An Analysis of the Economic Effects of a Japan-Korea FTA: Sectoral Aspects

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Abstract

A Japan-Korea Free Trade Agreement is already in the process of being negotiated by the two governments and is expected to be the first FTA established between Northeast Asian countries.We apply the CGE model using GTAP database ver.5 for the quantitative analysis of the economic effects of the FTA. We applied two types of model for our analysis, as in our previous paper. One is a model for an analysis of the short run effects. This is basically equivalent to the standard GTAP model. The other is a model with capital accumulation mechanism for an analysis of the long run effects. We found some positive results as a result of our simulation. In terms of macroeconomic effects, there are some gains in terms of real GDP or equivalent variance. With regard to sectoral effects, we were able to point out some sectors that would benefit from a FTA, such as the ROK's electronic equipment sector, where the removal of tariffs decreased costs in that sector. This suggests that an increase in intra-industry trade will enlarge the static effects of the FTA. Relating to the method of analysis, the elasticity of substitute of imports played a crucial role in terms of export sales of Japanese motor vehicles and other transport equipment. It might be advisable to invest greater energies in an empirical study of this area.

KEYWORDS: *Japan-Korea FTA, CGE model, capital accumulation, intra-industry trade*

1. Introduction

The idea of a Japan-Korea Free Trade Agreement (FTA) was raised by President Kim Dae-Jung at the Japan-Korea summit meeting with Prime Minister Keizo Obuchi in October 1998. As the first stage of negotiations, in December 1998 the Institute of Developing Economics (IDE), of the Japan External Trade Organization and the Korea Institute for International Economic Policy (KIEP) began research on the economic effects of a Japan–Korea FTA at the request of the two governments. Their reports were released in May 2000. Both of them applied CGE models, which used the database of the Global Trade Analysis Program (GTAP)[1] for quantitative analysis.[2]

As the second stage, the first meeting of the Japan–Korea FTA Business Forum, a gathering of business leaders from both countries, was held in September 2001. In January 2002, the Forum issued a joint statement that requested that the two governments conclude the FTA at as early a stage as possible. Following this statement, at the Japan-Korea summit meeting in March 2002, Prime Minister Junichiro Koizumi and President Kim Dae-Jung agreed to the establishment of a joint research group that includes government officials, business leaders and academicians.

The Japan-Korea FTA is expected to be the first FTA concluded between Northeast Asian countries. The unified market will have roughly US$5 trillion of GDP and a population of 170 million.

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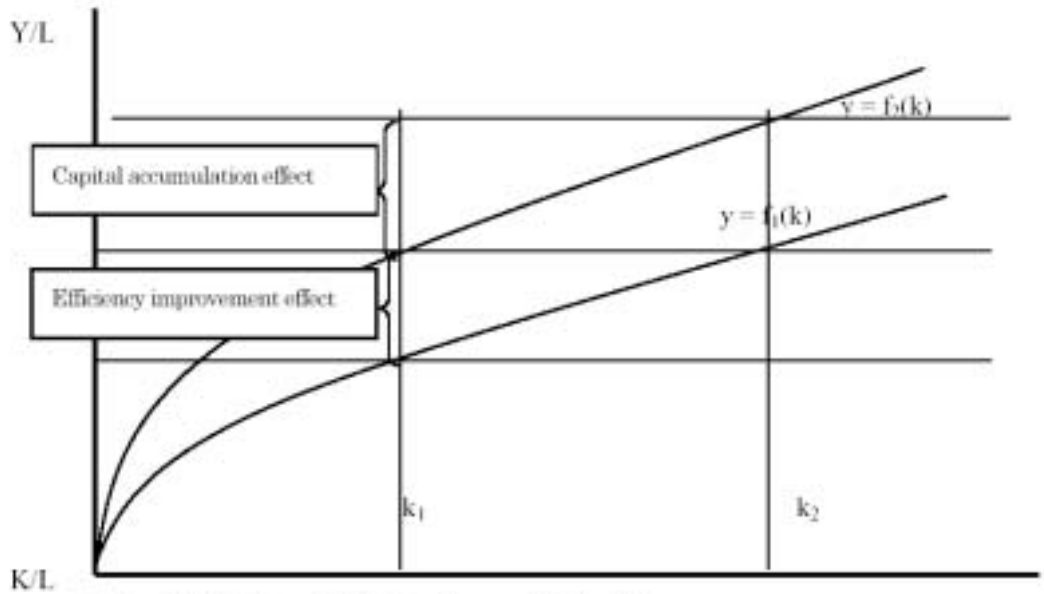
In Nakajima and Kwon (2001), we carried out some quantitative analyses of the economic effects of a Japan–Korea FTA using the CGE model. Here, we have added some new points on this topic. Firstly, we applied the GTAP database Ver.5 that is based on data for 1997. Secondly, we attempted more precise analyses of economic effects on sectors, including output and trade balance.

2. Outlines of models

We applied two types of model for our analysis, as in our previous paper. One is a model for an analysis of the short run effects. This is basically equivalent to the standard GTAP model. The other is a model for an analysis of the long run effects. This model is shown in Warmsley (1998). Here, we have capital stock as an endogenous variable for an analysis of the effects of capital accumulation.[3] In contrast, it is an exogenous variable in the standard GTAP model. At the same time, we assume interregional mobility for capital stock. With some shocks such as tariff removal, capital stock will move until the change in the rate of return on capital stock becomes equal across all regions.

