major Economic Indicators, 17 February 2006, as reported in Schott, Bradford, and Moll (2006, 19).

Note: Exports are free on board (fob) basis and imports are cost, insurance, freight (cif) basis.

$8.3 billion, 44 percent of total U.S. FDI in Korea, and the remainder in services-related sectors. World FDI flows into Korea by major countries from 1962–90 to 2005 are indicated in ***Table 17.*** Most of these inflows came from the United States, the European Union, and Japan. Korean outward FDI flows in manufacturing industry are shown in ***Table 18*** for 2001 to 2005. China has become the major recipient of Korean outward manufacturing FDI.

With the foregoing by way of background, we turn now to our computational analysis, which will focus on the economic effects on the United States and Korea of the bilateral removal of trade barriers on agricultural products, manufactures, and services as the result of a Korea-U.S. FTA. Depending on the details of the FTA negotiations, many of these bilateral barriers would be removed immediately, but some would be phased out over longer periods of time. For modeling purposes, however, we assume that all barriers are removed at the same time rather than in phases. As noted in Chapter 1, many other aspects of the Korea-U.S.

Table 16: **Inward and Outward Foreign Direct Investment for the United States, 2005 (millions of U.S. dollars)**

Areas of foreign direct investment	Inward FDI		Outward FDI	
	All countries	Korea	All countries	Korea
Mining			114,386	1
Manufacturing	538,122	577	451,402	8,251
Food	19,779	4	31,524	795
Chemicals	151,624	32	109,354	1,515
Primary and fabricated metals	28,651	139	21,671	102
Machinery	48,673	-7	29,224	495
Computers and electronic products	47,016	n.a.	58,785	2,328
Electrical equipment, appliances, and components	14,191	n.a.	13,079	286
Transportation equipment	76,036	n.a.	48,930	696
Other manufacturing	152,152	89	138,836	2,034
Wholesale trade	230,104	4,539	142,960	1,144
Retail trade	29,686	n.a.		
Information	142,556	n.a.	55,479	251
Depository institutions (banking)	130,940	328	70,331	3,712
Finance (except depository institutions) and insurance	207,552	144	393,723	1,949
Real estate and rental and leasing	41,006	59		
Professional, scientific, and technical services	41,879	2	49,202	856
Holding companies (nonbank)			623,076	312
Other industries	273,444	14	169,424	2,284
All industries	1,635,291	6,203	2,069,983	18,759

Sources: BEA (2006, 59 [Table 10.4]) for inward FDI for the United States; BEA (2006, 106 [Table 10.3]) for outward FDI for the United States.

FTA are to be negotiated besides the bilateral barriers. Because these other aspects involve primarily qualitative considerations on rules and procedures, they are not taken into account in what follows.

Comparative Static Computational Scenarios

The global welfare effects of the bilateral removal of agricultural protection, manufactures tariffs, and services barriers are indicated in Table 19. The sectoral effects on exports, imports, gross output, and employment are indicated in Table 20 and Table 21.[19]

Bilateral Agricultural Liberalization

The first four columns of ***Table 19*** refer to the bilateral elimination of agricultural tariffs and export subsidies. No allowance has been made for removal of domestic agricultural supports because these supports do not apply bilaterally. It is evident that U.S. welfare declines by $1.4

19. See the appendix for sensitivity analysis of introducing alternative parameters in the model and the resulting impacts of trade liberalization.

Table 17: **World Foreign Direct Investment Flows into Korea by Major Countries (millions of dollars, percentage)**

Period	Total	United States		European Union		Japan		Others	
		Values	Share (%)	Values	Share (%)	Values	Share (%)	Values	Share (%)
1962–90	7,874	2,243	29	984	13	3,798	48	848	11
1991	1,396	297	21	749	54	226	16	124	9
1995	1,947	643	33	461	24	424	22	419	22
2000	15,217	2,922	19	4,391	29	2,448	16	5,455	36
2001	11,292	3,889	34	3,062	27	772	7	3,569	32
2002	9,101	4,500	49	1,663	18	1,403	15	1,535	17
2003	6,467	1,240	19	3,061	47	541	8	1,625	25
2004	12,785	4,717	37	3,008	24	2,258	18	2,802	15
2005 (Jan.–Sept.)	7,697	1,350	17.4	3,778	49.1	972	12.6	1,597	20.7

Source: Korean Ministry of Commerce, Industry and Energy, each year, as reported in Lee and Lee (2005, 56).

Table 18: **Korean Outward FDI (Manufacturing Industry) to Major Countries: 2001–2005 (Sept.) (millions of dollars)**

Major countries	2001	2002	2003	2004	2005 (Sept.)
China	589.8	905.7	1,464.1	2,059.3	1,504.0
U.S.	975.7	165.2	360.6	492.9	154.5
EU	1,735.9	281.3	66.1	405.8	271.6
Japan	25.0	9.1	8.5	32.1	33.8

Source: Korea Export and Import Bank, as reported in Lee and Lee (2005, 58).

billion (0.01 percent of GDP) with bilateral removal of agricultural tariffs,[20] and there is a small welfare increase of $.05 billion for the bilateral removal of agricultural export subsidies. Korea experiences a welfare increase of $.05 billion for tariff removal. Global economic welfare rises by $2.73 billion, with most countries benefiting from the bilateral tariff removal and showing insignificant welfare losses from the bilateral removal of the export subsidies.

Bilateral Manufactures Liberalization

Columns (5) and (6) of Table 19 refer to the welfare effects of the bilateral elimination of manufactures tariffs. U.S. welfare is increased by $7.27 billion (0.04 percent of GDP), and Korea's welfare is increased by

20. The welfare decline with removal of bilateral agricultural tariffs may reflect the shift of labor and capital toward constant-returns-to-scale agricultural sectors and away from the increasing-returns-to-scale manufactures and services sectors.

