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IMPLICATIONS OF U.S. FREE TRADE AGREEMENT WITH SOUTH KOREA

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This paper examines the effects of a U.S.-Korea free trade agreement (FTA) on various sectors of the economy in the two countries using a general equilibrium model. Our analysis indicates that the increase in U.S.-Korea bilateral trade volume in recent years is through intra-industry trade of high-technology products. Under a U.S.-Korea FTA, the bilateral trade volume would increase for virtually all the sectors and the GDP and social welfare would improve for both countries. However, producers of textile products in the United States and producers of agriculture and food products in South Korea would suffer from the FTA. How to compensate those groups would be instrumental to the smooth implementation of the FTA.

Keywords: Free Trade Agreement, U.S.-Korea, Trade Creation and Trade Diversion
JEL classification: F13, F53, O24, R13

1. INTRODUCTION

The bilateral trade volume between the United States and South Korea has been growing dramatically since 1989. According to U.S. statistics, the bilateral trade volume between the two countries has increased from $33.2 billion (U.S. dollars) in 1989 to $71.5 billion in 2005, or an average annual growth rate of 4.90%. The United States has had a trade deficit with South Korea, with the exception of the 1995-1997 period. The U.S. trade deficit jumped from $6.3 billion in 1989 to $16.1 billion in 2005.

South Korea is the tenth largest economy in the world, with an annual GDP rapidly approaching one trillion U.S. dollars. While South Korea was the seventh-largest export market for the United States in 2004, the United States was South Korea's third-largest trading partner (third-largest supplier behind Japan and China) and second largest export market (behind China) in 2005 (Manyin (2006), The CalTrade Report (March 2, 2006)). Moreover, South Korea is the sixth-largest market for U.S. agricultural exports. The U.S.

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provides over one fifth of South Korea's agricultural imports (USDA/Foreign Agricultural Services (2006)).

Informal discussions on a U.S.-Korea free trade agreement (FTA) started in the mid 1980s, but were suspended in the 1990s due to disputes over tariff concessions in the agricultural sector under the Uruguay Round of the World Trade Organization (WTO) negotiation and disputes over the screen-quota issue (Cheong (2004), Lee and Lee (2005)). The two countries agreed to resume informal talks on an FTA at the U.S.-Korea Business Meeting held in Hawaii in January 2001 (Cheong (2004)). On February 2, 2006, the two countries formally announced that FTA talks would commence in May 2006 and end by June 2007 (Office of the United States Trade Representative (2006), Cooper and Manyin (2006)).

Many previous studies (e.g., Choi and Schott (2001), Cheong (2004), Lee and Lee (2005), Kiyota and Stern (2005)) have argued that a U.S.-Korea FTA[1] would benefit the economies of both countries, but with mixed projections. For example, the U.S. International Trade Commission (2001) argued that U.S. income would increase by $20 billion (or 0.23% of GDP) and South Korea's income would increase by $3.9 billion (or 0.69% of GDP). Note that the United States would gain more in terms of absolute value, but South Korea would gain more in terms of percentage increase of GDP, since South Korea's GDP is much smaller than that of the United States. They also projected that U.S. exports to South Korea would increase by $19 billion, while U.S. imports from Korea would increase by $10 billion. Choi and Schott (2001) argued that a U.S.-Korea FTA would substantially increase bilateral trade and contribute to a significant improvement in income for both countries. U.S. income would increase by $8.9 billion (or 0.13% of GDP) and South Korea's income would increase by $10.9 billion (or 2.41% of GDP). Thus, South Korea would gain more in terms of both an absolute increase in GDP and percentage increase in GDP. They also projected that the U.S.-Korea FTA would produce trade diversion effects for Japan and China. More recently, Lee and Lee (2005) argued that a U.S.-Korea FTA would provide a significantly positive opportunity for long-term and dynamic economic growth for both countries. They projected that a U.S.-Korea FTA would shrink South Korea's bilateral trade surplus with the United States, but in the long run, would improve South Korea's GDP. The USDA/Foreign Agricultural Service (2006) argued that U.S. agricultural exports to South Korea would significantly increase under a free trade agreement.

However, very few researchers have analyzed trade creation and diversion effects of a U.S.-Korea FTA on various sectors of the economy. The objective of this study is to fill this gap in the research by examining the effects of a U.S.-Korea FTA on the individual sectors of the economy in the two countries. Special attention is given to the following tasks: (1) to identify characteristics of U.S.-Korea bilateral trade; (2) to study the effects of a U.S.-Korea FTA on the economies of both countries; and (3) to analyze

[1] For a discussion of some previous studies on a U.S.-Korea FTA, see Cheong (2004).

trade creation and diversion effects of the FTA. It is expected that U.S.-Korea bilateral trade would increase in all sectors due to the elimination of trade barriers between the two countries.

The paper is organized as follows. Section two examines the key characteristics of U.S.-Korea bilateral trade, by sectors, since 1989[2]. Section three discusses the data and model used for this study. This section also presents general economic statistics and the export sales in various sectors for the selected countries and regions in the base year (2001). Section four presents simulation results and discusses our findings. Finally, section five presents conclusions of the paper.