Figure 1 illustrates the effects of FTA on real GDP. One effect is an improvement in efficiency arising from the removal of tariffs; the other is the capital accumulation effect. Short-run effects include only the efficiency improvement effect. Long-run effects include both of these.

Figure 1.
Illustration of Effects on Real GDP



Notes: Y: GDP, K: capital stock, L: labor, y = Y/L, k = K/L

There are 66 regions and 57 commodities available in the GTAP database ver.5. Aggregations of our model can be found in Table 1. We kept the machinery sectors, which are major source of exports for both Japan and the ROK, as close as possible to the original database.

Table 1.
Aggregation of Regions and Sectors

Regions	Sectors
8 regions: Japan, ROK, China, Asian NIES, ASEAN, NAFTA, EU, Rest of World (ROW)	17 sectors: Agricultural products (Agri), Forestry products (Forestry), Fishery products (Fishing), Mineral resources (Mineral), Processed food (ProFood), Textiles and apparel (Texwap), Metal products (Met), Motor vehicles (Mvh), Other transport equipment (Otn), Electronic equipment (Ele), Other machinery and equipment (Ome), Other manufacturing products (OthManu), Energy (Ene), Transport (Tra), Communications (Com), Finance (Fin), Other services (OthSvces)

Note: Asian NIES signifies Taiwan and Hong Kong. Singapore belongs to ASEAN.

Tariff rates between Japan and the ROK are shown in Table 2. Japan's tariff rates in manufacturing sectors other than textiles and apparel, and processed food are already very low. Meanwhile, the ROK maintains certain tariff rates in its manufacturing sectors. The tariff rates for agricultural products and processed food are high in both countries.

In our FTA simulations, we have simply assumed that these rates decrease to zero.

Table 2.
Tariff Rates Between Japan and ROK

(%)

	Japan	ROK
Agricultural products	36.3	51.9
Forestry products	4.7	2.3
Fishery products	6.8	11.7
Mineral resources	0	2.6
Processed food	42.1	44.8
Textiles and apparel	10.4	8
Metal products	2.1	7.3
Motor vehicle	0	8
Other transport equipment	0	2.8
Electronic equipment	0	8
Other machinery and equipment	0.3	7.9
Other manufacturing products	3.9	7.5

Source: GTAP database Ver.5

Table 3 shows GDP and trade data for Japan and the ROK. Japan is approximately ten times the size of the ROK in terms of GDP. The share accounted for by the other country in total exports and imports is higher in the ROK than Japan.

Table 3.
Base Date (1997)

Million of U.S. Dollars

	GDP	Exports	Export Share	Imports	Imports Share	Trade Balance
Japan	4,255,524	506,278	5.60%	418,249	3.80%	88,029
ROK	445,503	162,516	10.10%	158,518	18.10%	3,997

Source: GTAP database Ver.5
Notes: Trade data includes services
"Export Share" refers to the share of exports to the ROK or Japan as a share of total exports.
"Import Share" refers to the share of imports from the ROK or Japan as a share of total imports.

3. Macroeconomic effects

The macroeconomic effects of the results of our simulation are found in Table 4 and subsequent figures.

Firstly, there is not much change in real GDP in any region in the short-run case. Only the ROK shows an increase, of 0.29%. In the long-run case, the ROK shows a 1.09% increase. This is a result of capital accumulation. The removal of tariffs causes an increase in the rate of return on capital stock in the ROK as can be seen in Figure 2. Capital inflow to the ROK then occurs as in Figure 3. These effects are not seen on a large scale in Japan, therefore the increase in real GDP stays at only 0.02%. Other regions show negative change in the long-run case. This is caused by capital outflow to Japan and the ROK, since capital stock is a zero sum in this model.

Equivalent valiance shows positive in Japan and the ROK and negative in other regions. The scale is larger in the long-run case than the short-run case.

There is an obvious contrast with regard to the effect on the terms of trade. There are improvements in Japan and the ROK, i.e. the members of the FTA, and deteriorations in other regions, with an increase in export prices in Japan and the ROK which was caused by increase of export and domestic demand for their products, and decreases in other regions. The magnitude is larger in the short-run case.

There is also an obvious contrast in the trade balance, which grows worse in Japan and the ROK and improves in other regions, apart from China in the long-run case. The magnitude is larger in the short-run case.

Table 4-1.
Macroeconomic Effects (Short-Run)

	Real GDP (%)	Equivalent variance (Million US dollars)	Terms of trade (%)	Trade balance (Million US dollars)
Japan	-0.01	963	0.26	-961
ROK	0.29	1811	0.31	-982
China	-0.01	-340	-0.12	22
ANIES	0	-176	-0.05	62
ASEAN	-0.01	-308	-0.09	40
NAFTA	0	-469	-0.04	696
EU	0	-230	-0.01	467
ROW	0	-677	-0.04	656

Table 4-2.
Macroeconomic Effects (Long-Run)

	Real GDP (%)	Equivalent variance (Million US dollars)	Terms of trade (%)	Trade balance (Million US dollars)
Japan	0.02	2945	0.23	-277
ROK	1.09	3972	0.06	-301
China	-0.05	-735	-0.1	-23
ANIES	-0.06	-397	-0.04	58
ASEAN	-0.1	-687	-0.06	3
NAFTA	-0.02	-2213	-0.03	316
EU	-0.02	-1560	-0.01	62
ROW	-0.03	-1659	-0.02	162

