

Assessing the Economic Impacts of Free Trade Agreement: A Computable Equilibrium Model Approach

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This paper presents assessments of the economic impacts of Free Trade Agreements (FTAs) relating to Japan. The analysis relies on a simulation with a computable equilibrium model. The impacts of various combination of FTAs are assessed to draw policy implications. This paper first review the theoretical framework, together with the specification of the simulation model. Then, simulations on the various cases cover both the bilateral FTAs of Japan and regional FTAs including Japan. Finally, short summary of implication from the simulation work comes.

1. The Theoretical Framework and the Simulation Model Adopted

(1) Surveys on the Impacts of an FTA

Welfare Decomposition of Efficiency Improvement

A tariff reduction of an FTA has a wide variety of economic impacts to the member countries of the agreement, as well as the rest of the world. The effects encompass those on welfare, production, exports and imports in both real and nominal terms. On the effects on the welfare of the peoples, a survey by Baldwin and Venables (1995) demonstrated a comprehensive framework to decompose the impacts on the national welfare into six effects, based on an indirect utility function with respect to the consumption expenditure¹. Assuming that all trade barriers give rise to rents only to domestic agents², one effect (trade cost effect) can be omitted from the six effects. Out of the remaining five effects, three effects (output effect, scale effect and variety effect) are only relevant in the models that allow for increasing returns to scale and imperfect competition.³ These effects are important for analyzing the regional trade agreements between countries with similar industrial and trade structures, and where horizontal intra-industry trade is dominant, as between the United States and Canada and among the countries in the EU. Because the percentage share of horizontal intra-industry trade in total bilateral trade within the East Asian region is still low, we may limit our analysis to the remaining two effects only, namely, trade volume effects and terms of trade

¹ The six effects consist of: trade volume effect, trade cost effect, terms of trade effect, output effect, scale effect and variety effect.

² In contrast, some trade barriers may be real trade costs incurred to the domestic agencies, or a quota under which foreigners capture the quota rents.

³ The main reference on this theoretical application is Helpman and Krugman (1989).

effects. Such treatment is also due to a lack of necessary data for simulating the welfare effects under the increasing returns to scale. The welfare decomposition of trade volume effect in formal expression is shown in Appendix 1.

Following the discussion above, the assumptions, mainly the constant returns to scale without significant product differentiation, enable us to limit the whole welfare change brought about by a tariff reduction under an FTA to only two effects: namely trade volume effect and terms of trade effect. The effects are in essence based on comparative statics, which just takes the difference of the two statuses of variables in equilibrium. Some details of these two effects are as follows:

Trade Volume Effect: This is essentially the change in tariff revenues, brought about by the changes in imports. As such, the effects in terms of income are obtained as the weighted-average of existing tariff rates, using changes in the import volumes, as the weights.⁴ This effect is related to the seminal study by Viner (1950) in which he classified the effects of the Customs Union⁵ (CU) into two types: namely the trade creation and trade diversion effects. The sum of the two effects corresponds to the trade volume effect, producing ambiguous results on the welfare. Trade diversion effect means reduced import from non-FTA members, while trade creation effect means the increase in the sum of increased imports from FTA/CU.⁶ Trade diversion results from discriminatory tariff reduction that leads private agents to import from a supplier that is not the lowest cost source. Therefore, trade diversion reduces home welfare by raising the nation's cost of consuming such goods. If bilateral tariffs are reduced only on imports from countries that are already the lowest-cost supplier, trade diversion does not occur. FTAs/CUs are likely to be beneficial if the partners initially account for large shares of each other's imports, as it would be the case if they were low cost producers.

Terms of Trade Effect: Changes in the trades by Japan and other East Asian countries will probably induce changes in their border prices with consequent effects on welfare through the change of their terms of trade. If imports of the FTA members from the rest of the world decrease, then the terms of trade of the members of the FTA are likely to improve, and vice versa. The terms of trade effects are supposed to have ambiguous results in general, because a FTA may or may not bring expansion of intra-regional trade and contraction of external trade. It is necessary to test the effects by means of economic models by taking into account the complex structure of complementarities in trade and other factors.

Location Effects and Regional Disparity

⁴ As the Appendix 1 illustrates, the trade volume effects amount to tdm where t represents a vector of import tariffs and dm is the derivative of import vector. In the case of trade liberalization, the amount is approximately equal to the sum of two triangles of the dead-weight loss under tariff in the standard textbooks of trade theory, by means of the mean-value theorem.

⁵ The Customs Union sets the common tariffs to the non-member countries, as well as abolishes the substantially all the tariffs between the members.

⁶ According to Kowalczyk (1992), there are many other definitions of trade creation and diversion.

Researchers have identified many other effects of an FTA than the static efficiency improvement. An important one is the location effect. There is a concern that regional integration may be associated with increased inequality between the regions. In a perfectly competitive environment, regional integration would reduce intra-FTA factor price differences, as was proved in the “factor price equalization theorem”. As long as the countries’ endowments lie inside the same cone of diversification, integration will equalize factor prices, *in the long run*. For example, China and Japan have much different endowments, but the virtual integration of the countries will eventually increase the internationally traded goods and factors, which will increase the size of the cones of diversifications. Actually, wages in China have been increasing rapidly, while those in Japan have declined.