Table 19: **Global Welfare Effects of Korea-U.S. FTA (billions of U.S. dollars and percentage)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Agricultural protection										Real returns		
	Tariff		Export subsidy		Manufactures tariffs		Services barriers		Total		Capital	Labor	Terms of trade
Countries and areas of the world	% of GDP	Billions of dollars	% of GDP	Billions of dollars	% of GDP	Billions of dollars	% of GDP	Billions of dollars	% of GDP	Billions of dollars	%	%	%
Japan	0.01	0.83	0.00	(0.01)	-0.00	(0.09)	0.00	0.24	0.01	0.97	0.01	0.00	0.01
United States	-0.01	(1.40)	0.00	0.05	0.04	7.27	0.11	19.20	0.14	25.12	0.03	0.02	0.05
EU and EFTA	0.01	0.74	0.00	(0.01)	0.00	0.08	0.00	0.39	0.01	1.21	0.00	0.00	0.01
Canada	0.01	0.10	0.00	(0.00)	0.01	0.08	0.01	0.09	0.02	0.28	0.01	0.00	0.00
Australia	0.01	0.05	0.00	(0.00)	0.01	0.03	0.01	0.04	0.02	0.12	0.01	0.01	0.01
New Zealand	0.01	0.01	0.00	(0.00)	0.00	0.00	0.01	0.00	0.02	0.01	0.01	0.01	-0.00
Hong Kong	0.02	0.05	0.00	(0.00)	0.02	0.05	0.00	0.00	0.04	0.10	0.02	0.02	0.02
Korea	-0.07	(0.50)	-0.02	(0.16)	0.61	4.48	0.74	5.46	1.26	9.28	1.36	1.53	-0.28
Singapore	0.01	0.01	0.00	(0.00)	0.00	0.00	0.01	0.01	0.02	0.03	0.01	0.01	0.00
Taiwan	0.01	0.05	0.00	(0.00)	-0.02	(0.11)	0.01	0.04	-0.01	-0.03	0.00	-0.01	0.00
China	0.08	1.69	0.00	(0.00)	0.02	0.44	0.00	0.07	0.11	2.20	0.11	0.08	-0.03
India	0.00	0.02	0.00	(0.00)	0.00	0.00	0.00	0.02	0.00	0.04	0.00	0.00	-0.01
Indonesia	0.02	0.05	0.00	(0.00)	0.01	0.01	0.01	0.02	0.03	0.08	0.02	0.01	0.01
Malaysia	0.02	0.03	-0.00	(0.00)	-0.04	(0.06)	0.02	0.02	-0.01	-0.01	0.01	-0.01	0.01
Philippines	0.02	0.03	0.00	(0.00)	-0.01	(0.01)	0.01	0.02	0.02	0.03	0.01	0.01	0.00
Thailand	0.03	0.06	0.00	(0.00)	-0.02	(0.05)	0.01	0.01	0.01	0.02	0.01	-0.01	-0.00
Vietnam	0.04	0.02	0.00	(0.00)	0.05	0.03	0.01	0.00	0.10	0.06	0.07	0.07	-0.06
Russia	0.01	0.04	0.00	(0.00)	-0.00	(0.00)	0.00	0.00	0.01	0.04	0.00	-0.00	-0.00
Turkey	0.00	0.01	0.00	(0.00)	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	-0.01
Mexico	0.01	0.09	0.00	(0.00)	0.00	0.01	0.01	0.07	0.02	0.17	-0.00	-0.00	0.00
Argentina	-0.01	(0.05)	0.00	(0.00)	-0.00	(0.01)	0.00	0.01	-0.01	-0.05	0.00	0.01	-0.03
Brazil	0.05	0.48	0.00	(0.00)	0.00	0.02	0.00	0.02	0.06	0.51	0.07	0.03	-0.03
Chile	0.02	0.02	0.00	(0.00)	0.01	0.01	0.01	0.01	0.03	0.04	0.02	0.02	0.01
Colombia	0.01	0.01	0.00	(0.00)	0.01	0.01	0.00	0.00	0.02	0.02	0.00	0.01	0.00
Peru	0.01	0.01	0.00	(0.00)	0.00	0.01	0.00	0.01	0.01	0.03	0.00	-0.00	0.01
Uruguay	0.00	0.00	0.00	(0.00)	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00
Rest of Asia	0.02	0.07	0.00	(0.00)	-0.00	(0.02)	0.00	0.01	0.01	0.06	0.01	0.01	-0.02
Rest of Middle East	0.01	0.11	0.00	(0.00)	0.01	0.11	0.02	0.18	0.03	0.39	0.02	0.01	0.01
Rest of Central and Latin America	0.01	0.04	0.00	(0.00)	0.01	0.05	0.00	0.03	0.02	0.12	0.01	0.01	0.00
Africa	0.01	0.09	0.00	(0.00)	0.01	0.09	0.00	0.03	0.02	0.21	0.02	0.01	0.01
Total		2.73		(0.15)		12.43		26.05		41.04			

Source: Authors' data.

$4.48 billion (0.61 percent of GDP). There are small welfare increases and declines for the other countries or regions. Global welfare rises by $12.43 billion.

Bilateral Services Liberalization

The effects of bilateral services liberalization noted in columns (7) and (8) are considerably larger compared with the agricultural and manufactures liberalization. U.S. welfare increases by $19.20 billion (0.11 percent of GDP), and Korea's welfare increases by $5.46 billion (0.74 percent of GDP). All other countries or regions show small and positive increases in welfare.

Combined Bilateral Liberalization

The effects of the combined bilateral liberalization of agricultural protection, manufactures, and services are shown in columns (9) and (10). U.S. welfare increases by $25.12 billion (0.14 percent of GDP), and Korea's welfare increases by $9.28 billion (1.26 percent of GDP). Most of the other countries or regions show small, positive increases in welfare. Global economic welfare rises by $41.04 billion. These results are in contrast with the magnitudes and signs of the welfare effects generated using the GTAP framework as noted in Tables 1 and 6.

Real Returns to Capital and Labor

The real returns to capital and labor are shown in columns (11) and (12). These returns increase by 0.03 and 0.02, respectively, for the United States and considerably more for Korea—1.36 percent and 1.53 percent. There are small increases in the real returns in the other countries or regions. These results differ significantly from those noted in Table 6 above, based on Schott, Bradford, and Moll (2006, 26), which show increases in real factor prices for labor and capital greater than 10 percent for Korea and very small changes for the United States. The results in McDaniel and Fox (2001, 5–15) are somewhat more in line with our results in Table 19.