2. CHARACTERISTICS OF U.S.-KOREA BILATERAL TRADE

The predominant mode of U.S.-Korea bilateral trade has shifted from inter-industry trade to intra-industry trade (Noland 2004). In particular, the trade pattern was inter-industry trade on the basis of differences in resource endowments prior to1994. The United States exported land-intensive and natural resource-based industry goods (e.g., agriculture and food products) and technology and capital-intensive goods to South Korea and imported labor-intensive products (e.g., textiles) from that country. However, intra-industry trade between the two countries has increased significantly in the high-technology product sector since 1995. A major increase in trade of high-technology products between the two countries demonstrates the surge in bilateral intra-industry trade based on product differentiation (Krugman (1980, 1981), Head and Ries (2001)). The two countries have also increased their bilateral trade in differentiated mid-technology products.

Comparisons between trade volumes and trade surpluses, by sectors, can give us insight on the bilateral trade patterns between the two countries. In this study, we examine U.S.-Korea bilateral trade in six sectors: agriculture and food (agri-food), natural resource-based industries (natural-res), textiles, mid-technology products (mid-tech), high-technology products (high-tech), and others. The sectors are determined on the basis of the standard international trade classification (SITC) 2-digit code. The agri-food sector includes primary agriculture goods (e.g., grains, live animals, fruit, and vegetables) and processed food (e.g., beverages, tobacco products, and meat products). The natural-res sector includes coal, gas, wood, and petroleum products. The textiles sector includes apparel, clothing, and footwear. The mid-tech sector includes fertilizers, chemical materials, nonferrous metals, and furniture. The high-tech sector includes machinery, transport equipment, and scientific instruments.

[2] Data are not available prior to 1989.

Table 1. U.S.-Korea Bilateral Trade Volumes by Sector (1989-2005)

U.S. Exports to South Korea (billion U.S. dollars)							
Year	AgFood	NRes	Textiles	MidTech	HighTech	Others	Total
1989	1.64	1.38	1.38	3.36	5.58	0.13	13.5
1990	1.59	1.78	1.54	3.42	5.88	0.17	14.4
1991	1.39	1.67	1.22	3.65	7.29	0.29	15.5
1992	1.51	1.50	1.18	3.22	6.94	0.27	14.6
1993	1.29	1.63	1.10	3.25	7.27	0.24	14.8
1994	1.59	1.41	1.23	3.82	9.66	0.31	18.0
1995	2.92	1.79	1.42	5.59	13.24	0.45	25.4
1996	3.22	1.68	1.23	5.11	14.63	0.71	26.6
1997	2.31	1.67	1.20	4.82	14.61	0.46	25.1
1998	1.76	0.75	0.80	3.11	9.79	0.33	16.5
1999	2.27	1.08	0.69	3.86	14.63	0.43	23.0
2000	2.30	1.05	0.94	4.86	18.30	0.46	27.9
2001	2.29	0.86	0.99	4.49	13.18	0.39	22.2
2002	2.47	0.88	0.82	4.89	13.11	0.43	22.6
2003	2.74	1.16	0.84	5.39	13.54	0.42	24.1
2004	2.32	1.51	0.81	6.89	14.41	0.40	26.3
2005	2.11	1.60	0.78	6.70	16.06	0.43	27.7
U.S. Imports from South Korea (billion U.S. dollars)							
Year	AgFood	NRes	Textiles	MidTech	HighTech	Others	Total
1989	0.21	0.19	6.29	3.83	9.10	0.14	19.7
1990	0.19	0.13	6.37	3.89	7.76	0.14	18.5
1991	0.19	0.14	5.35	3.64	7.53	0.17	17.0
1992	0.17	0.21	4.82	3.48	7.85	0.17	16.7
1993	0.17	0.20	4.24	3.13	9.20	0.18	17.1
1994	0.17	0.22	3.61	3.35	12.13	0.18	19.7
1995	0.18	0.21	3.11	3.53	16.90	0.25	24.2
1996	0.18	0.14	2.67	3.42	15.83	0.44	22.7
1997	0.18	0.20	2.82	3.54	15.97	0.45	23.2
1998	0.15	0.29	3.15	4.58	15.28	0.48	23.9
1999	0.18	0.44	3.35	4.75	21.94	0.60	31.3
2000	0.20	0.79	3.62	5.20	29.81	0.67	40.3
2001	0.22	0.84	3.42	4.68	25.28	0.74	35.2
2002	0.25	0.58	3.35	4.54	26.09	0.77	35.6
2003	0.26	0.54	3.04	4.44	27.97	0.72	37.0
2004	0.29	0.98	3.08	5.57	35.39	0.86	46.2
2005	0.33	2.07	2.40	6.80	31.30	0.89	43.8

Source: U.S. Department of Commerce (www://tse.export.gov)

Table 1 summarizes U.S.-Korea bilateral trade in the six industrial sectors over a period from 1989 to 2005. The United States has trade surpluses with South Korea in the sectors of agriculture and food and the natural resource-based industries. By contrast, the United States has a trade deficit with South Korea in the high-technology sector which has increased over time. The U.S. also has a trade deficit with Korea in the textiles sector, but this deficit has decreased over time. In fact, both U.S. exports and imports of textile products have decreased since 1990, due to the third country effect in the market. Since other countries and regions such as China, Thailand, Indonesia, and Latin American countries have become more competitive in producing textile products, both the United States and South Korea have increased their imports of these products from these "third" countries. For the mid-technology sector, the U.S. trade balance with Korea averaged $0.241 billion, with a standard deviation of $0.948 billion. For the services sector, the United States had a small trade surplus with South Korea prior to 1997 but had a trade deficit afterwards.