Figure 2.
Change in Current Net Rate of Return on Capital Stock

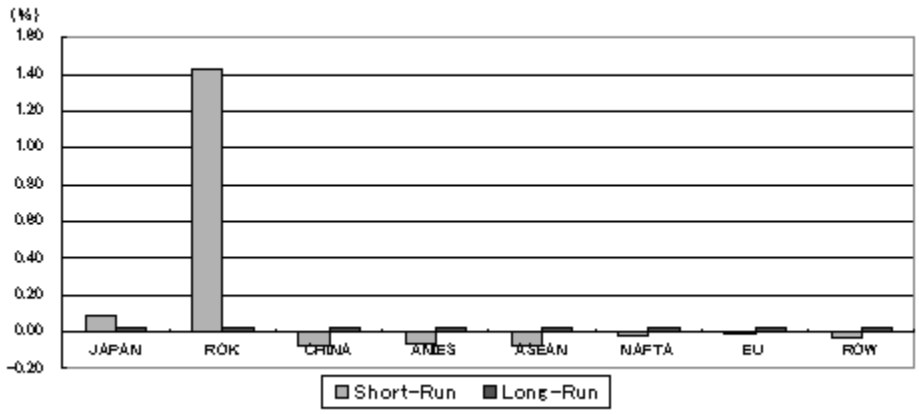
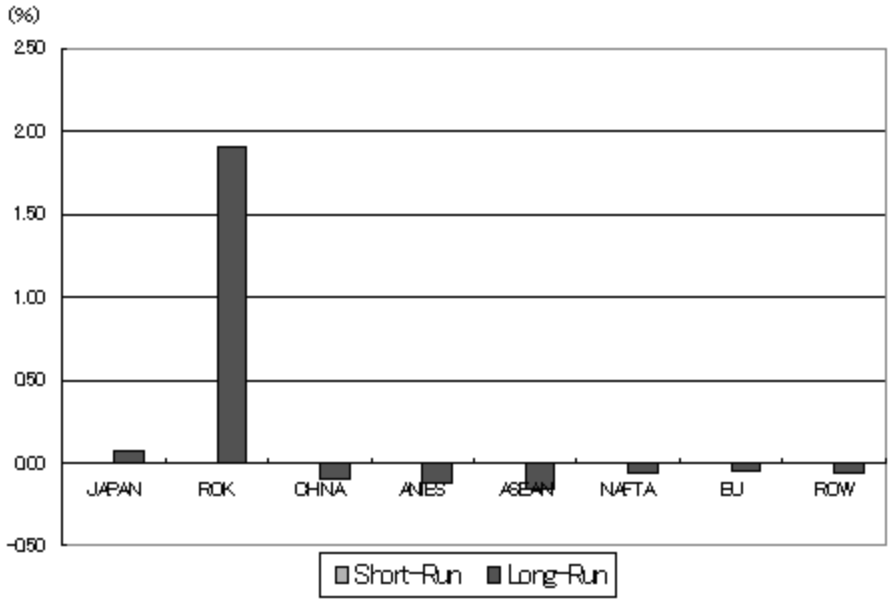


Figure 3.
Change in Beginning of Period Capital Stock



4. Sectoral effects

4-1 Composition of exports

Before analyzing the results of our simulation of sectors, we would like to provide an overview of the trade patterns of Japan and the ROK. Figures 4 and 5 show the composition of the exports of the two countries based on the GTAP database.

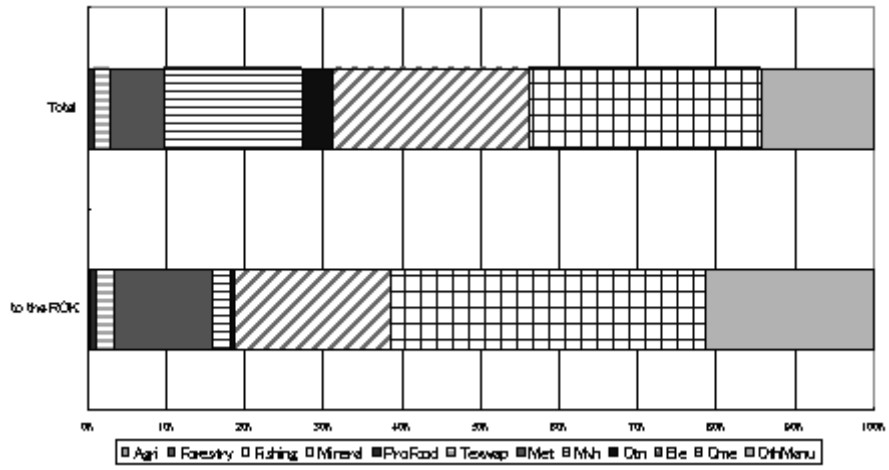
The composition of exports is similar in both countries. Machinery, including motor vehicles, other transport equipment, electronic equipment, and other machinery and equipment, is a major export for both Japan and the ROK. In contrast, although textiles and apparel features in the ROK's exports, this area is not represented in Japan's exports.