Terms of Trade

The last column in Table 19 shows small terms-of-trade improvement for both the United States and Korea. These changes in terms of trade are much smaller than the terms-of-trade results generated by

Table 20: **Korea-U.S. Free Trade Agreement: Change in Exports, Imports, Outputs, and Number of Workers for the United States**

	Exports		Imports		Output		Employment Number of workers[a]	
Industry	Value	Percent	Value	Percent	Value	Percent	Value	Percent
Rice	30	4.8	0	0.3	33	1.1	460	1.1
Wheat	25	0.4	1	0.2	28	0.2	388	0.2
Other grains	618	5.8	2	0.2	649	1.6	7,446	1.6
Vegetables and fruits	99	1.1	13	0.1	83	0.2	1,064	0.2
Oil seeds	494	4.6	1	0.3	527	1.7	7,151	1.7
Sugar	0	0.1	0	0.2	4	0.1	67	0.1
Plant-based fibers	26	0.6	(0)	-0.1	6	0.0	63	0.0
Other crops	185	3.3	16	0.2	193	0.3	3,390	0.3
Livestock	78	1.1	8	0.1	197	0.1	1,092	0.1
Other natural resources	10	0.4	2	0.1	8	0.0	(2)	-0.0
Mining	5	0.1	131	0.1	(72)	-0.0	(363)	-0.0
Food, beverages, and tobacco	1,046	2.0	101	0.2	1,226	0.1	1,880	0.1
Textiles	(19)	-0.1	784	1.5	(1,109)	-0.4	(4,426)	-0.5
Wearing apparel	(10)	-0.1	1,209	1.4	(954)	-0.5	(3,482)	-0.6
Leather products and footwear	14	0.4	70	0.2	(32)	-0.1	(171)	-0.2
Wood and wood products	32	0.1	148	0.1	(54)	-0.0	(483)	-0.0
Chemicals	784	0.4	434	0.2	490	0.0	119	0.0
Nonmetallic mineral products	149	0.6	43	0.1	104	0.0	289	0.0
Metal products	157	0.3	288	0.3	(87)	-0.0	(1,077)	-0.0
Transportation equipment	51	0.0	1,009	0.3	(704)	-0.1	(2,287)	-0.1
Machinery and equipment	1,341	0.3	716	0.1	792	0.0	1,438	0.0
Other manufactures	125	0.5	177	0.2	(8)	-0.0	(186)	-0.0
Construction	(2)	-0.1	3	0.1	2	0.0	(68)	-0.0
Electricity, gas, and water	(5)	-0.1	2	0.2	20	0.0	(639)	-0.0
Trade and transport	646	0.6	1,043	0.7	(72)	-0.0	(5,379)	-0.0
Other private services	1,534	0.8	1,064	0.9	612	0.0	(569)	-0.0
Government services	322	0.4	470	1.3	(344)	-0.0	(5,714)	-0.0
Total	7,735		7,735		1,537		0	

Source: Authors' data.

a. Changes in employment sum to zero because of assumption of full employment.

the GTAP framework, as, for example, in Table 2 based on Choi and Schott (2001).

Sectoral Effects: United States

The changes in U.S. exports and imports arising from the FTA are indicated in the first four columns of ***Table 20.*** Total exports and imports increase by $7.8 billion. Agricultural exports increase by $1.6 billion; food, beverages, and tobacco by $1 billion; manufactures by $2.6 billion; and services by $2.5 billion. There are negligible imports of agricultural

products, imports of manufactures increase by $4.9 billion, and imports of services increase by $2.6 billion. These changes in U.S. trade differ from the changes noted in McDaniel and Fox (2001, 5–10), Choi and Schott (2001, 58), and Lee and Lee (2005, 88).

Changes in the value of output are indicated in the fifth and sixth columns. It is evident that output expands in all of the agricultural sectors; food, beverages, and tobacco; chemicals; nonmetallic mineral products; machinery and equipment; other manufactures; and other private services. Output declines especially in textiles and wearing apparel. These results are smaller than those reported in McDaniel and Fox (2001, 5–13) and especially those reported in Table 8 above that is based on Schott, Bradford, and Moll (2006).

Changes in employment shown in the seventh and eighth columns mirror the changes in output. It appears that employment is shifted to the expansion of the agricultural sectors and food, beverages, and tobacco, and away from most of the manufacturing sectors and from services. But the employment changes noted are all comparatively small in percentage terms. It should also be noted that the employment changes sum to zero because of the assumption of full employment of the fixed labor supply. That is, there will be positive and negative shifts in employment that balance out for the economy as a whole.

Sectoral Effects: Korea

The changes in Korea's exports and imports arising from the FTA are indicated in ***Table 21.*** Korea has minor changes in its agricultural exports. Its exports of manufactures increase by $6.4 billion and services by $2.3 billion. Korea's imports of agricultural products and food, beverages, and tobacco increase by $1.7 billion, manufactures by $3.8 billion, and services by $2.8 billion.

Korea's declines in output are concentrated in four of the agricultural sectors and to a small extent in nonmetallic mineral products and machinery and equipment. Within agriculture, there are negative output and employment changes in other grains, vegetables and fruits, oil seeds, and other crops, while output and employment increase in rice, wheat, and livestock. The underlying results, which stem from the structure of the model,[21] indicate that Korean agricultural import prices fall relative to domestic goods for all sectors. But the change in the quantity

21. For the complete description of the formal structure and equations of the model, see the Michigan Model of World Production and Trade, www.Fordschool.umich.edu/rsie/model/.

Table 21: **Korea-U.S. Free Trade Agreement: Change in Exports, Imports, Outputs, and Number of Workers for Korea**

	Exports		Imports		Output		Employment Number of workers[a]	
Industry	Value	Percent	Value	Percent	Value	Percent	Value	Percent
Rice	0	6.6	36	27.7	380	2.7	23,659	2.7
Wheat	(0)	-0.4	39	4.0	17	0.7	512	0.7
Other grains	0	2.2	161	8.3	(90)	-34.7	(4,294)	-34.7
Vegetables and fruits	(5)	-1.0	112	22.1	(39)	-0.2	(2,317)	-0.3
Oil seeds	(0)	-0.3	327	34.8	(129)	-58.2	(8,655)	-58.2
Sugar	0	0.1	0	2.4	0	1.9	0	1.8
Plant-based fibers	(0)	-1.8	74	8.9	3	4.2	190	4.1
Other crops	(5)	-1.1	176	13.6	(120)	-3.1	(6,939)	-3.1
Livestock	4	3.9	65	3.4	459	3.5	6,656	3.5
Other natural resources	1	0.6	18	1.3	79	1.4	289	0.2
Mining	(1)	-1.8	386	1.0	(41)	-1.3	(317)	-1.6
Food, beverages, and tobacco	277	6.9	663	7.6	2,255	3.1	(2,373)	-0.7
Textiles	2,123	8.6	242	3.6	3,942	9.5	29,591	7.6
Wearing apparel	1,746	27.7	(182)	-6.0	2,181	15.5	33,033	13.2
Leather products and footwear	327	7.7	12	0.6	592	8.0	5,168	5.8
Wood and wood products	10	0.2	111	2.0	250	0.7	(1,694)	-0.4
Chemicals	407	1.0	1,034	3.5	1,515	0.9	(1,374)	-0.2
Nonmetallic mineral products	4	0.2	170	3.4	(43)	-0.2	(2,215)	-1.4
Metal products	94	0.4	357	1.7	283	0.3	(3,556)	-0.7
Transportation equipment	1,244	2.7	243	2.1	1,904	2.0	4,116	0.7
Machinery and equipment	(213)	-0.2	1,575	1.8	(841)	-0.3	(20,385)	-1.4
Other manufactures	261	5.3	112	4.2	287	2.8	1,077	1.4
Construction	0	0.1	2	1.1	580	1.2	63	0.1
Electricity, gas, and water	(0)	-0.1	1	1.4	250	0.3	(4,476)	-0.3
Trade and transport	1,018	7.9	591	2.7	2,783	1.4	(23,553)	-0.3
Other private services	904	6.1	1,837	7.8	1,831	0.6	(9,512)	-0.4
Government services	396	9.7	432	15.8	158	0.1	(12,692)	-0.3
Total	8,594		8,594		18,449		(0)	