The relative importance of each sector in the bilateral trade has changed over time. The share of textile products in U.S.-Korea bilateral trade decreased sharply from 23.1% in 1989 to 4.5% in 2005. The share of agriculture and food products decreased from 5.6% in 1989 to 3.4% in 2005, and the share of mid-technology products decreased from 21.6% to 18.9% in the same period. The shares of natural resource-based industry products and services are relatively small, with an average share of 4.0% and 1.6%, respectively. By contrast, trade of high-technology products has taken the lion's share of the bilateral trade between the two countries, jumping from 44.2% in 1989 to 66.3% in 2005. U.S.-Korea bilateral trade volume in the high-technology sector has increased from $14.7 billion in 1989 to $47.4 billion in 2005. The U.S. trade deficit with South Korea in the high-technology sector has also increased from $3.51 billion in 1989 to $15.24 billion in 2005.

Investigation of the data provides five important empirical facts. First, the increase in U.S.-Korea bilateral trade in recent years is due mainly to increased bilateral trade in differentiated high-technology products. Second, while the United States has increased its exports of high-technology products to South Korea, its imports of the products have increased more rapidly, resulting in an increase of the U.S. trade deficit with South Korea over time. Third, the importance of the mid-technology sector in U.S.-Korea bilateral trade tends to decline over time in terms of trade share, even if the trade volume in the sector has increased steadily since 1989. Fourth, trade shares in the textile and agriculture and food sectors are small and tend to decrease over time. This is particularly true for the textiles sector due to the third country effect. Finally, bilateral trade in the services sector accounts for only a small portion of the total U.S.-Korea bilateral trade volume.

3. MODEL AND DATA

There are two economic approaches to evaluate the effects of policy changes on a set of endogenous variables: partial equilibrium and general equilibrium models. The partial equilibrium models are relatively simple and typically focus on only a few sectors of the entire economy. By contrast, general equilibrium models are complex and may capture the complicated interplay of effects that may be induced by policy changes in the entire economy (Lee and Lee (2005)). Since the U.S.-Korea FTA would cover virtually all traded goods in various industrial sectors between the two countries, a CGE model would excel beyond an econometric or a partial equilibrium model, in the sense that the former allows complex interactions among a wide range of economic variables across various sectors in an economy.

Similar to many previous studies (e.g., Choi and Schott (2001), U.S. International Trade Commission (2001)), we also use a multi-region Global Trade Analysis Project (GTAP) model in this study. However, our aggregation of industries and countries are different from previous studies. The GTAP model is a static general equilibrium model, and thus simulation results using this model are comparative static in nature (Hertel (1997), DeRosa and Gilbert (2005)). The assumptions in the GTAP model include a constant return to scale and perfect competition, which are similar to basic trade models and theories (e.g., the Ricardian model, the Hechscher-Ohlin model, and the Stolper-Sammuelson theorem). Also, input factors such as labor and capital are assumed to be mobile across the various sectors in an economy. Responses in bilateral trade to price changes are based on the Armington (1969) assumption, which says that traded products are differentiated by country of origin (see the Appendix for more details about GTAP).

The 87 countries and regions covered in the GTAP Version-6 database are aggregated into seven countries and regions: the United States, South Korea, China (mainland), the European Union[3], Japan, other Asian countries (OAsia), and the rest of world (ROW). The 57 commodity sectors covered in the original database are aggregated into six sectors: agriculture and food, natural-resource-based industries, textiles, mid-technology products, high-technology products, and services.

The trade flows among the selected countries and regions in the base year 2001 provide the following three observations. First, South Korea, China, and Japan are the most important trade partners in Asia for the United States. U.S. exports (all sectors combined) to Japan alone ($71.94 billion) surpassed its exports to all other Asian countries ($60.32 billion), excluding South Korea and China. Second, U.S. exports (all sectors combined) to South Korea ($29.41 billion) surpassed its exports to China ($29.00 billion), even though the U.S. bilateral trade with South Korea is much smaller than that with China. Third, the high-technology sector dominates any other single

[3] European Union 15.

sector in terms of U.S. bilateral trade volume with any country or region. In particular, the United States imports a tremendous amount of high-tech products from Japan. Fourth, the United States is the most important market for South Korea's high-tech products.

This study uses the standard general equilibrium (GE) closure, which is the classification of the variables in the model as either endogenous or exogenous. For the standard GE closure, the variables for import tariff rates and export taxes are exogenous; thus these variables may be subjected to a shock in order to examine the effects of the changes of these exogenous variables on the endogenous variables. It is assumed that other countries and regions would not retaliate and that all other things such as population and endowment of primary factors remain unchanged from the observations for the base year 2001. For a free trade agreement between the United States and South Korea, we assume that all trade barriers, including import tariffs, tariff equivalents of non-tariff barriers, and export subsidies and taxes, except trade barriers in the agriculture and food sector between the two countries are completely eliminated. One of the limitations of the GTAP model is that it assumes constant return to scale regardless of sectors. However, the high-tech sector may experience an increasing return to scale, particularly, an FTA would encourage the member countries to specialize in production and explore higher degree of scale economies. Thus, it is assumed that the productivity in the high-tech sector in the United States and South Korea would increase by 1% under an FTA. We consider three scenarios in which trade barriers for agriculture and food products between the United States and South Korea are cut by 25%, 50%, and 75%.