Economic geography, recently drawing the attention of some economists, often assumes imperfect competition and scale economies, which sometimes imply reverse outcomes. Scale economies and economies of agglomeration mean that firms will not locate some productive capacity in every country or region. The decision of the firm depends on the balance between production costs and the trade costs. This balance changes as trade barriers are reduced, and it is possible that industry will be drawn into high wage locations, increasing inter-regional wage difference. Regional disparity has been a top concern of the Chinese government. The coastal region enjoyed high rates of growth, compared to the inland regions, which have lagged behind. In Japan, disparity among both people and regions has become a serious political issue. Relocation of production process and reduction of employment have long taken place in several regions of Japan. Concern about regional disparity sometimes manifests as political pressure to resist FTAs. The location effects are something new to trade theory, and we still need to accumulate literature and empirical data.

Other Dynamic Effects of an FTA on Economic Growth and Welfare

In addition to the effects above, researchers have identified the effects of trade liberalization under an FTA on economic growth. The tariff reduction may provide an incentive: (i) to mobilize inputs and to improve their quality; (ii) to increase the efficiency of management through the increased pressure of competition (the “competition enhancing” effect); and (iii) to enhance technological innovation. Most of these effects are hypothetical, and empirical studies on the growth function have tested them by the panel data estimates. At present, an economic model simulation may not be able to capture these effects.

The FTAs, especially the type of the Economic Partners Agreements (EPA) of Japan, include many other liberalization and cooperation clauses in the agreements. They apparently bring about many economic effects, some of which may be more significant than the tariff reduction. Some existing studies have tried to assess the service sector liberalization and other trade cost reduction measures in FTAs/EPAs. Most of them rely on more or less arbitrary assumptions. Our study takes a model simulation approach, and as a result, limits to the assessment of tariff reduction.

(2) Framework of the Simulation Model Adopted

Computable Equilibrium Models and their Advantage

In spite of the huge stock of theoretical literature, it is not empirically possible to construct a simulation model to assess quantitatively all the wide-ranging effects of an FTA, under the present model technology and availability of required data. The following analysis in this paper adopts a simulation of a computable general equilibrium (CGE) model for assessing the FTAs. A standard CGE model consists of equations of market demands and supply, market clearance conditions, as well as input-output relations, having a foundation of the microeconomic general equilibrium theory. The CGE model in its international version has its theoretical foundation in neo-classical trade theory. The pattern of comparative advantage explains the causes of trade and the gains from trade on the basis of the relative differences between economies in factor endowments and production functions. By specializing in products that suit local conditions, and trading these for other goods that are produced with comparatively greater efficiency in other economies, each economy will have a higher real income and welfare than in the absence of trade. This is the basic motivation behind trade and explanation for the pattern of trade in the world economy.

In the framework, tariffs cause distortions in the markets that impede trade, and bring about losses of trade and welfare to the economies. Tariff elimination under an FTA is therefore understood as the removal of economic distortions. Tariff cuts lower import costs that lead to pushing down the import prices in the domestic markets under a competitive environment. The lower import prices stimulate imports in the short-run. Cheaper imports, in turn, lead to lower production costs for other domestic industries. Relocation of labor and capital to other, more efficient sectors takes place from the formerly protected sectors, in the medium- to long-run. The improved competitiveness of the export industries, led by the relocation of the resources and cheaper production costs, eventually increases the exports of the economy. After the adjustment process completes, the nation may take more benefits from the trade, and production of the economy shift toward sectors with comparative advantage. The static improvement of welfare through this efficiency gain is measured as the trade volume effects, as indicated in the sub-section above. The model measures the terms of trade effects on welfare, as well.

The CGE models have an apparent advantage of having multi-sector and multi-country structure. They can identify a likely impact of an FTA on some sector of some country, as well as on the country and/or the world as a whole. This merit favorably distinguishes the CGE model from other macroeconomic models in the context of policy analysis. As another advantage of the CGE models, they have a concrete microeconomic foundation, which enables the modelers to assess rigorously the welfare changes.

“Accumulation Effect” Measured by a CGE Model

The CGE models are inherently designed to undertake comparative statics, skipping the intermediate process of market adjustment. On the effect of trade liberalization, the standard models can only measure the simple efficiency gains of recovering the dead weight loss. Notwithstanding, the model builders have tried to enable the models to assess dynamic effects of trade liberalization, in addition to measure the efficiency gain / loss from the

external shocks. For example, recent models can incorporate a capital accumulation mechanism, which is induced by trade liberalization. This is the “accumulation effect”, introduced in Baldwin (1992).⁷ The mechanism, which is incorporated into the CGE model, is as follows: increased incomes caused by an enhanced efficiency of the economy lead to increased savings, and the increased savings induce an increase in investment, and such an increase continues until the increased capital stock requires a larger amount of capital depreciation to balance the net investment. As such, the model measures the accumulation effects as medium-term transient, rather than the increase in the long-term growth rates. Appendix 2 provides a detailed explanation on the specification. Our study adopts the specification, because of its greater reality.