Source: Authors' data.

a. Changes in employment sum to zero because of assumption of full employment.

demanded is greater than the relative price decline in the rice, wheat, and livestock sectors, so that output and employment increase in these sectors. There are noticeably large increases in output and employment in textiles, wearing apparel, leather products and footwear, and transportation equipment and declines in the other manufacturing sectors and in services. The employment changes thus reflect the shift of labor from the more capital-intensive to the relatively labor-intensive manufacturing sectors, and the changes are large enough to suggest that adjustment problems may be encountered depending on how rapidly the bilateral

Table 22. **Korea-U.S. Free Trade Agreement: Changes in Bilateral Trade Flows (millions of dollars)**

	To															
From	JPN	USA	EUN	CAN	AUS	NZL	HKG	KOR	SGP	TWN	CHN	IND	IDN	MYS	PHL	THA
JPN	0	104	(16)	8	(0)	(0)	(12)	25	1	(4)	(77)	(2)	(3)	1	1	(1)
USA	(136)	0	(530)	(138)	(22)	(6)	(27)	9,173	(32)	(41)	(79)	(14)	(10)	(16)	(9)	(14)
EUN	(58)	264	0	17	(6)	(3)	(28)	(117)	(8)	(12)	(76)	(18)	(7)	(6)	(3)	(9)
CAN	(7)	54	(29)	0	(1)	(0)	(2)	(5)	(1)	(2)	(11)	(1)	(1)	(1)	(0)	(1)
AUS	(6)	9	(5)	1	0	(3)	(1)	10	(0)	(3)	(7)	(1)	(1)	(1)	(1)	(1)
NZL	(0)	4	(1)	0	0	0	(0)	(10)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
HKG	(1)	6	(2)	1	0	(0)	0	(19)	0	(2)	(30)	(1)	(0)	(0)	(1)	(1)
KOR	205	6,930	289	57	11	5	60	0	(11)	(12)	468	12	66	(12)	15	15
SGP	(5)	12	(9)	1	(0)	(0)	(7)	(5)	0	(1)	(11)	(2)	(2)	(3)	(1)	(1)
TWN	(0)	27	3	2	(0)	(0)	(10)	(1)	2	0	(48)	(1)	(7)	1	(6)	(2)
CHN	36	218	141	19	6	0	(9)	(428)	18	14	0	4	2	8	1	7
IND	(1)	(8)	(7)	(0)	(0)	(0)	(1)	(11)	(0)	(1)	(3)	0	(1)	(1)	(0)	(1)
IDN	(3)	8	6	1	(0)	(0)	(1)	35	(1)	(2)	(5)	(1)	0	(1)	(1)	(1)
MYS	(7)	16	(5)	1	(0)	(0)	(4)	(3)	(5)	(1)	(11)	(4)	(1)	0	(0)	(1)
PHL	(4)	8	(1)	1	0	(0)	(1)	(7)	(1)	(0)	(2)	(0)	(0)	(0)	0	(0)
THA	0	6	3	1	1	(0)	(1)	(21)	3	1	(3)	(0)	(1)	1	(0)	0
VNM	12	3	43	1	(0)	0	0	(14)	(0)	2	(1)	(0)	(0)	0	0	0
RUS	(2)	10	(12)	0	0	(0)	(0)	(7)	(0)	(0)	(10)	(1)	(0)	(0)	(0)	(0)
TUR	(0)	(2)	(10)	0	0	(0)	(0)	(3)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(0)
MEX	(2)	(8)	(9)	1	(0)	(0)	(1)	(3)	(0)	(1)	(2)	(2)	(0)	(0)	(0)	(0)
ARG	1	9	8	1	0	0	(0)	(90)	0	(0)	0	0	0	(0)	0	0
BRA	3	41	20	2	0	0	(0)	(156)	0	0	0	0	0	0	0	0
CHL	(2)	6	(1)	0	(0)	(0)	(0)	6	(0)	(0)	(2)	(0)	(0)	(0)	(0)	(0)
COL	(0)	1	(0)	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
PER	(0)	12	(2)	(0)	(0)	(0)	(0)	0	(0)	(0)	(0)	(4)	(0)	(0)	(0)	(0)
URY	(0)	0	0	0	0	(0)	(0)	(1)	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)
ROA	1	(25)	6	1	0	(0)	(1)	3	(1)	(0)	(2)	0	(0)	(0)	(0)	1
XME	(20)	14	(39)	(0)	(1)	(0)	(3)	248	(3)	(8)	(14)	(6)	(2)	(2)	(1)	(4)
CLA	(1)	(16)	(4)	2	0	(0)	(0)	(12)	(0)	(0)	(1)	(0)	(0)	0	0	(0)
AFR	(3)	34	(33)	1	(0)	(0)	(1)	(7)	(0)	(3)	(6)	(4)	(1)	(0)	(0)	(1)
ROW	(2)	(0)	(43)	(0)	(1)	(0)	(0)	15	(0)	(1)	(6)	(1)	(0)	(0)	(0)	(1)
Imp.	(3)	7,735	(241)	(21)	(14)	(9)	(52)	8,594	(41)	(73)	60	(47)	29	(33)	(7)	(16)

barriers would be removed. These employment results are in contrast with those reported in Table 5 above based on Lee and Lee (2005) and Table 9 based on Schott, Bradford, and Moll (2006).