4. RESULTS AND DISCUSSION

This section is divided into three parts. First, effects of the FTA on GDP, household income, national welfare, and terms of trade are presented. Second, effects of the FTA on production in various sectors in the two countries are illustrated. Finally, trade creation and trade diversion effects of the U.S.-Korea FTA on each sector of the two countries are discussed.

4.1. Changes in GDP, Household Income, National Welfare, and Terms of Trade

Table 2 summarizes the changes in GDP, household income, national welfare, and terms of trade in the selected seven countries and regions under the three scenarios. U.S. GDP would increase by $54.85 billion (or 0.54% of GDP) under scenario 1, $58.05 billion (0.58%) under scenario 2, and $62.51 billion (0.62%) under scenario 3. The GDP in South Korea would increase by $7.38 billion (or 1.73% of GDP), $6.12 billion (1.43%), and $3.36 billion (0.79%) under scenarios 1, 2, and 3, respectively. The GDP in all other countries and regions would decrease by different amounts, ranging from

0.29% of GDP in ROW to 0.53% of GDP in Japan. For household income, the pattern and magnitude of percentage change are similar to those characteristics for GDP.

Table 2. Changes in GDP, Household Income, Welfare (EV), and TOT in Each Country

Country and Region	GDP (billion U.S.$)	GDP (%)	Household Income (%)	Welfare (billion U.S.$)	Per Capita Welfare (%)	TOT (%)
Agricultural and Food Tariffs Cut by 25%						
USA	54.85	0.54	0.59	21.41	0.23	0.22
South Korea	7.38	1.73	1.87	3.84	1.02	0.55
China	-4.27	-0.37	-0.37	-0.52	-0.05	-0.08
Japan	-20.78	-0.50	-0.5	-1.35	-0.04	-0.24
Other Asian Countries	-4.44	-0.35	-0.35	-0.41	-0.04	-0.04
EU	-26.32	-0.33	-0.33	-1.56	-0.02	-0.05
ROW	-18.13	-0.29	-0.29	-0.85	-0.02	-0.01
Agricultural and Food Tariffs Cut by 50%						
USA	58.05	0.58	0.62	21.91	0.24	0.26
South Korea	6.12	1.43	1.55	4.23	1.12	0.45
China	-4.63	-0.40	-0.4	-0.54	-0.05	-0.08
Japan	-21.37	-0.51	-0.51	-1.36	-0.04	-0.23
Other Asian Countries	-4.83	-0.38	-0.38	-0.45	-0.04	-0.05
EU	-27.25	-0.34	-0.34	-1.62	-0.02	-0.05
ROW	-19.33	-0.31	-0.31	-1.02	-0.02	-0.02
Agricultural and Food Tariffs Cut by 75%						
USA	62.51	0.62	0.67	22.62	0.25	0.33
South Korea	3.36	0.79	0.83	4.17	1.11	0.25
China	-5.07	-0.44	-0.44	-0.56	-0.05	-0.09
Japan	-22.26	-0.53	-0.54	-1.38	-0.04	-0.22
Other Asian Countries	-5.29	-0.42	-0.42	-0.47	-0.04	-0.05
EU	-28.54	-0.36	-0.36	-1.71	-0.02	-0.05
ROW	-20.81	-0.33	-0.33	-1.20	-0.02	-0.03

Note: TOT and EV refer to Terms of Trade and Equivalent Variation in income, respectively.

The national welfare (measured by Equivalent Variation in income) in the United States would increase by $21.41, $21.91, and $22.62 billion under the three scenarios, respectively. The national welfare in South Korea would increase by $3.84, $4.23, and $4.17 billion, respectively. The welfare in all other countries and regions would decrease by different magnitudes, ranging from $0.41 billion in Other Asian Countries to $1.71 billion in the EU. However, the total global welfare would increase by about $21.0 billion under any scenario.

This is not surprising since we assume that there is an FTA between the United

States and South Korea, while the economic situations and trade policies for all other countries and regions remain unchanged. Free trade improves welfare since it encourages efficient producers to produce more and inefficient producers to produce less. South Korea benefits more than the United States does from the FTA, in terms of total national welfare gain and percentage increase of GDP and household income. This is because Korea's economy is much smaller in size than the U.S. economy.

Terms of trade would also change across the countries and regions. The terms of trade for the United States would increase by 0.22% under scenario one, 0.26% under scenario two, and 0.33% under three. The terms of trade for South Korea would increase by 0.55%, 0.45%, and 0.25%, respectively. Terms of trade for all other countries and regions would decrease slightly, ranging from 0.01% in the ROW to 0.24% in Japan.