The accumulation effect of the Baldwin specification is measured by comparing a set of variables to another, both on the long-run growth paths. Therefore, the model does not trace and identify the dynamic path in the transition period. However, the order and sequence of the choice of FTA partners, which reflect the transitional path, significantly matters in the context of policy. Moreover, the Baldwin’s specification has a semi-linear nature, which precludes the path-dependency of the final results. But the political consideration often requires the assessment of the difference of the final outcomes, brought about by the sequence of the possible FTAs. As such, “real” dynamic models are desired for the policy analysis. In this paper, several cases of combination of the FTAs relating to Japan are simulated to illustrate the transition, as compromise⁸.

The Global Trade Analysis Project Model

Our study uses the Global Trade Analysis Project (GTAP) model version 6.2, and its database version 6.0, provided by Purdue University. The original database consists of 87 regions and 57 industrial sectors, which are aggregated for the study into 24 regions and 25 sectors. Appendix 3 summarizes the aggregation with abbreviation. The GTAP model provides the Baldwin accumulation specification, as a standard option.

One of the specific features of the GTAP model is the Armington structure, which sets the fixed elasticity of substitution between imported and domestic goods due to changes in the relative price of those two goods⁹ (see Armington (1969)). The incomplete substitutability between the imported and domestic goods, because of the international product discrimination, implies the finite elasticity. The Armington structure significantly simplifies the model.

The Plan for Simulations in this Paper

The remaining portion of this paper plans to make CGE model simulations on the effects of tariff reduction and elimination under the possible FTAs. The static model with the Baldwin accumulation specification is employed to assess the existing three FTAs of Japan.

⁷ Baldwin (1992) termed the same effects “dynamic gains.”

⁸ Our study tried to use a Dynamic GTAP, which is a dynamic recursive CGE model. However, the latest version of dataset and model still need to be improved to obtain stable results with detailed disaggregation.

⁹ The elasticity is known as the Armington elasticity.

2. The Simulations of the Existing and Future Bilateral FTAs of Japan

Trade and Tariff Structures of the Three Countries of the Existing FTAs of Japan

As of now, Japan has three FTAs¹⁰, with Singapore (effective in November 2002), Mexico (effective in April 2005) and Malaysia (effective in July 2006). There have been FTA negotiations with several countries/region, including the Philippines, Thailand, Korea, Indonesia, Chile and the Association of Southeast Asian Nations (ASEAN) as a whole.

As for the imports of Japan, the sector shares of the amounts of import and tariff rates in Japan are summarized in Table 1. Japan imported from Singapore and Malaysia mainly the products of mining and manufactures, and almost no amounts of agriculture, forestry and fisheries. The imports from Mexico included about ten percent of livestock, and six percent of crops.

Table 1: Sector Shares of Imports and Tariffs of Japan (percent)

	Singapore		Mexico		Malaysia	
	Import Share	Tariff Rates	Import Share	Tariff Rates	Import Share	Tariff Rates
GRN	0.0	0.0	0.0	0.0	0.0	967.1
CROP	0.1	1.6	6.1	3.0	0.5	0.2
LSK	0.0	119.2	9.3	62.7	0.0	9.0
FRS	0.0	1.0	0.2	0.0	0.0	0.0
FSH	0.1	3.4	2.8	3.9	0.4	3.2
MNG	23.1	0.0	17.2	3.1	33.7	0.0
FDP	4.6	20.8	1.8	8.5	2.8	3.7
TEX	0.0	8.6	0.2	6.1	0.5	4.1
WAP	0.1	15.4	1.3	11.8	0.5	6.6
CHM	11.3	1.8	3.0	0.2	7.5	0.2
MET	6.4	0.4	7.1	0.0	3.2	0.0
MVH	0.1	0.0	10.3	0.0	0.3	0.0
OTN	0.1	0.0	0.0	0.0	0.0	0.0
ELE	24.2	0.0	10.6	0.0	25.7	0.0
OME	28.9	0.1	22.5	0.0	11.3	0.0
OMF	0.8	0.5	7.6	0.4	13.5	2.6
Total	100.0		100.0		100.0	

1. See Appendix 3 for the abbreviation of sectors.
2. Import shares are made from the Customs Statistics of Japan in 2006.
3. Tariff rates are taken from the GTAP database, based on the 2001 data.

¹⁰ The Japanese government has tried to make the Economic Partnership Agreements (EPAs) as their standard bilateral agreements that would include all the typical components of an FTA, as well as additional agreements on economic cooperation and liberalization measures.