Looking at each country's exports to the other, a common tendency can be identified. Although motor vehicles are a major export for both, there are only limited exports of these between these two countries. Trade policy explains this in part. Until 1999, the ROK had a discriminatory trade policy with regard to Japanese exports, called the Import Origin Diversification Act. On the other hand, Japan's automobile market might be more difficult for the ROK's exporters to penetrate than other markets, such as North America. We can see a similar tendency with regard to other transport equipment, including shipbuilding.

On the other hand, the share of exports of electronic equipment to each other is high. This includes not only final products, but also intermediate parts. Intra-industrial trade between the two countries is already flourishing in this sector.

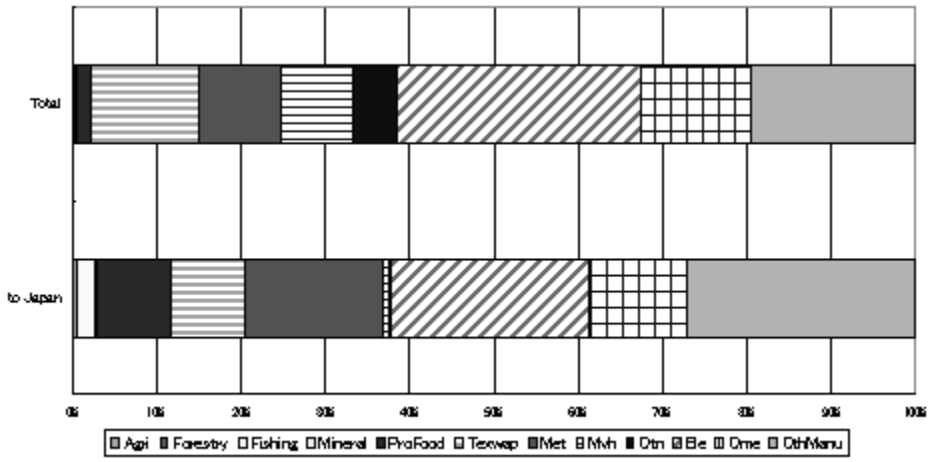
In addition to the above, there are other unique characteristics in the pattern of trade between the two countries. The share of processed food is high in the ROK's exports to Japan. The share of other machinery and equipment is high in Japan's exports to the ROK. This includes industrial machinery such as machine tools.

Figure 4.
Composition of Japan's Exports by Sector



Source: GTAP database Ver.5

Figure 5.
Composition of the ROK's Exports by Setor



Source: GTAP database Ver.5

4-2 Results of simulation

Here, we will look at the results in the short-run case, in order to examine the direct effects of tariff removal.

Figure 6 illustrates the change in trade balance by sector.[4] In Japan, other machinery and equipment shows the largest improvement in trade balance. Metal products, other manufacturing products, and electronic equipment follow. Other sectors show deteriorations.

In ROK, the improvement in the processed food sector is remarkably large, with textiles and apparel following. On the other hand, there is a large deterioration in other machinery and equipment. Metal products, motor vehicle, other transport equipment, and other manufacturing products also show a deterioration.

Figure 7 illustrates the change in value added by sector. The directions of change are almost same as those in the figures for the trade balance. However, there are some exceptions. For example, the trade balance of ROK's agricultural products sector grows worse, but the value added increases. This is caused by a large increase in production in the ROK's processed food sector. Imports and domestic production of agricultural products increase at the same time.

Figure 8 and 9 illustrates the change in employment by sector. Again, the directions of change are similar to those of value added on Figure 7. In this model full employment of labor is assumed. Therefore labor force will move from decreasing sector to increasing sector. Even though, these results may suggest potential needs for reallocations of labor force through sectors.

Figure 6.
Change in Trade Balance by Sector
(Short-Run)

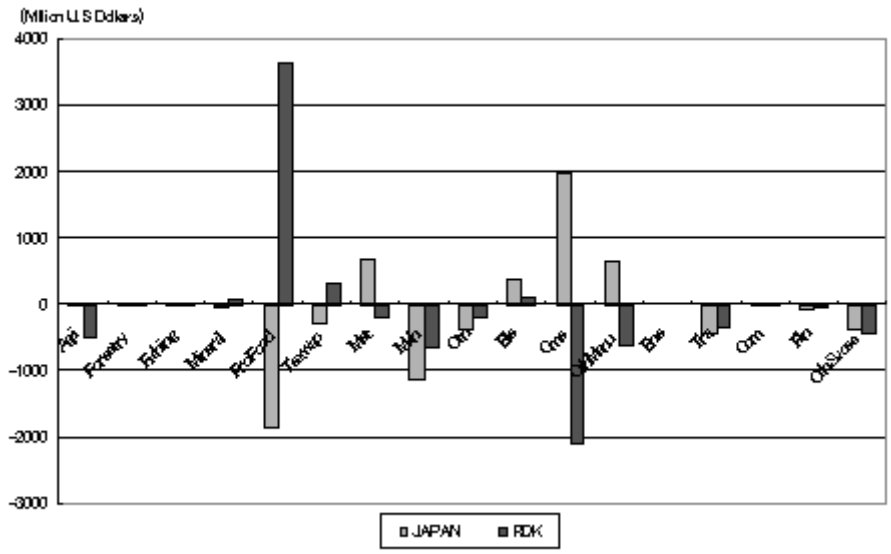


Figure 7.
Change in Value Added by Sector
(Short-Run)