Changes in Bilateral Trade Flows

Table 22 provides an indication of the changes in the bilateral trade flows in all the countries or regions of the model in response to the Korea-U.S. FTA. U.S. bilateral exports to Korea increase by $9.2 billion but decline across all other countries or regions as trade diversion takes place. U.S. imports from Korea increase by $6.9 billion, and there are increased U.S. imports from several other trading partners as well as small reductions in imports from a number of other countries. Korea's bilateral exports increase to most of its trading partners. Its bilateral imports from the United States increase, but its imports decline from most of its trading partners, again indicating the presence of trade diversion.

Table 22. **Korea-U.S. Free Trade Agreement: Changes in Bilateral Trade Flows (millions of dollars)** ***(continued)***

To															
VNM	RUS	TUR	MEX	ARG	BRA	CHL	COL	PER	URY	ROA	XME	CLA	AFR	ROW	Exp.
(2)	(0)	(1)	4	(2)	(3)	(0)	(0)	(0)	(0)	(7)	5	(17)	(3)	(1)	(3)
(1)	(14)	(10)	(95)	(20)	(41)	(5)	(3)	(8)	(1)	(12)	(28)	(83)	(42)	0	7,735
9	(25)	(19)	7	(20)	(28)	(2)	(1)	(0)	(1)	(16)	29	(23)	(50)	(31)	(241)
0	(1)	(0)	(1)	(1)	(2)	(0)	(0)	(0)	(0)	(1)	(0)	(4)	(2)	(0)	(21)
0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(2)	1	(0)	(1)	(1)	(14)
0	(0)	(0)	0	(0)	(0)	0	(0)	(0)	(0)	(0)	0	(0)	(0)	(0)	(9)
1	(0)	(0)	0	(1)	(1)	0	(0)	0	(0)	(2)	2	(0)	(0)	(0)	(52)
43	25	17	21	4	14	6	4	6	2	81	105	111	70	(12)	8,594
1	(0)	(0)	0	(0)	(1)	(0)	(0)	(0)	(0)	(7)	2	(1)	(1)	(0)	(41)
(10)	(0)	(0)	2	(1)	(1)	(0)	(0)	(0)	(0)	(13)	(3)	(4)	(2)	(0)	(73)
4	(2)	1	10	0	2	1	0	1	0	(8)	11	(0)	6	(3)	60
0	(1)	(0)	0	(0)	(1)	(0)	(0)	0	(0)	(5)	(1)	(1)	(1)	(0)	(47)
(1)	(0)	(0)	0	(0)	(0)	0	(0)	0	(0)	(2)	(0)	(0)	0	(0)	29
(1)	(0)	(0)	1	(1)	(0)	(0)	(0)	0	(0)	(5)	1	(0)	(1)	(0)	(33)
0	(0)	(0)	0	(0)	(0)	0	(0)	0	(0)	(0)	0	0	0	(0)	(7)
0	(0)	(0)	1	(0)	(0)	0	0	0	(0)	(4)	0	(0)	(1)	(0)	(16)
0	(0)	0	1	0	0	0	0	0	0	0	1	(0)	0	(0)	47
0	0	(1)	0	(0)	(1)	0	(0)	0	(0)	(1)	2	(1)	(0)	(13)	(39)
0	(1)	0	0	(0)	(0)	0	(0)	0	(0)	(0)	(1)	(0)	(1)	(2)	(22)
0	(0)	(0)	0	(1)	(1)	(0)	(0)	(0)	(0)	(0)	0	(7)	(1)	(0)	(39)
0	0	0	1	0	4	4	0	0	0	(0)	3	2	2	(0)	(54)
0	0	0	6	(3)	0	2	0	2	0	(0)	4	3	2	(1)	(72)
0	(0)	0	0	(1)	(1)	0	(0)	(0)	(0)	(0)	0	(1)	(0)	(0)	3
0	(0)	(0)	0	(0)	(0)	(0)	0	0	(0)	(0)	0	(1)	(0)	(0)	(1)
0	(0)	(0)	(0)	(0)	(1)	(0)	(0)	0	(0)	(0)	0	(4)	(0)	(0)	(0)
(0)	(0)	(0)	0	(1)	(0)	0	(0)	0	0	(0)	0	(0)	(0)	(0)	(2)
(0)	0	(0)	1	(0)	(0)	(0)	0	0	(0)	0	(1)	(0)	(0)	(0)	(19)
0	(1)	(2)	(0)	(1)	(3)	(0)	(0)	(0)	(0)	(11)	0	(1)	(5)	(1)	133
0	(1)	(0)	2	(2)	(2)	(0)	(0)	0	(0)	(0)	1	0	(0)	(0)	(37)
0	(1)	(1)	0	(1)	(4)	(0)	(0)	0	(0)	(1)	2	(1)	0	(1)	(32)
0	(15)	(4)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(1)	(1)	(1)	(2)	0	(69)
47	(39)	(22)	(39)	(54)	(72)	3	(1)	(0)	(2)	(19)	133	(37)	(32)	(69)	

Source: Authors' data.

JPN = Japan, USA = United States, EUN = EU and EFTA, CAN = Canada, AUS = Australia, NZL = New Zealand, HKG = Hong Kong, KOR = Korea, SGP = Singapore, TWN = Taiwan, CHN = China, IND = India, IDN = Indonesia, MYS = Malaysia, PHL = Philippines, THA = Thailand, VNM = Vietnam, RUS = Russia, TUR = Turkey, MEX = Mexico, ARG = Argentina, BRA = Brazil, CHL = Chile, COL = Colombia, PER = Peru, URY - Uruguay, ROA = Rest of Asia, XME = Rest of Middle East, CLA = Rest of Central and Latin America, AFR = Africa, ROW = Rest of World, Imp. = Imports, Exp. = Exports

Dynamic Scenarios

As noted, the Michigan Model essentially provides comparative static estimates of the economic effects of the bilateral removal of Korea-U.S. tariffs and other trade barriers. The question arises as to whether the bilateral liberalization may induce additional effects arising from changes in rates of return to capital that may motivate movements of FDI and improvements in factor productivity. These changes depend on a variety of empirical circumstances that are difficult to model in a general way. But, as we already noted, it has been common in GTAP-type modeling studies to make some allowance for increases in capital stocks that may be engendered by trade liberalization. Such efforts of necessity are matters of judgment and should therefore be interpreted

Table 23: **Global Welfare Effects of Korea-U.S. Free Trade Agreement, including Foreign Direct Investment**