The import tariffs of Japan before the FTAs, which may have reflected the most favored nations (MFN) treatments, had the very similar structures across the three countries. The import tariff rates of agriculture and FDP (processed food) are higher¹¹, while those of mining and manufacture are lower. Among the manufacture, TEX (textile) and WAP (wearing apparels) have comparatively higher tariffs, and many of the other manufacture sectors have zero or minimal tariffs. The tariff elimination under FTAs of Japan would bring about almost no change in the effective tariffs in most of manufacturing sectors, except for FDP, TEX and WAP. These sectors, together with agriculture, are the key sectors for the FTAs.

The sector shares of the bilateral export of Japan and the tariff rates of the three FTA partners are summarized in Table 2. Japan exported virtually no agriculture, forestry, and fisheries. The main export items are all manufacturing goods. Among them, ELE (electronic equipments), OME (other manufactured equipments), MET (metal products), MVH (motor vehicles) lead the exports of Japan. ELE invariably takes the top share.

Table 2: Sector Shares of Imports and Tariffs of the FTA Partners (percent)

	Singapore		Mexico		Malaysia	
	Import Share	Tariff Rates	Import Share	Tariff Rates	Import Share	Tariff Rates
GRN	0.0	0.0	0.0	0.0	0.0	0.0
CROP	0.0	0.0	0.0	5.5	0.0	1.3
LSK	0.1	0.0	0.0	22.7	0.0	8.8
FRS	0.0	0.0	0.0	0.0	0.0	0.0
FSH	0.1	0.0	0.0	17.0	0.0	0.1
MNG	1.7	0.0	0.0	12.9	0.3	0.1
FDP	0.3	1.3	0.0	20.5	0.1	10.3
TEX	0.4	0.0	0.2	18.2	0.7	10.5
WAP	0.1	0.0	0.0	30.8	0.1	15.0
CHM	8.5	0.0	3.5	14.8	10.0	7.7
MET	13.2	0.0	11.6	14.1	19.8	12.0
MVH	6.9	0.0	31.5	16.7	10.0	45.4
OTN	5.7	0.0	0.0	25.9	0.6	14.8
ELE	35.9	0.0	37.4	7.9	36.4	0.1
OME	25.4	0.0	14.8	12.9	19.8	3.8
OMF	1.8	0.0	0.9	18.1	2.0	11.2
Total	100.0		100.0		100.0	

1. See Appendix 3 for the abbreviation of sectors.
2. Import shares are made from the Customs Statistics of Japan in 2006.
3. Tariff rates are taken from the GTAP database, based on the 2001 data.

¹¹ As the GTAP tariff rates are the effective tariff rates, calculated from the sector-base tariff revenue divided by the import amounts, the imports of GRN (grains), almost all the imports of which were quantitatively restricted without tariff payments, have the entries of zero percent in Singapore and Malaysia. The similar backgrounds apply to the different tariff rates in LSK(livestock).

The import tariffs of the three countries from Japan sharply contrast each other. Singapore has virtually no import tariff. Mexico levies comparatively high rates of tariffs, particularly on the WAP (wearing apparel) and OTN (other transport equipments). The import tariff of Malaysia is particularly high in MVH (motor vehicle), but the tariff rates of the other sectors are lower than Mexico. The protection of the automobile is a common policy in the developing countries in Asia, as well as Mexico.

Details of the Simulations and Technical Assumptions

The simulation is implemented by applying external shocks to the model, and measures the impacts from the changes of the values of model variables. In this study, the external shocks are the reduction and elimination of the import tariff rates agreed in the existing FTAs. Four technical points deserve to note.

1. The GTAP database reflects the effective tariff rates in 2001. The FTA partners may have changed the tariff rates between the year 2001 and the enforcement of the FTAs. The simulation should measure the impacts of changes of the tariff rates between the periods of agreed and implemented points. In this study, the possible changes after 2001 are ignored, because no major multilateral or regional initiatives to liberalize trade took place for that period, except for China's WTO accession
2. The targeted tariff rate specified by the FTAs may be lower than, equal to, or even higher than the existing concession rate, because the existing rates may be the concession rates of the MNF treatment made after the WTO agreement, which is lower than the FTA concession rates¹². Our observation on the import shares and existing and target tariff rates of the items implies that the tariff reduction under the existing FTAs may bring about no virtual tariff reduction in agriculture, fisheries, forestry and food related manufacture (FDP) in Japan. In addition, assuming zero tariff rates of Japan under FTAs provides a good approximation for mining and manufacturing.
3. The existing FTAs often allowed for grace periods and scheduling in the reduction of tariff rates of specific items, often over next ten years. In this study, the transition periods are ignored, and the simulation shocks simply assume the total change of target rates. As the three FTA partners are virtually committed to eliminate all the tariffs at the end of the transition period, the shocks are that all the tariff rates of the FTA partners will become zero.

¹² To compare the FTA target rates and the existing concession rates, we classified the import items of Japan on the HS two-digits basis into the following for categories: (i) excluded (the FTA does not change the existing tariff rate); (ii) minimal (the FTA reduces the tariff rates of less than three tariff lines (on the six-digit basis) within the two-digit item); (iii) most (the FTA reduces the tariff rates of more than or equal to three tariff lines (on the six-digit basis) within the two-digit item); and (iv) all (the FTA eliminates all the tariff lines (on the six-digit basis) within the two-digit item).