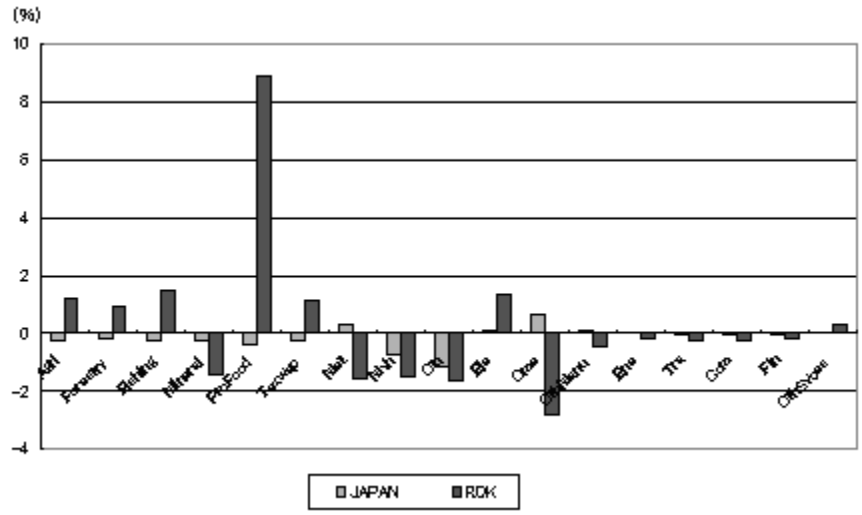


Figure 8.
Change in Employment of Skilled Labor by Sector
(Short-Run)

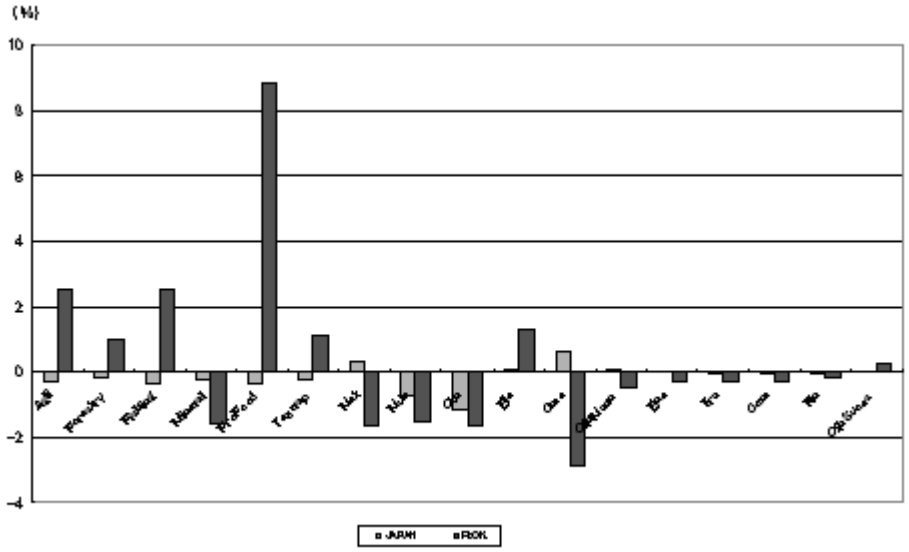
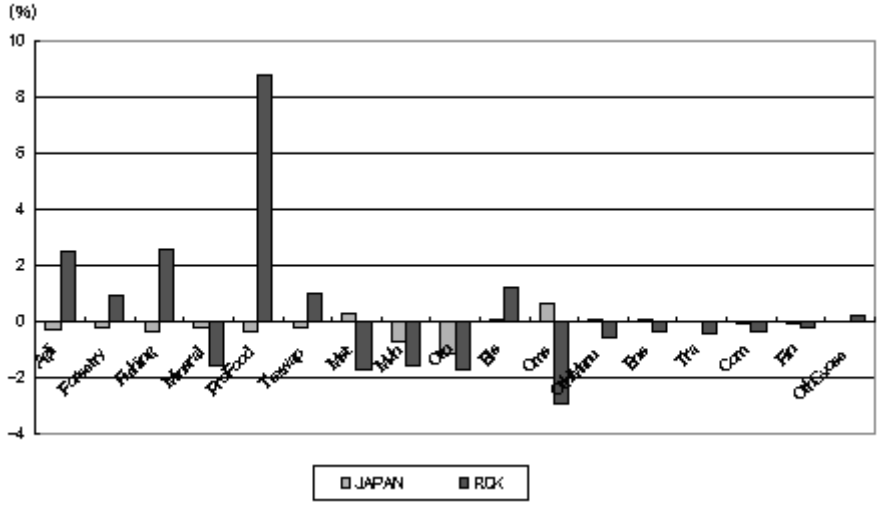


Figure 9.
Change in Employment of Unskilled Labor by Sector
(Short-Run)