		No FDI		FDI (1%)			FDI (5%)		
		Welfare effects		FDI flows	Welfare effects		FDI flows	Welfare effects	
	Countries and areas of the world	%	Billions of dollars	Billions of dollars	%	Billions of dollars	Billions of dollars	%	Billions of dollars
FDI home	Japan	0.01	1.0	-69.5	-0.01	-0.4	-347.7	-0.08	-6.1
FDI home	United States	0.14	25.1	-144.9	0.13	22.9	-724.6	0.08	13.8
FDI home	EU and EFTA	0.01	1.2	-92.5	-0.01	-0.8	-462.5	-0.06	-8.8
	Canada	0.02	0.3		0.03	0.3		0.04	0.5
	Australia	0.02	0.1		0.04	0.2		0.12	0.7
	New Zealand	0.02	0.0		0.03	0.0		0.09	0.1
	Hong Kong	0.04	0.1		0.05	0.1		0.10	0.3
FDI host	Korea	1.26	9.3	342.6	2.62	19.3	1713.0	8.05	59.4
	Singapore	0.02	0.0		0.05	0.1		0.18	0.2
	Taiwan	-0.01	0.0		0.01	0.1		0.07	0.4
FDI home	China	0.11	2.2	-35.6	0.07	1.4	-178.2	-0.08	-1.6
	India	0.03	0.1		0.06	0.2		0.17	0.4
	Indonesia	0.00	0.0		0.01	0.1		0.03	0.3
	Malaysia	-0.01	0.0		0.05	0.1		0.27	0.4
	Philippines	0.02	0.0		0.05	0.1		0.17	0.2
	Thailand	0.01	0.0		0.02	0.0		0.08	0.2
	Vietnam	0.10	0.1		0.11	0.1		0.19	0.1
	Russia	0.01	0.0		0.01	0.0		0.01	0.1
	Turkey	0.01	0.0		0.01	0.0		0.03	0.1
	Mexico	0.02	0.2		0.02	0.2		0.02	0.3
	Argentina	-0.01	0.0		-0.01	0.0		0.02	0.1
	Brazil	0.06	0.5		0.06	0.6		0.08	0.7
	Chile	0.03	0.0		0.05	0.1		0.13	0.1
	Colombia	0.02	0.0		0.03	0.0		0.06	0.1
	Peru	0.01	0.0		0.02	0.0		0.03	0.1
	Uruguay	0.01	0.0		0.01	0.0		0.04	0.0
	Rest of Asia	0.01	0.1		0.02	0.1		0.05	0.2
	Rest of Middle East	0.03	0.4		0.08	0.9		0.26	3.0
	Rest of Central and Latin America	0.02	0.1		0.03	0.2		0.07	0.4
	Africa	0.02	0.2		0.03	0.3		0.05	0.5
	Total		41.0			46.1			66.3

Source: Authors' data.
FDI = foreign direct investment

with care. It is in this light that we have adapted the Michigan Model to make allowance for changes in FDI that are assumed to be induced by a Korea-U.S. FTA.

For this purpose, we ran two scenarios in which FDI in Korea was assumed to increase by 1 percent and by 5 percent of Korea's base capital stock. We further assumed that the FDI flows to Korea came from Japan, the United States, the European Union and the European Free Trade Association, and China based on the proportions of the FDI flows that these countries or regions represented in 2004. In modeling

the FDI flows, it is assumed that each sector has a demand for capital as a function of sectoral production and factor prices. The capital market sums up demands across sectors and sets demand equal to supply to determine the rate of return on capital. So, an inflow of FDI expands the capital stock. The increase in the capital stock is then allocated across sectors to equate the marginal value product across sectors. The results of the FDI inflows are indicated in ***Table 23.*** With a 1 percent increase in Korea's capital stock, Korea's welfare increases by $19.3 billion (2.62 percent of GDP); and with a 5 percent increase, Korea's welfare increases by $59.4 billion (8.05 percent of GDP). These results compare with a welfare increase for Korea of $9.3 billion (1.26 percent of GDP), assuming no FDI as in our basic comparative static scenario. Welfare declines in some cases, reflecting the declines in capital stocks that provide for the FDI flows.

What is suggested by the foregoing exercise is that the benefits of an FTA could be much larger if capital stocks are assumed to increase compared with the benefits of the bilateral removal of existing trade barriers. It is difficult to determine, however, how likely this may be in reality.

Conclusions

We have had occasion in Chapter 2 and in the preceding discussion in this chapter to offer a number of criticisms of the results based on the GTAP conceptual framework that has been used in a number of studies of a Korea-U.S. FTA. It is unfortunately difficult to make comprehensive comparisons between the detailed results of the GTAP and Michigan models because of their conceptual differences, parameter differences, and differences in the level of aggregation and the base-period data used. We acknowledge that the Michigan Model does not represent the last word when it comes to modeling trade liberalization, but we offer our computational analysis and results in the hope that they will provide a comprehensive and informative representation of the likely economic effects of a Korea-U.S. FTA.

4

Computational Analysis of Alternative Negotiating Options

Having analyzed the economic effects of a bilateral Korea-U.S. FTA, we now compare U.S. and Korean economic interests for other FTAs that the two nations have negotiated or are in progress of negotiating, and how and whether their interests would be more or less enhanced by unilateral free trade and global (multilateral) free trade compared with the adoption of bilateral FTAs. The welfare comparisons are indicated in Table 24.

Korean FTAs

The first column in ***Table 24*** summarizes the welfare effects of the Korea-U.S. FTA and below this the welfare effects of the actual and potential bilateral FTAs between Korea and a number of partner countries, including Canada, Chile, Japan, Mexico, and Singapore.[22] It is evident that Korea's welfare gain from a Korea-U.S. FTA of $9.3 billion is considerably greater than any of the other FTAs listed. The global welfare increase of $41.0 billion from a Korea-U.S. FTA is similarly greater than the increases of the other FTAs.

The third column in Table 24 indicates the welfare effects of a Korea-ASEAN FTA. Korea's welfare gain of $8.7 billion is similar to the gain from a Korea-U.S. FTA. The global welfare gain of $33.2 billion is less than the $41.0 increase from a Korea-U.S. FTA.