4. The simulation model specifies the Baldwin dynamic closure, as illustrated in the former section in this paper. The simulation under the specification generally produces larger amounts of impacts in terms of welfare and product.

Table 3 below summarizes the expected percentage changes in the import tariff rates under the FTAs, as the shocks to the simulation. Japan will cut the tariffs on the TEX and WAP rather significantly, by 5 to 15 percentage points, but will make virtually no change in tariffs for the other sectors, except for minor reductions in CHM, MET and OMF. Singapore, because of the virtually zero rates of the existing tariffs, will not change any tariffs, except for a minor reduction in FDP. Mexico and Malaysia were committed to abolish all the tariffs at the end of the schedules in the FTAs.

Table 3: Shocks to the Import Tariff under the FTAs of Japan (percent changes)

	JSEPA		JMxEPA		JMsEPA	
	Japan	Singapore	Japan	Mexico	Japan	Malaysia
GRN	0.0	0.0	0.0	0.0	0.0	0.0
CROP	0.0	0.0	0.0	-5.5	0.0	-1.3
LSK	0.0	0.0	0.0	-22.7	0.0	-8.8
FRS	0.0	0.0	0.0	0.0	0.0	0.0
FSH	0.0	0.0	0.0	-17.0	0.0	-0.1
MING	0.0	0.0	0.0	-12.9	0.0	-0.1
FDP	0.0	-1.3	0.0	-20.5	0.0	-10.3
TEX	-8.6	0.0	-6.1	-18.2	-4.1	-10.5
WAP	-15.4	0.0	-11.8	-30.8	-6.6	-15.0
CHM	-1.8	0.0	-0.2	-14.8	-0.2	-7.7
MET	-0.4	0.0	0.0	-14.1	0.0	-12.0
MVH	0.0	0.0	0.0	-16.7	0.0	-45.4
OTN	0.0	0.0	0.0	-25.9	0.0	-14.8
ELE	0.0	0.0	0.0	-7.9	0.0	-0.1
OME	-0.1	0.0	0.0	-12.9	0.0	-3.8
OMF	-0.5	0.0	-0.4	-18.1	-2.6	-11.2

1. See Appendix 3 for the abbreviation of sectors.

Macroeconomics Impacts

The macroeconomic impacts of the simulations of the CGE models are usually summarized in the changes in the real Gross Domestic Product (GDP) and the Equivalence of Variation (EV). Both reflect the efficiency improvement. The EV measures the income based welfare improvement, theoretically explained in Appendix 1. Table 4 shows the simulation results.

**Table 4: Macroeconomic Impact of the FTAs of Japan
(GDP in percent change, EV in US\$ million)**

	JSEPA		LMxEPA		JMsEPA	
	GDP	EV	GDP	EV	GDP	EV
AUS	0.00	-1	0.00	2	-0.01	-32
NZL	0.00	0	0.00	0	0.00	0
CHN	0.00	-5	0.00	-75	0.00	-69
HKG	0.00	0	-0.01	-17	0.02	25
JPN	0.00	-2	0.02	1358	0.02	1017
KOR	0.00	-1	-0.01	-64	-0.01	-63
TWN	0.00	-1	-0.02	-72	-0.01	-67
IDN	0.00	-1	-0.01	-19	-0.03	-47
MYS	0.00	-2	-0.03	-40	1.41	862
PHL	0.00	-1	-0.07	-44	-0.04	-24
SGP	0.02	26	-0.02	-19	-0.01	-26
THA	0.00	-1	-0.05	-58	-0.04	-53
VNM	0.00	-1	0.00	0	0.00	1
XSE	0.00	0	0.01	6	0.01	8
IND	0.00	-1	0.00	12	0.00	0
XSA	0.00	0	0.00	-5	0.01	6
CAN	0.00	-1	0.01	50	0.00	11
USA	0.00	-11	0.00	-405	0.00	139
MEX	0.00	-2	0.64	3032	0.01	57
PER	0.00	0	0.02	7	0.01	5
CHL	0.00	0	0.00	0	0.00	1
EJ15	0.00	-12	0.00	207	0.00	139
RUS	0.00	-1	0.00	23	0.00	1
ROW	0.00	-6	0.00	53	0.00	58
World		-25		3929		1948

1. See Appendix 3 for the abbreviation of regions
2. Author's simulation, using GTAP database and GEMPACK.

Three major points characterize the simulation result. First, the FTA members, both Japan and her FTA partners, tend to gain GDP and EV, and many of the other regions lose them. This results from the trade diversion effect. The non-member regions will have the FTA members import their products less, and they will be induced to produce less the goods of the sectors with comparative advantage. The trade diversion effect should also take place in the FTA members, but the trade creation effect outweighs the trade diversion effects for them. Second, Mexico and Malaysia will gain larger percentage of GDP, but Japan and Singapore gain little. Theoretically, the countries that reduce the tariffs more will generally gain more. Mexico and Malaysia will reduce tariffs by greater percentage, but the tariff reduction of Singapore and Japan will be less. The existing tariff rates of Singapore are virtually zero. Japan will maintain the high tariff in agriculture and only reduced the existing tariff rates in limited sectors, i.e. TEX and WAP. Third, the EV in the world generally adds

up to positive numbers. The FTAs will increase the welfare in the world, albeit the little amounts.