4.2. Effects of the FTA on Production

The U.S.-Korea FTA is expected to affect production across the industrial sectors in the two countries. Table 3 summarizes the changes in production in the two countries. In general, the pattern of production changes follows the Hecksher-Ohlin theorem. For instance, the United States is more advanced in the high-technology sector than other countries because it is a capital and technology-abundant country. As we expected, the United States would increase its production of high-tech products under a U.S.-Korea FTA. Similarly, the United States would increase its production of agricultural and food products (land-intensive products). By contrast, South Korea would dramatically increase its production of textile products (labor-intensive products).

Table 3. Changes in Industrial Output Values in the United States and South Korea

Sectors	Scenario 1		Scenario 2		Scenario 3	
	USA	Korea	USA	Korea	USA	Korea
Changes in Output Values (billion U.S. dollars)						
Agri-Food	3.71	-1.98	7.27	-5.41	12.36	-10.47
Natural-Res	-1.23	-0.66	-1.33	-0.68	-1.45	-0.69
Textiles	-3.80	4.90	-4.12	5.77	-4.59	7.10
Mid-Tech	-4.35	-2.68	-4.81	-2.52	-5.46	-2.14
High-Tech	11.80	1.01	10.68	0.94	9.04	1.16
Services	68.89	8.59	72.58	8.72	77.69	8.34
Percentage Changes (%)						
Agri-Food	0.39	-2.71	0.77	-7.43	1.30	-14.36
Natural-Res	-0.31	-1.69	-0.33	-1.73	-0.36	-1.75
Textiles	-1.40	14.06	-1.52	16.57	-1.70	20.39
Mid-Tech	-0.22	-1.82	-0.25	-1.72	-0.28	-1.45
High-Tech	0.66	0.51	0.59	0.47	0.50	0.58
Services	0.55	1.80	0.58	1.83	0.62	1.75

Specifically, U.S. production in the sectors of agri-food would increase by $3.71 billion (0.39%) under scenario one, $7.27 billion (0.77%) under scenario two, and $12.36 billion (1.30%) under scenario three. U.S. production in the high-technology sector would increase by $11.80 billion (0.66%), $10.68 billion (0.59%), and $9.04 billion (0.50%), respectively. U.S. production in the services sector would increase by 0.55%, 0.58%, and 0.62%, respectively. Since GTAP does not have protection data for the services sector (thus no trade barriers are cut for the sector), the removal of tariffs in other sectors indirectly give more protect for the services sector. And thus, the production in the services sector in both the FTA member countries would tend to increase. By contrast, U.S. production in the sectors of textiles, mid-technology, and natural-res sectors would decrease by different amounts, ranging from 0.22% in the mid-technology sector to 1.70% in the textiles sector. This is because we assume that all factor endowment (capital, labor, land, etc.) remains unchanged from the base year 2001, the increase in production in the sectors of agri-food, high-tech, and services means that more resources are allocated to those sectors. As a result, the resources allocated to other sectors such as natural-res, textiles, and mid-tech sectors would be reduced, which in turn would result in a decrease in the production in these sectors. In reality, we expect that factor endowment would also increase (e.g., capital accumulation and increase of labor force). Therefore, the U.S. production in these other sectors might not necessarily reduce as much. Based on our results, we conclude that U.S. farmers and high-tech product producers and the consumers of textile products would benefit from the FTA. However, U.S. producers of textile products might suffer from the FTA.

For South Korea, production of textiles products would increase by $4.90 billion (14.06%) under scenario one, $5.77 billion (16.57%) under scenario two, and $7.10 billion (20.39%) under scenario three. Production in the high-tech sector would increase by $1.10 billion (0.51%), $0.94 billion (0.47%), and $1.16 billion (0.58%), respectively. Production in the services sector would increase by $8.59 billion (1.80%), $8.72 billion (1.83%), and $8.34 billion (1.75%), respectively. Production in all other sectors including the sectors of agri-food, natural-res, and mid-tech would decrease by a different amount. In particular, production in the agri-food sector would decrease $1.98 billion (2.71%) under scenario one, $5.41 billion (7.43%) under scenario two, and $10.47 billion (14.36%) under scenario three. The reduction in production in natural-res and mid-tech sectors would not change significantly from scenario to scenario. Again, this is because we assume that all factor endowments are fixed, an increase in production in some sectors would necessarily result in a decrease of production in other sectors in the economy. We conclude that producers in the agriculture and food sector in South Korea would suffer dramatically from the FTA, and that producers in the textiles sector would benefit tremendously.

4.3. Trade Creation and Trade Diversion Effects

Table 4 summarizes the changes in exports in the six sectors for the seven selected countries and regions under scenario 2 (a 50% cut in import tariffs). As expected, U.S.-Korea bilateral trade would increase for all sectors except the services sector[4]. In particular, U.S. exports to South Korea in the agriculture and food sector would increase by $4.37 billion. U.S. exports to South Korea in the high-tech and mid-tech sectors would increase by $2.90 and $1.76 billion, respectively. South Korea's export sales to the U.S. in the textiles sector would increase the most ($5.24 billion), followed by the increase in the high-tech sector ($2.00 billion). Total U.S.-Korea bilateral trade (all sectors combined) would increase by $17.87 billion (export sales for the United States and South Korea would increase by $9.88 billion and $7.98 billion, respectively).