We can see deterioration in the trade balance and decreases in the value added in Japan's motor vehicle and other transport equipment sectors. These results are puzzling, since there are import tariffs on these in the ROK and the FTA would remove them. Furthermore, there are no import tariffs on these in Japan. In considering the removal of tariffs, the direction of the results can be the opposite of what is expected. Changes in the value of Japanese exports in these two sectors are shown in Figure 10. Exports to the ROK increase in both sectors, but exports to other regions decrease. The percentage of these decreases is small, but these regions include NAFTA and EU, which are major export markets for Japan in these two sectors. Therefore, the two sectors experience an overall deterioration. We can see the change in Japan's export price by sector in Figure 11. There are increases in export price in the two sectors, as well as in other manufacturing sectors such as electronic equipment or other machinery and equipment, and there are improvements in the trade balance in these sectors. A crucial point for our results is the elasticity of substitute of imports by origin.[5] As we can see in Appendix 4, these are relatively high in the two sectors compared with other manufacturing sectors, causing a decrease in imports of intermediate inputs.[6] This extreme result, in which the removal of tariffs on particular products causes decreased exports and production of them, suggests the necessity of further examination of the elasticity of the model.[7]

Figure 10.
Change in Export States in Two Japanese Sectors (Short-Run)

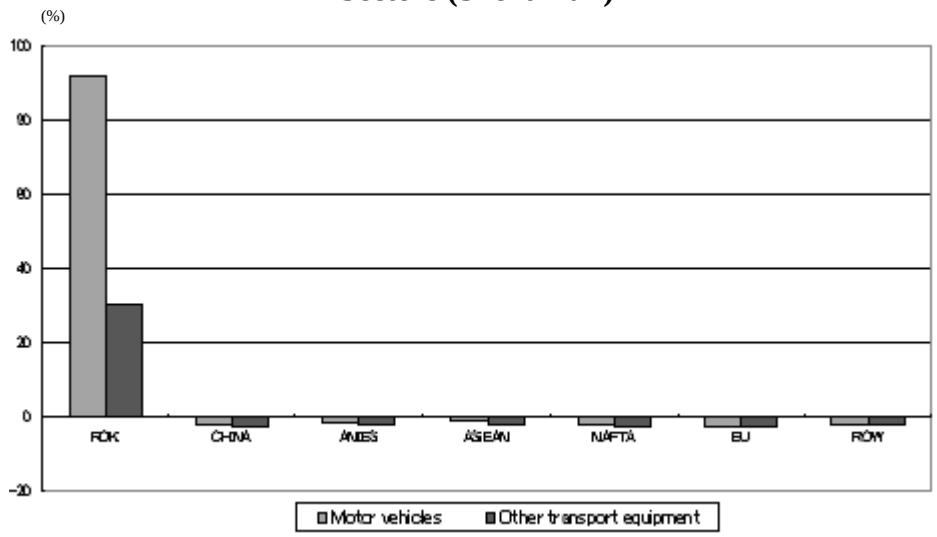
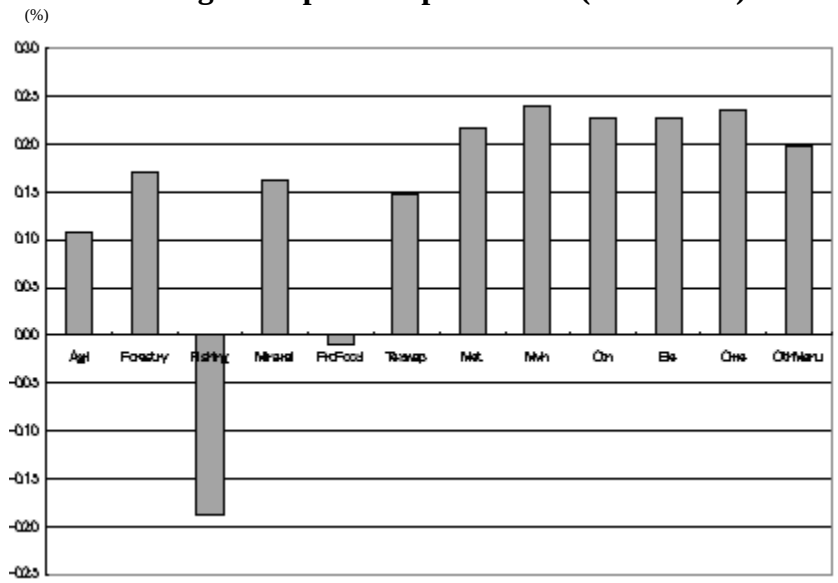


Figure 11.
Change in Japan's Export Prices (Short-Run)



The ROK's electronic equipment can be identified as another puzzling case, as its trade balance improves, while at the same time, other machinery sectors deteriorate. The change in the ROK's export price by sector is shown in Figure 12. Electronic equipment is the only sector in which a decrease in export price is seen; this is caused by the removal of import tariffs. The import ratio of intermediate inputs in electronic equipment is high as can be seen in Figure 13. Moreover, as mentioned before, electronic equipment has a high share in exports from Japan to the ROK.

Therefore, the removal of tariffs could reduce the prices of products. This case suggests that an increase in intra-industry trade may enlarge the static effects of the FTA.