Impacts on Sectors

The CGE model simulation can assess the impacts on the sectors in each economy. The impacts on sector production would interest more the domestic groups than the macroeconomic impacts. Generally, the sectors protected by high tariff rates will lose their production more, when the tariffs are reduced. While the trade liberalization brings about efficiency gains to increase in income and production across the sectors, the gains will not generally offset the decrease of the production of the losing sectors. Table 5 illustrates the impacts on the production of the sectors.

Table 5: Impacts on the Industry Sectors of the FTAs of Japan
(percents)

	JSEPA		JMxEPA		JMSEPA		Total
	Japan	Singapore	Japan	Mexico	Japan	Malaysia	Japan
GRN	0.0	0.0	-0.1	0.1	-0.1	-0.5	-0.2
CROP	0.0	0.0	-0.1	0.0	0.0	-0.3	-0.1
LSK	0.0	0.1	-0.1	0.4	-0.1	-0.4	-0.2
FRS	0.0	0.0	-0.1	0.5	0.0	2.2	-0.1
FSH	0.0	0.0	0.0	0.3	0.0	0.3	0.0
MNG	0.0	0.0	-0.1	0.1	0.0	0.3	-0.2
FDP	0.0	0.0	0.0	0.4	0.0	0.3	0.0
TEX	0.0	0.8	-0.3	0.5	-0.1	3.6	-0.4
WAP	0.0	4.7	-0.1	0.6	-0.1	3.7	-0.3
CHM	0.0	0.0	0.0	0.5	0.1	0.7	0.1
MET	0.0	0.0	0.2	0.5	0.4	0.0	0.5
MVH	0.0	-0.1	0.0	1.1	0.3	3.8	0.3
OTN	0.0	-0.1	-0.5	0.6	-0.1	1.7	-0.5
BLE	0.0	0.0	0.0	2.0	-0.4	2.4	-0.4
OME	0.0	0.0	0.2	1.2	-0.1	2.9	0.1
OMF	0.0	0.0	0.0	0.6	0.0	3.6	0.0
EGW	0.0	0.0	0.0	0.5	0.1	1.2	0.1
CNS	0.0	0.0	0.0	0.9	0.0	2.2	0.1
TRD	0.0	0.0	0.0	0.7	0.0	0.8	0.0
TRS	0.0	0.0	0.0	0.6	0.0	1.3	0.0
OMN	0.0	0.0	0.0	0.6	0.0	0.7	0.0
FIN	0.0	0.0	0.0	0.5	0.0	1.3	0.0
PRS	0.0	0.0	0.0	0.7	0.0	1.2	0.0
OFS	0.0	0.0	0.0	0.3	0.0	0.3	0.0
DWE	0.0	0.0	0.1	0.8	0.0	1.0	0.1

1. See Appendix 3 for the abbreviation of regions
2. Author's simulation, using GTAP database and GEMPACK.

The impacts on the production of the industrial sectors for Japan are generally much smaller in terms of percentage, less than 0.5 percent throughout the sectors. Singapore will receive some positive impact only on the production of WAP. In contrast, many sectors in Mexico and Malaysia will face larger impacts in terms of percentage changes. For Mexico, all the industrial sectors will be “the winners”, while the largest gains in terms of percentage will go to ELE, OME and MVH. For Malaysia, “the losers” include GRN, CROP and LSK, but the percentage of the loss will be less than 0.5. All the other sectors will increase the production, particularly some manufacturing, such as MVH, TEX, WAP and OMF. The difference of the percentage changes between Japan and her FTA partners should reflect the magnitude of the economies, as well as the scales of the tariff reductions. The column of total, adding the impacts of the three FTAs, in Table 5 indicates that Japan will receive comparatively small impacts in terms of percentage change in the production in the industrial sectors.

The present structure of the GTAP database incorporates the input-output tables which simply mix the imported and domestically produced intermediates. In the model, all the exports from an FTA member to another can enjoy the tariff concession, even if the local contents of such exports are very low. In reality, however, the rules of origin (ROOs) clauses in the FTAs may possibly block the concession to the exports¹³. ROOs may function as trade protection measures when a country establishes numerous overlapping FTAs. The issue is essential in the case of the regional FTAs which are expected to function to extend the regional production networks, but the bilateral FTAs also suffer from them. The effects assessed by the GTAP model, therefore, should be possibly overestimated.