22. For further analyses and details, see Cheong (2002) and McKibbin, Lee, and Cheong (2004).

Table 24: **Computation of Welfare Effects of Bilateral FTAs, Unilateral Free Trade, and Global Free Trade (billions of dollars and percentage)**

Bilateral Free Trade		
Korea-U.S.	Welfare	
	(U.S.$)	(% of GDP)
United States	25.1	0.1
Korea	9.3	1.3
Global	41.0	
Canada-Korea	Welfare	
	(U.S.$)	(% of GDP)
Canada	1.8	0.1
Korea	2.0	0.3
Global	4.1	
Chile-Korea	Welfare	
	(U.S.$)	(% of GDP)
Chile	0.4	0.3
Korea	0.5	0.1
Global	0.7	
Japan-Korea	Welfare	
	(U.S.$)	(% of GDP)
Japan	15.7	0.2
Korea	2.2	0.3
Global	18.4	
Korea-Mexico	Welfare	
	(U.S.$)	(% of GDP)
Mexico	2.2	0.2
Korea	2.1	0.3
Global	3.0	
Korea-Singapore	Welfare	
	(U.S.$)	(% of GDP)
Singapore	0.5	0.3
Korea	0.9	0.1
Global	1.8	

Bilateral Free Trade (continued)		
Australia-U.S.	Welfare	
	(U.S.$)	(% of GDP)
United States	15.7	0.1
Australia	3.8	0.6
Global	18.1	
Chile-U.S.	Welfare	
	(U.S.$)	(% of GDP)
United States	5.5	0.0
Chile	1.0	0.9
Global	6.4	
Singapore-U.S.	Welfare	
	(U.S.$)	(% of GDP)
United States	13.0	0.1
Singapore	2.0	1.5
Global	16.1	
Thailand-U.S.	Welfare	
	(U.S.$)	(% of GDP)
United States	12.4	0.1
Thailand	5.0	2.5
Global	16.3	
Unilateral Free Trade		
United States	Welfare	
	(U.S.$)	(% of GDP)
United States	358.9	2.0
Global	471.8	
Korea	Welfare	
	(U.S.$)	(% of GDP)
Korea	33.8	4.6
Global	92.4	

U.S. FTAs

The second column in Table 24 summarizes the welfare effects of some selected U.S. bilateral FTAs, including those with Australia, Chile, and Singapore that are now operative and one with Thailand that is being negotiated. The United States has also been negotiating bilateral FTAs with several additional countries, including Bahrain, Central America and the Dominican Republic, Colombia, Israel, Jordan, and Morocco, and is currently negotiating FTAs with Malaysia, Oman, Panama, Peru,

Table 24: **Computation of Welfare Effects of Bilateral FTAs, Unilateral Free Trade, and Global Free Trade (billions of dollars and percentage) (*continued*)**

Regional Free Trade			Global Free Trade		
Korea+ASEAN	Welfare			Welfare	
	(U.S.$)	(% of GDP)		(U.S.$)	(% of GDP)
Indonesia	4.5	1.8	United States	614.3	3.4
Malaysia	5.1	3.3	Korea	86.1	11.7
Philippines	2.2	1.8	Global	2,857.7	
Singapore	3.1	2.2	**Global Free Trade: Decomposition**		
Thailand	4.0	2.0	Agricultural protection	Welfare	
Vietnam	0.8	1.4		(U.S.$)	(% of GDP)
Korea	8.7	1.2	United States	19.5	0.1
Global	33.2		Korea	-1.9	-0.3
FTAA	Welfare		Global	7.8	
	(U.S.$)	(% of GDP)	Manufactures tariffs	Welfare	
United States	73.0	0.4		(U.S.$)	(% of GDP)
Canada	6.2	0.5	United States	85.2	0.5
Mexico	11.9	1.1	Korea	52.3	7.1
Argentina	10.7	2.2	Global	965.0	
Brazil	13.5	1.5	Services barriers	Welfare	
Chile	4.0	3.5		(U.S.$)	(% of GDP)
Colombia	2.3	2.4	United States	509.6	2.8
Peru	2.9	1.3	Korea	35.7	4.8
Uruguay	0.8	2.3	Global	1,885.0	
Rest of FTAA	15.9	2.6			
Global	130.1				

Source: Authors' data.

the Southern African Customs Union, and the United Arab Emirates.[23] Looking at the welfare estimates for only the four countries in comparison with the Korea-U.S. FTA, the welfare increase for the United States of $25.1 billion for the Korea-U.S. FTA is substantially greater than the increase for any of the other four countries indicated. This is the case as well for the global welfare increase of $41.0 billion for the Korea-U.S. FTA compared with the other bilateral FTAs. These conclusions would hold for any of the other bilateral FTAs mentioned.

The third column of Table 24 lists the welfare effects of regional free trade represented by the Free Trade Area of the Americas (FTAA). The U.S. welfare increase of $73.0 billion from the FTAA is about three times greater than the gain from the bilateral Korea-U.S. FTA.

23. For detailed computational analyses of several U.S. FTAs, see Brown, Kiyota, and Stern (2005a, 2005b, 2006a, 2006b).

U.S. and Korean Unilateral Liberalization

The bottom of the second column of Table 24 shows the welfare gains from unilateral free trade undertaken individually by the United States. The increase in U.S. welfare with unilateral free trade of $358.9 billion is much greater than the increase associated with any of the U.S. bilateral and regional FTAs shown in the table. This is the case as well for the increase in global welfare with U.S. unilateral free trade. Similarly, Korea's welfare increase with unilateral free trade of $33.8 billion is greater than the welfare increases of any of the FTAs listed individually and in total.

Global (Multilateral) Free Trade

The last column of Table 24 shows the welfare effects of global free trade. U.S. welfare rises by $614.3 billion, and Korea's welfare rises by $86.1 billion. Global welfare rises by $2.9 trillion. The welfare benefits of global free trade are therefore much greater than the benefits to be derived from the bilateral FTAs, regional FTAs, and from unilateral free trade for both the United States and Korea. It can also be seen that most of the welfare gains from global free trade come from the elimination of manufactures tariffs and services barriers.

These calculations clearly show that multilateral trade liberalization offers potentially far greater increases in economic welfare for the United States, Korea, their FTA partner countries, and the other countries or regions that are covered in the global trading system. This is the case even if there would be less than complete free trade globally. That is, if existing trade barriers in the ongoing Doha Development Agenda negotiations were to be reduced, for example, by one-third or one-half, the resulting global and national gains would be proportionally lower. But these welfare gains but would still far exceed the welfare gains from the FTAs noted and the gains from the possible adoption of unilateral free trade by the United States and Korea. This would almost certainly remain true even if there are other benefits stemming from the FTAs that have not been taken into account in the Michigan Model simulations.

5

Conclusions and Implications for Further Research and Policy

We have noted that the United States and Korea have a variety of economic and political motivations in pursuing an FTA. In this connection, the present study has been designed to assess the economic effects involved in such an agreement. The Korea-U.S. FTA negotiations were initiated in May 2006 and are ongoing. It is hoped to conclude the negotiations and sign the agreement prior to the expiration of the president's negotiating authority in mid-2007.