Figure 12.
Change in the ROK's Export Prices
Sectors (Short-Run)

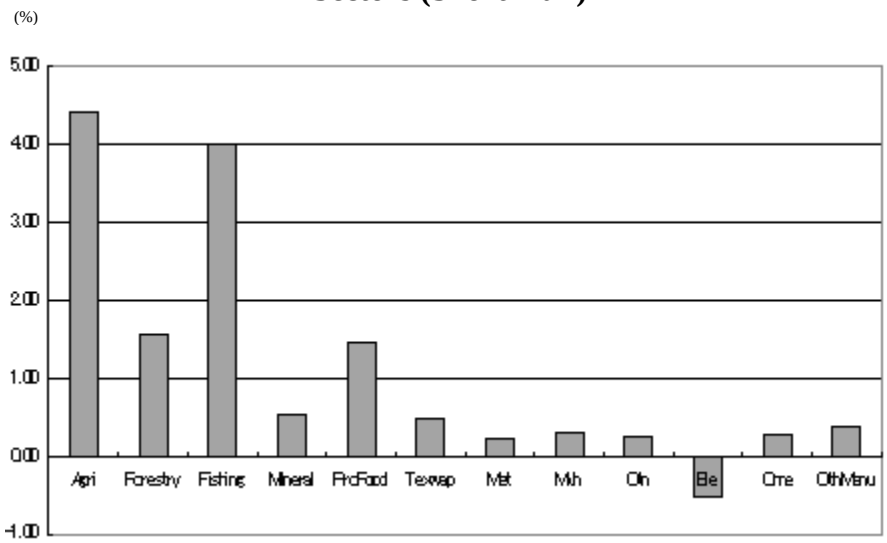
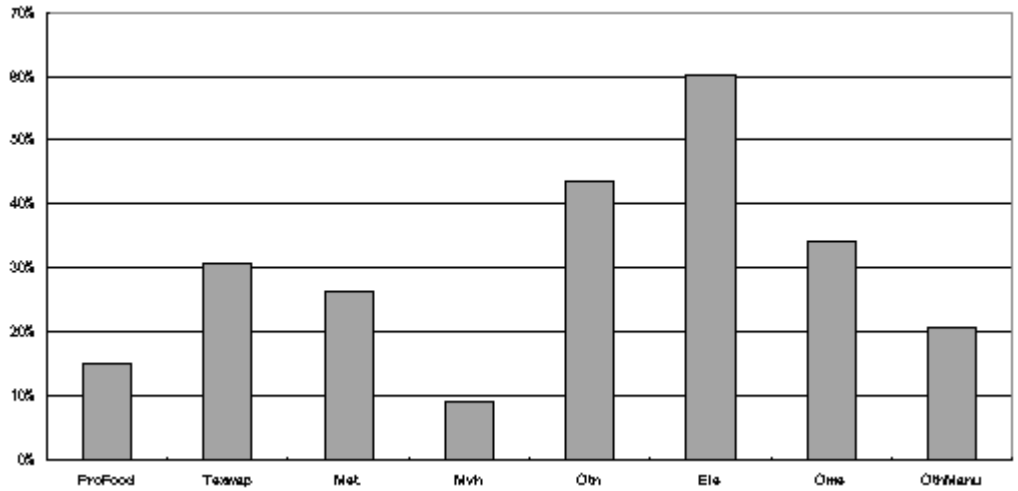


Figure 13.
The ROK's Import Ratio in Intermediate Inputs
by Sector



5. Results of Other Analyses and Comparisons

Here, we introduce results of current quantitative analyses on Japan-Korea FTA, and compare to ours.

Brown, Deardorff and Stern (2001) shows results of simulations by Michigan Model of World Production of Trade. The model is a static CGE model which apply GTAP database Version 4 as a main data source. However, the model assumes increasing returns to scale in production. On the contrary, standard GTAP model and ours assume constant returns to scale.

They only mentioned about macroeconomic effect. Compare to our short-run effect, Japan get more and the ROK get less in the term of GDP growth. It might be affected by the assumption of increasing returns to scale.

Cheong (2001) can be the most comprehensive work on Japan-Korea FTA by CGE approach. Their static CGE model is also based on GTAP database Version 5. They made some versions of models for the analysis. Firstly, models can be either with capital accumulation mechanism or without it. Secondly, models can assume either increasing returns to scale or constant returns to scale. Lastly, models can apply newly estimated the Armington parameter on the ROK or those from GTAP database. Therefore, they have 8 variations of model in total.

They only present results on the ROK side in their paper. In the term of GDP growth, results of cases with capital accumulation mechanism and constant returns to scale are 0.82~0.96%. It is roughly equal to our long-run case. Then, results of cases with capital accumulation mechanism and increasing returns to scale are higher or 1.79~1.90%. On the sectoral effect, the ROK's machinery sectors get positive effects in the versions with increasing returns to scale. Those get negative effects in our simulation.

Hasegawa, Sasai and Imagawa (2001) shows results of simulations by JIDEA (Japanese Interindustry Dynamic Economic Analysis) which is a multi-sector econometric model with input-output analytical methods. Since the model is a dynamic econometric model, we can see the effects of the FTA in time series here. In the term of GDP growth, effect of the FTA was limited. Japan's gain is negligible scale, and the ROK's gain is almost equal level to our short-run case in first 5 years. For this analysis, they estimated import function for 63 tradable sectors in Japan. However they could not get statistically significant results in 27 sectors. Those include major imports of Japan from the ROK, such as Forestry, Fishery, Textiles, Cothing and IC. This problem might caused under estimation for the effect of the FTA in their analysis.