3. Simulations of the Future Scenarios of the FTAs of Japan

Simulations in this Section

The objective of this section is to assess the scenarios of the future FTAs of Japan, making comparisons between these multiple scenarios. This section contains two groups of simulation works: the first group covers the simulations on the effects of the FTAs relating to Japan. The group undertakes the simulations on:

- (1) Bilateral FTAs of Japan with her possible FTA partners in the future. Such potential partners may include: (i) remaining ASEAN 8 countries (ASEAN10, except for Singapore and Malaysia); (ii) China and Korea; (iii) ASEAN 10 countries plus China and Korea; and (iv) ASEAN 10 countries plus China, Korea, Australia, New Zealand and India. The simulations assess only the effects of the combinations of the bilateral FTAs of Japan, not the effects brought about the regional FTAs. As such, additional sets of simulations in this section

¹³ Preferential trade agreements, including FTAs, require ROOs to enable a given trade good to be identified as originating in the area covered by the agreement, and thus subject to exemption from customs duties. ROOs exist to prevent imports from countries outside the scope of the agreement from taking advantage of the concessions of FTAs. Such imports are known as the trade deflection.

- (2) Regional FTAs relating to Japan or the East Asia in the future. Such potential regional FTAs will be: (i) ASEAN10 countries; (ii) China, Japan and Korea; (iii) ASEAN10 plus 3 (China, Japan and Korea); and (iv) ASEAN10 plus six (China, Japan, Korea, Australia, New Zealand, and India).

The simulations above adopt basically the same methodology as in the former section, i.e. the static model with the Baldwin accumulation specification.

Four points on the assumptions and model structures deserve to note. First, the simulation shocks for the bilateral FTAs of Japan are such that the FTA partners will abolish all the tariffs to Japan, and that Japan will *not* change the tariff rates in agriculture, fishery, forestry and processed food. This asymmetrical assumption reflects the experiences in the existing three FTAs of Japan. In contrast, the regional FTAs assumes, as the simulation shocks, that all the parties, including Japan, will reduce the tariff rates to zero in all the sectors. Second, it should be reiterated, as in the former section, that ROOs may significantly curtail the merits of the concession under the regional FTAs by preventing the free movement of materials in the regional production networks. The GTAP simulation may overestimate the impacts. Third, the GTAP model simulations cannot measure the scale merits from the formation of regional production networks, which may result from the region-wide FTAs. On the contrary to the third point, the GTAP simulation may fail to assess this effect, and therefore, it may underestimate the impacts. Table 6 below summarizes the welfare gains from the potential bilateral and regional FTAs. Fourth, rather technically, as China significantly reduced the tariff rates of many sectors as the commitment to access WTO after 2001, the simulated impacts of zero tariffs of China should be not fully attributable to the FTAs of China. Therefore, the effects of the FTAs of China are rather overestimated.

**Table 6: Welfare Gains from the Potential FTAs
(Million US\$)**

	Patterns of Japan's Bilateral FTAs					Regional FTAs			
	Existing FTAs	ASEAN10	C+K	ASEAN10 +CK	ASEAN10 +CKANI	ASEAN10	CJK	ASEAN10 +3	ASEAN10 +6
AUS	-31	-78	-300	-366	188	-9	-586	-701	8,384
NZL	0	2	-69	-64	88	-15	-93	-110	827
CHN	-149	-621	3,253	2,639	2,438	-329	5,509	8,596	9,345
HKG	8	47	-208	-156	-203	85	-311	-19	-100
JPN	2,373	4,094	11,452	15,503	17,781	-262	10,304	14,233	16,177
KOR	-129	-400	-503	-861	-1,012	-199	17,587	18,628	20,623
TWN	-140	-336	-1,571	-1,854	-1,955	-151	-1,889	-2,788	-3,131
IDN	-68	1,099	-597	427	377	1,167	-709	3,588	4,132
MYS	820	827	-510	280	241	1,498	-622	3,468	4,446
PHL	-69	412	-529	-147	-192	909	-605	1,429	1,539
SGP	-19	-47	-413	-450	-515	2,143	-464	3,620	4,044
THA	-113	3,698	-857	2,591	2,439	3,271	-1,066	11,421	11,462
VNM	0	440	-153	168	159	220	-299	2,105	2,106
XSE	14	211	-162	42	30	472	-107	691	461
IND	12	-108	-456	-540	35	-65	-457	-857	3,945
XSA	0	-26	-231	-248	-252	-21	-245	-361	-506
CAN	61	21	-259	-225	-250	68	-226	-74	-241
USA	-278	-253	-6,232	-6,208	-6,777	679	-5,779	-5,194	-7,116
MEX	3,087	30	-841	-772	-754	75	-403	-185	-206
PER	12	-6	-114	-114	-121	-19	-137	-173	-232
CHL	0	3	-92	-85	-87	13	-161	-162	-204
EU15	333	18	-5,822	-5,550	-6,157	636	-4,357	-2,981	-4,426
RUS	23	-7	-262	-260	-287	68	-150	-62	-128
ROW	105	-123	-3,290	-3,287	-3,788	507	-3,166	-2,010	-3,638
World	5,853	8,898	-8,764	463	1,426	10,742	11,570	52,103	67,563