Table 4. Changes in Exports by Sector under a U.S.-Korea FTA (billion U.S. dollars)

Sectors	USA	Korea	China	Japan	OAsia	EU	ROW	Total
USA								
Agri-Food	0	4.37	-0.09	-0.36	-0.13	-0.23	-0.89	2.66
Natural-Res	0	0.54	-0.024	-0.10	-0.06	-0.24	-0.60	-0.48
Textiles	0	0.24	-0.024	-0.037	-0.022	-0.10	-0.57	-0.51
Mid-Tech	0	1.76	-0.23	-0.49	-0.31	-1.82	-3.57	-4.66
High-Tech	0	2.90	0.24	0.34	0.39	1.71	2.70	8.28
Services	0	0.07	-0.10	-0.42	-0.36	-2.57	-1.59	-4.95
Total	0	9.88	-0.23	-1.07	-0.48	-3.25	-4.51	0.34
Korea								
Agri-Food	0.09	0	0.02	0.14	0.02	0.02	0.05	0.35
Natural-Res	0.11	0	-0.09	-0.09	-0.03	-0.01	-0.05	-0.15
Textiles	5.24	0	-0.18	-0.05	-0.10	-0.06	-0.18	4.67
Mid-Tech	0.67	0	-0.59	-0.23	-0.33	-0.17	-0.51	-1.16
High-Tech	2.00	0	-0.02	-0.05	-0.07	-0.003	-0.15	1.71
Services	-0.13	0	-0.02	-0.06	-0.06	-0.39	-0.22	-0.88
Total	7.98	0	-0.88	-0.34	-0.56	-0.61	-1.04	4.55
China								
Agri-Food	0.03	-0.61	0	0.00	0.00	0.00	0.02	-0.56
Natural-Res	0.03	-0.04	0	0.01	0.01	0.01	0.02	0.04
Textiles	-0.37	0.26	0	-0.08	0.01	0.00	0.10	-0.09
Mid-Tech	0.72	-0.06	0	0.02	0.02	0.02	0.16	0.86
High-Tech	-0.50	-0.21	0	-0.26	-0.18	-0.21	-0.44	-1.80
Services	0.06	0.01	0	0.00	0.00	0.02	0.01	0.09
Total	-0.04	-0.65	0	-0.32	-0.15	-0.17	-0.12	-1.45

[4] GTAP does not have protection data (import tariffs and export taxes) for the services sector.

Japan								
Agri-Food	0.01	-0.12	0.00	0	0.00	0.00	0.01	-0.10
Natural-Res	0.02	-0.02	0.01	0	0.01	0.01	0.03	0.06
Textiles	-0.01	0.05	0.07	0	0.01	0.00	0.02	0.15
Mid-Tech	0.43	-0.14	0.17	0	0.13	0.10	0.27	0.96
High-Tech	-0.36	-0.57	-0.05	0	-0.24	0.02	-0.34	-1.55
Services	0.08	0.05	0.00	0	0.02	0.10	0.07	0.31
Total	0.18	-0.76	0.21	0	-0.07	0.23	0.04	-0.16
OAsia								
Agri-Food	0.12	-0.42	0.00	0.00	-0.02	-0.01	0.04	-0.30
Natural-Res	0.02	-0.07	0.01	0.00	0.00	0.00	0.02	-0.02
Textiles	-0.49	0.09	0.01	-0.02	0.00	-0.03	0.03	-0.40
Mid-Tech	0.29	-0.07	0.04	0.00	0.04	0.00	0.12	0.43
High-Tech	-0.52	-0.31	-0.14	-0.33	-0.69	-0.22	-0.45	-2.66
Services	0.19	0.07	0.00	-0.01	0.00	0.04	0.04	0.33
Total	-0.40	-0.71	-0.09	-0.35	-0.66	-0.20	-0.20	-2.62
EU								
Agri-Food	0.17	-0.34	0.00	-0.01	-0.01	-0.26	0.07	-0.38
Natural-Res	0.05	-0.01	0.00	0.00	0.00	0.06	0.07	0.17
Textiles	-0.18	0.09	0.00	-0.02	0.00	-0.11	0.05	-0.16
Mid-Tech	1.19	-0.12	0.04	0.01	0.03	-0.06	0.95	2.04
High-Tech	-1.50	-0.34	-0.31	-0.30	-0.44	-4.94	-3.45	-11.27
Services	1.23	0.43	-0.02	-0.11	-0.01	0.13	0.18	1.83
Total	0.96	-0.30	-0.28	-0.44	-0.42	-5.18	-2.13	-7.79
ROW								
Agri-Food	0.51	-1.04	-0.02	-0.05	-0.05	-0.18	0.03	-0.80
Natural-Res	0.32	-0.56	-0.01	-0.09	-0.07	-0.25	0.05	-0.61
Textiles	-0.99	0.05	0.00	-0.01	-0.01	-0.19	-0.02	-1.18
Mid-Tech	1.91	-0.16	0.06	-0.04	-0.02	-0.34	0.41	1.81
High-Tech	-3.27	-0.23	-0.22	-0.24	-0.33	-1.22	-1.38	-6.89
Services	0.93	0.26	-0.06	-0.10	-0.02	-0.04	0.04	1.01
Total	-0.60	-1.69	-0.25	-0.52	-0.51	-2.22	-0.87	-6.65

Note: Positive (negative) numbers represent increased (decreased) exports.