McKibbin, Lee and Cheong (2002) shows results of simulations by G-Cubed (Global General Equilibrium Growth) Asia-Pacific Model. G-Cubed is a dynamic CGE model with rational expectations or optimizing mechanism in different time periods. In the term of GDP growth, Japan get about 0.1% and the ROK get about 0.15% at the peak in 20 years. Growth of the ROK is lower than results of static CGE approach with capital accumulation mechanism which are in Cheong (2001) and our analysis.

6. Conclusion

Our analysis provided us with a positive impression of a Japan-Korea FTA.

In terms of macroeconomic effects, there was a certain increase in the ROK's real GDP in the long-run case. On the other hand, gains for Japan were limited in terms of the scale of real GDP. However, both countries benefited in terms of equivalent variance.

With regard to sectoral effects, there were some unique cases, such as the ROK's electronic equipment sector, where the removal of tariffs decreased costs in that sector. This suggests that an increase in intra-industry trade will enlarge the static effects of the FTA.

Relating to the method of analysis, the elasticity of substitute of imports played a crucial role in terms of export sales of Japanese motor vehicles and other transport equipment. It might be advisable to invest greater energies in an empirical study of this area.

Notes

[1] For the detail of GTAP database and models, see Hertel (1997).

[2] The results obtained by the two institutes are summarized in Nakajima and Kwon (2001)

[3] Closures can be found in Appendix 1.

[4] See Table 1 for abbreviations on sectoral names on figures.

[5] This parameter is set as double the Armington parameter or elasticity of substitute between imports and domestic products in the GTAP model

[6] See Appendix 2 and 3 for the import structure of the GTAP model.

[7] Kawasaki (1999) shows the scale of Armington parameter and elasticity of substitute of imports by origin have strong effect on simulation results compare to other parameters in GTAP model by sensitivity analyses. Cheong (2001) applied newly estimated these parameters of the ROK to their simulations.

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Appendix A.
GTAP Closures

	Short-run	Long-run
Exogenous	qo (capital) or kb	EXPAND
Endogenous	EXPAND RORDELTA=1 DTBAL is endogenous.	qo(capital) or kb

qo (capital) or kb: beginning-of-period capital stock

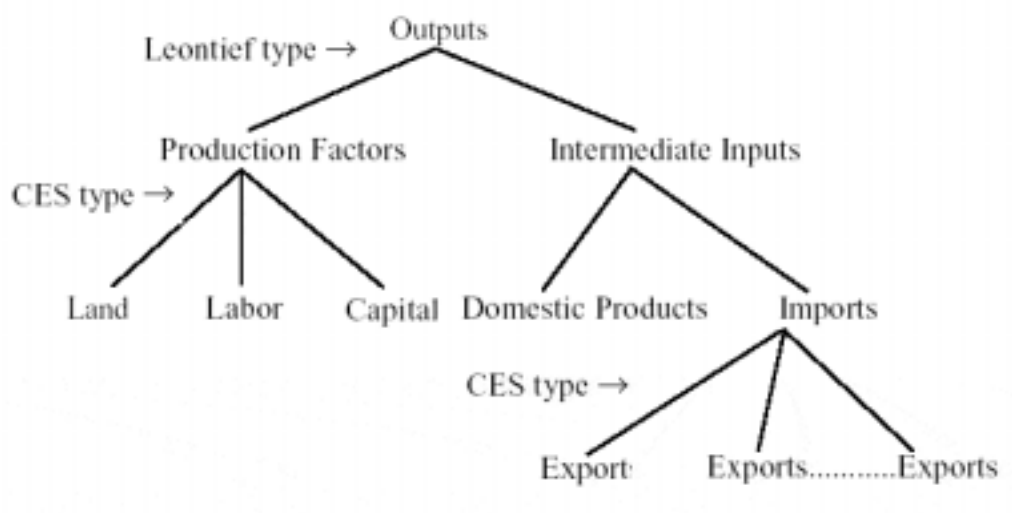
EXPAND: change in investment levels relative to endowment stock

DTBAL: change in trade balance

RORDELTA: parameter for binary switch mechanism of allocating investment funds

*Lower-case values show rate of change in GTAP models.

Appendix B.
Production Structures of GTAP Models



Appendix C.
Composite Import Nest in the Production Structure of GTAP Model

$qxs(i,r,s) = qim(i,s) - \sigma_M [pms(i,r,s) - pim(i,s)]$
$pim(i,s) = \Sigma MSHRS(i,r,s) * pms(i,r,s)$

qxs (i,r,s) : exports of commodity i from region r to region s
qim (i,s) : imports of commodity i in region s
pms (i,r,s) : import price of commodity i from region r to region s
pim (i,s) : import price of commodity i in region s
$\sigma_M(i)$: elasticity of substitution of imports by origin of commodity i
MSHRS (i,r,s) : the share of imports of i from region r in region s
* Lower-case values show rate of change in GTAP models.

Appendix D.
Elasticity of Substitution of Imports by Origin

Agricultural products	4.52
Forestry products	5.60
Fishery products	5.60
Mineral resources	5.60
Processed food	4.73
Textiles and apparel	6.31
Metal products	5.60
Motor vehicle	10.40
Other transport equipment	10.40
Electronic equipment	5.60
Other machinery and equipment	5.60
Other manufacturing products	4.55

Source: GTAP database Ver.5