The computational analysis presented has been based on the Michigan Model of World Production and Trade, which is a multicountry, multisector computable general equilibrium (CGE) model that has been used for more than three decades to provide estimates of the economic effects of multilateral, regional, and bilateral trade negotiations and other aspects of changes in trade policies of the United States and other major trading countries or regions. The version of the model used covers 27 economic sectors, including agriculture, manufactures, and services, in each of 30 countries or regions. The distinguishing feature of the Michigan Model is that it incorporates elements of the New Trade Theory, including increasing returns to scale, monopolistic competition, and product variety. The data for the model are based on version 6.0 of the GTAP database for 2001 together with data derived from other sources.

The United States uses a common framework covering the issues to be negotiated in each of its bilateral FTA negotiations. This framework, which is patterned after NAFTA, negotiated in 1992–93, has been updated and adapted for the new FTAs. The main negotiating issues in

the FTAs cover bilateral removal of tariffs and other barriers to trade in agricultural products, manufactures, and services; rules of origin; intellectual property rights; worker rights; environmental standards; investment; government procurement; customs administration and trade facilitation; trade remedies; and dispute settlement procedures. The actual negotiations are adapted to reflect the particular conditions and interests of the United States and partner countries.

We had occasion to review a number of previous studies that reviewed the important bilateral issues of concern to the two countries in the FTA negotiations and to assess the economic effects involved. The economic assessments in these studies were based on the GTAP modeling framework in which it is assumed that there is perfect competition, constant returns to scale, and that products are distinguished by country of production (Armington assumption). We had some reservations with the GTAP framework that related in particular to the use and interpretation of the Armington assumption and the handling of employment changes.

In using the Michigan Model, our focus has been on the effects of the bilateral removal of trade barriers, which lend themselves most readily to quantification. The nontrade aspects of the FTAs may also be important, but they are intrinsically more difficult to incorporate into a modeling framework. Although we have made some allowance for possible increases in FDI that may be induced over time as the consequence of the Korea-U.S. FTA, no allowance has been made for improvements in productivity that could result from the FTA. Because of the foregoing limitations, the computational results presented for the bilateral FTAs are therefore best interpreted as providing a lower bound for the potential benefits involved. Because these benefits are shown mostly to be rather small for Korea and the United States in both absolute and relative terms, the nontrade and other benefits of the Korea-U.S. FTA are unlikely to alter these results significantly.

Although the bilateral FTA removal of trade barriers would be phased in annually for some products and sectors, it is assumed for modeling purposes that all of the barriers are removed at the same time and entered as inputs into the model for the policy changes involved. The model is then solved computationally to represent the percent changes in the variables of interest and to calculate the absolute changes in employment by sector. Because full employment is assumed, the employment results presented indicate the shifts in sectoral employment that will occur with bilateral liberalization. Some sectors will have increases

in employment, others will have decreases, and there is no change in employment overall.

The Korea-U.S. FTA is shown to increase Korea's economic welfare by $9.28 billion (1.26 percent of GDP), with $4.48 billion coming from the bilateral removal of manufactures barriers and $5.46 billion from bilateral removal of the services barriers. U.S. economic welfare is increased by $25.12 billion (0.14 percent of GDP), with $7.27 billion coming from elimination of manufactures tariffs and $19.20 billion from elimination of services barriers. Global economic welfare rises by $41.04 billion. There is evidence of trade diversion for nonmember countries, but the welfare reductions are small. U.S. employment is increased in its agricultural sectors and food, beverages, and tobacco and is reduced in textiles and wearing apparel, metal products, transportation equipment, and services. But these employment changes are relatively small in percentage terms based on the initial employment levels. Korea's employment increases are concentrated in rice, livestock, textiles, wearing apparel, leather and leather products, and transportation equipment. Its employment declines are noteworthy in a number of the other agricultural sectors, manufactures, and services. Some of the employment changes are fairly large in percentage terms and indicate that there may significant adjustment problems in the Korean labor market, depending on how rapidly the bilateral removal of the trade barriers would take place.

To provide some perspective on the results of the FTAs, the model was also used to calculate the effects of unilateral tariff removal by Korea and the United States. Unilateral free trade would result in much larger increases in economic welfare for Korea and the United States than the bilateral FTAs. Finally, the effects of global (multilateral) free trade were calculated and shown to be far greater for Korea and the United States compared with the bilateral FTAs. It is possible that there may be some significant benefits to Korea and the United States from the negotiation of the trade and nontrade aspects of the Korea-U.S. FTA that are not captured by the modeling framework. Nonetheless, the computational results of unilateral and multilateral trade liberalization suggest that much greater increases in economic welfare could be gained from more broadly based trade liberalization than from the bilateral Korea-U.S. FTA.

Appendix: Sensitivity Analysis

This appendix reports on sensitivity analysis of the Michigan Model. There are three key elasticities or parameters in the model: the elasticity of substitution among varieties, which is exogenously set at 3; the parameter that measures the sensitivity that consumers have to the number of varieties, which is set at 0.5; and the elasticities of supply that are taken from the literature. The variety parameter can take on values between zero and 1. The larger it is, it means that consumers value variety more. If the parameter is set at zero, consumers have no preference for variety. This would correspond to the Armington assumption, according to which consumers view products depending on their place of production. To analyze the sensitivity of our model results, we have experimented with different values of the elasticity of substitution among varieties and the consumer sensitivity to the number of varieties. The following tests were conducted: (1) increase the elasticity of substitution among varieties by 10 percent, holding other parameters constant; (2) decrease the elasticity of substitution by 10 percent, holding other parameters constant; (3) increase the consumption varieties parameter by 10 percent, holding other parameters constant; and (4) decrease the consumption varieties by 10 percent, holding other parameters constant.

The results, which are available on request, are not very sensitive to the alternative parameters of the consumption varieties. That is, a 10 percent increase (decrease) in these parameters yields only less than 0.1 percentage point larger (smaller) welfare effects compared with the baseline model. The sensitivity to the changes in the elasticity of substitution is large compared with the results of differences in the variety

parameters. In Brown, Deardorff, and Stern (2000), sensitivity tests reveal that the model may exaggerate the likely gains from economies of scale owing to trade liberalization in the context of expansion of the NAFTA. But the error is small in this context because the impact of trade liberalization is small. When econometric estimates of scale economies are incorporated into the model, the welfare gains owing to capital flows are shown to remain robust.

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