For the agriculture and food sector, trade creation occurs since South Korea would reduce its production of agri-food products by 7.43% (Table 3) and increase its imports of agri-food products from the United States. Specifically, U.S. agricultural and food exports to South Korea would increase by $4.37 billion while its exports to all other countries and regions would decrease slightly by $1.71 billion. As a result, the net increase in U.S. total exports (with its all trading partners) of agricultural and food products would be $2.66 billion under the U.S.-Korea FTA. For U.S. imports in the

sector, the United States would increase its imports of agricultural and food products from both South Korea and all other trading partners. Total U.S. imports in the sector would increase by $0.92 billion. South Korea's total imports in the sector would increase by $1.84 billion, even though its imports from all countries except the United States would decrease by a sum of $2.53 billion. South Korea would increase its exports to all countries slightly by a sum of $0.35 billion.

Trade creation also occurs for the sector of natural resource-based industries. The United States and South Korea would reduce their production by 0.33% and 1.73%, respectively (Table 3). However, the two countries would increase their exports in the sector to each other while their exports to all other countries and region would decrease slightly. Specifically, the United States would increase its exports to South Korea (by $0.54 billion) while decreasing its exports to all other countries and regions (by $1.02 billion). As a result, total U.S. exports in the sector would decrease by $0.48 billion. The United States would increase its imports from all countries and regions, with a total increase by $0.55 billion. South Korea would divert its imports in the sector from other countries and regions to the United States, with a net decrease in imports by $0.17 billion (an increase of $0.54 billion in imports from the United States and a decrease of $0.71 billion in imports from other countries and regions). South Korea would also slightly decrease its total exports in the sector, by $0.15 billion.

For the textiles sector, both trade creation and trade diversion occur since the United States would decrease its production of textile products (by 1.52%) and the reduced production is solely replaced by imports from South Korea. Specifically, U.S. imports from South Korea would increase by $5.24 billion (trade creation effect) while its imports from all other countries and regions would decrease by a sum of $2.03 billion (trade diversion effect). Since trade creation effect dominates trade diversion effect, U.S. total imports in the sector would increase by $3.21 billion. It is generally believed that the "third" countries (China, OAsia, and ROW) are more efficient producers of textile products than South Korea because of lower labor cost in those developing countries. However, the United States would divert its imports from these more efficient non-FTA countries and regions to less efficient South Korea under the FTA. While the U.S. exports to South Korea in the sector would increase slightly ($0.24 billion), its exports to all other countries and regions would decrease by $0.75 billion, resulting in a net decrease of $0.51 billion. South Korea's exports of textile products to all other countries and regions except the Untied States would decrease slightly by $0.57 billion, with a total increase in exports of $4.67 billion. South Korea's imports of textile products from all its trading partners would increase slightly, with a total increase of $0.78 billion.

For the sector of mid-technology products, the United States and South Korea would decrease their production by 0.25% and 1.72%, respectively (Table 3). However, the two countries would increase their exports of mid-tech products to each other. Thus, trade creation occurs. Specifically, U.S. exports to South Korea would increase by $1.76 billion and its exports to all other countries and regions would decrease by a total of $6.42 billion. As a result, total U.S. exports in the sector would decrease by $4.66 billion.

U.S. imports from all countries and regions would increase, with a total increase of $5.20 billion. South Korea would increase its exports of mid-tech products to the United States, but it would also reduce its exports to all other countries and regions, resulting in a net decrease of $1.16 billion in exports. Similarly, South Korea would increase its imports of mid-tech products from the United States by $1.76 billion and divert its imports from all other countries and regions by $0.55 billion. As a result, South Korea's total imports in the sector would increase by $1.21 billion.

For the sector of high-technology products, the Untied States and South Korea would increase their production in the sector by 0.59% and 0.47%, respectively (Table 3). Total U.S. exports would increase dramatically by $8.28 billion. In particular, U.S. exports to South Korea, ROW, and the EU would increase by $2.90, 2.70, and 1.17 billion, respectively. While U.S. imports from South Korea would increase by $2.00 billion, its imports from all other countries and regions would decrease by a total of $6.15 billion. As a result, total U.S. imports would decrease by $4.15 billion. For South Korea, while its exports to the United States in the high-tech sector would increase by $2.00 billion, its exports to all other countries and regions would decrease slightly, by a sum of $0.29 billion, resulting in a net increase of $1.71 billion in exports. South Korea would also divert its imports of high-tech products from other trading partners to the United States. While South Korea's imports from the United States would increase by $2.90 billion, its imports from other countries and regions would decrease by $1.67 billion. Thus, South Korea's total imports in the high-tech sector would increase by $1.23 billion.

For the sector covering services, while U.S. exports to South Korea would increase slightly ($0.07 billion), its exports to all other countries and regions would decrease ($5.03 billion), resulting in a net decrease of $4.95 billion. In contrast, U.S. imports in the sector from South Korea would decrease slightly, by $0.13 billion, while its imports from all other countries and regions would increase by $2.47 billion, resulting in a net increase of $2.34 billion. South Korea would have trade diversion effects for its exports and trade creation effects for its imports: while total exports in the sector to all destinations would decrease by $0.88 billion, imports from all sources would increase by $0.89 billion.

U.S. trade (with all countries and regions) would increase in all sectors except the sector covering services. In particular, U.S. trade in the sectors of agri-food, textiles, and high-tech products would increase by $3.58[5], $2.70, and $4.13 billion, respectively. Similarly, South Korea's trade would increase in all sectors except the sector of natural resource based industries. South Korea's trade in the above same sectors would increase by $2.19, $5.46, and $2.95 billion, respectively.

For scenarios 1 and 3 in which import tariffs for agriculture and food products between the United States and South Korea are cut by 25% and 75%, respectively, the changes in exports are not reported in Table 5 (they are available upon request). It is

[5] Which is equal to $2.66 billion (increase in exports) plus $0.92 billion (increase in imports).

straightforward that U.S. exports to South Korea in the agri-food sector would increase by a smaller amount if the trade barriers for agriculture and food products between the two countries are cut by a smaller amount. Specifically, U.S. exports of agri-food products to South Korea would increase by $1.75 billion under scenario one and $8.07 billion under scenario three. The changes in exports in other sectors across the countries are would only change slightly from scenario two as reported in Table 3. Total U.S.-Korea bilateral trade (all sectors combined) would increase by $15.0 billion under scenario one and $22.0 billion under scenario three. The difference in total bilateral trade under different scenario is mainly due to the significantly different trade volume of agri-food products between the two countries.

5. SUMMARY AND CONCLUSIONS

In this study, we have examined the characteristics of U.S.-Korea bilateral trade since 1989. We have used a general equilibrium model (a multi-region GTAP model) to examine the effects of a U.S.-Korea FTA on various sectors of the economy under three different scenarios in the two countries.

The U.S.-Korea bilateral trade volume has been growing dramatically since 1989. The main reason behind the increased bilateral trade is that the two countries have increased their trade in differentiated high-technology products with each other. While the United States has increased its exports of high-technology products to South Korea, its imports of high-technology products from South Korea have increased more rapidly, resulting in a growing U.S. bilateral trade deficit. The relative importance of other sectors (e.g., mid-technology and textiles) in U.S.-Korea bilateral trade tends to decline over time, since an increase in South Korean wages makes its labor-intensive goods less competitive.

Under a U.S.-Korea FTA, the bilateral trade volume between the two countries would increase through inter-industry and intra-industry trade. Major increases in inter-industry trade include a dramatic increase in U.S. exports of agricultural and food products to South Korea and a sharp increase in Korean exports of textile products to the United States. Specifically, U.S. exports to South Korea in the agriculture and food sector would increase by $1.75 billon under scenario one, $4.37 billion under scenario two, and $8.07 billion under scenario three. South Korea's export sales to the United States in the textiles sector would increase by $5.01, $5.24, and $5.60 billion under the three scenarios, respectively. While U.S. exports of high-tech products to South Korea would increase by about $2.9 billion under each scenario, South Korea's exports to the United States would increase by $2.0 billion. The total U.S.-Korea bilateral trade (all sectors combined) would increase by $15.0 billion under scenario one, $17.9 billion under scenario two, and $22.0 billion under scenario three.

A U.S.-Korea FTA would improve the national welfare for both countries. The effects of an FTA on GDP and household income in both countries would be positive.

South Korea benefits more from an FTA in terms of per capita welfare gain and per capita GDP increase. While U.S. producers in the agri-food and high-tech sectors would benefit from the FTA, South Korea's producers in the textiles and high-tech sector would benefit from the FTA. By contrast, producers in the U.S. textiles sector and producers in the agri-food sector in South Korea would suffer from the FTA. Thus, it would be vital to compensate those groups in order to smoothly implement an FTA between the two countries.

The limitations of the study may include the following two aspects: (1) the data are based on the year 2001. There are some major changes over the past five years across the sectors in the economies throughout the world, particularly in the high-technology sector. (2) Assumptions in the GTAP model such as constant return to scale, perfect competition, and perfect mobility of labor and capital across the sectors may not be plausible.

Appendix. A Brief Explanation of the GTAP Model

The Global Trade Analysis Project (GTAP) is coordinated by the Center for Global Trade Analysis, which is housed in the Department of Agricultural Economics at Purdue University. The project consists of several components including a global data base, a standard modeling framework, and software for manipulating the data, etc. It is the most widely used computable general equilibrium (CGE) model for analysis of global trade. The equations are anchored with the actual economic data from the countries being modeled, while behavioral parameters are either assumed or adapted from estimates elsewhere.

The assumptions for the GTAP model include constant return to scale and perfect competition. Also, resources are assumed to be fully employed and input factors such as labor and capital are assumed to be mobile across the various sectors in a country. Bilateral demand for trade is based on the Armington (1969) assumption, which states that internationally traded products are differentiated by country of origin.

The standard general equilibrium (GE) closure, which classifies the variables in the model as either endogenous or exogenous is provided in the software for implementing the model. In the standard GE closure, the exogenous variables (e.g., tariffs, technology, and population) can be readily shocked to examine the effects of the changes of these external factors on the endogenous variables. The standard GE closure can be modified according to the research objectives. The latest version-6 database released in 2005 contains 57 commodity groups and 87 countries and regions. The database depicts the global economic activity for the 2001 reference year. Hertel (1997) provides details about the GTAP model.

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