1. See Appendix 3 for the abbreviation of regions
2. Author's simulation, using GTAP database and GEMPACK.

Japan always gains welfare from her own bilateral FTAs. The welfare gain of Japan expands as the number of the bilateral FTAs increases. The welfare gain from the existing three FTAs in total will be much smaller than those from the FTAs with China and Korea, and/or ASEAN10 countries. In particular, the FTAs with ASEAN10 plus five (China, Korea, Australia, New Zealand and India) will bring about the welfare gain of more than seven times as the existing three FTAs. As the standard concern on the preferential trade agreements, the bilateral FTAs of Japan tend to bring about welfare loss to the third countries. This is due to trade diversion effect. In particular, the case of the combination of Japan-China and Japan-Korea FTAs will reduce the total amount of economic welfare, while other cases will not. In this case, even Korea will lose the welfare, because of the aggravated terms of trade.

The countries that are members of a regional FTA almost always gain the welfare. The magnitude of welfare gains to the members expands as the members of the regional FTA expands. The largest-scaled regional FTA by ASEAN10 plus six will bring about the largest amount of welfare gains to the members, as well as the world in total. However, the welfare loss to the non-member countries also expands, due to the more serious trade diversion.

4. Implications from the Study

The model study provides the following implications. First, the existing three FTAs of Japan may bring about only small benefits. Much larger potential welfare gains are expected from the bilateral FTAs with ASEAN10, China, Korea, Australia, New Zealand, and India. Japan should proceed to expand the FTA partners. Second, regional FTAs including Japan will bring about welfare gains to all the members in the region, without minimizing the trade diversion. In consideration with the unassessed benefit of forming regional production networks, Japan should seek the formation of FTA networks to make them regional. In order to do so, ROOs should be harmonized. Third, the preferential trade arrangements, including an FTA, inevitably cause trade diversion, especially to the non-member countries. Expansion of the FTA members in the region will reduce such non-member countries, as well as build the achievement toward the multi-lateral arrangements at the same time.

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Appendix 1: Simplified framework for welfare analysis

The text adopts an analytical framework which much simplified the formulation by Baldwin and Venables (1995). Suppose that the welfare of the representative consumer in a country can be represented by an indirect utility function

$V = V(p + t, E)$ where p is border price vector, t is a vector of import tariff (domestically captured rent), and E is total expenditure on consumption. Total expenditure is equal to the sum of factor income, profits and domestically accruing trade rents including tariff revenue, net of investment. Therefore,

$$E = wL + rK + tm \text{ where } m \text{ is the net import vector.}$$

Totally differentiating V and dividing through by the marginal utility of expenditure, and assuming perfect competition in the market for used capital, we find:

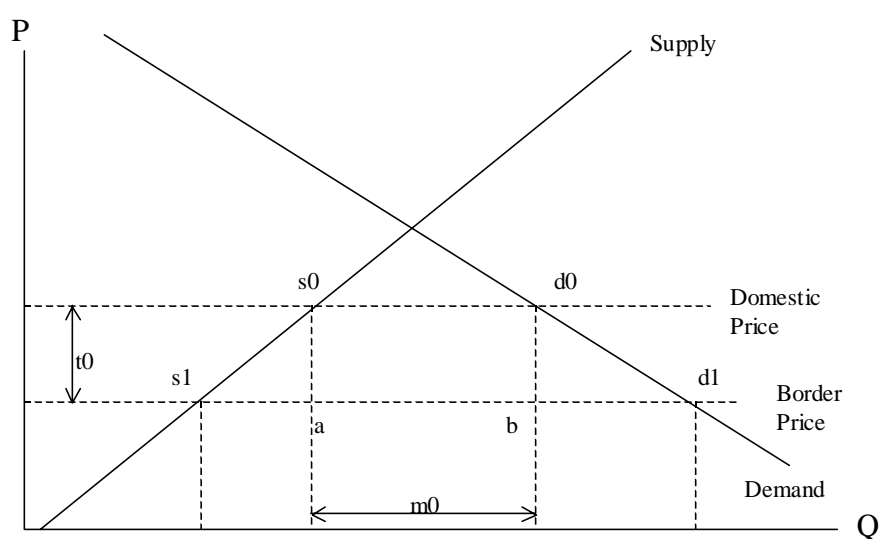
$$dE \approx dV / V_E = tdm - mdp$$

The first term is trade volume effect, and the second, terms of trade effect.

In the case of tariff elimination, the trade volumes effect amounts to the following integral:

$$dE \approx \int_{t_0}^0 t \frac{dm}{dt} dt = [tm]_{t_0}^0 - \int_{t_0}^0 m dt = \int_0^{t_0} m dt - t_0 m_0$$

where t_0 is the level of import tariff before the tariff elimination, and m_0 is the amount of import before the tariff elimination. In a partial equilibrium framework, the first term denotes the trapezoid $s_0 d_0 d_1 s_1$, and the second term is the rectangular $s_0 d_0 b a$ in the chart below. The two terms add up to the sum of two triangles $s_0 a s_1$ and $d_0 b d_1$.

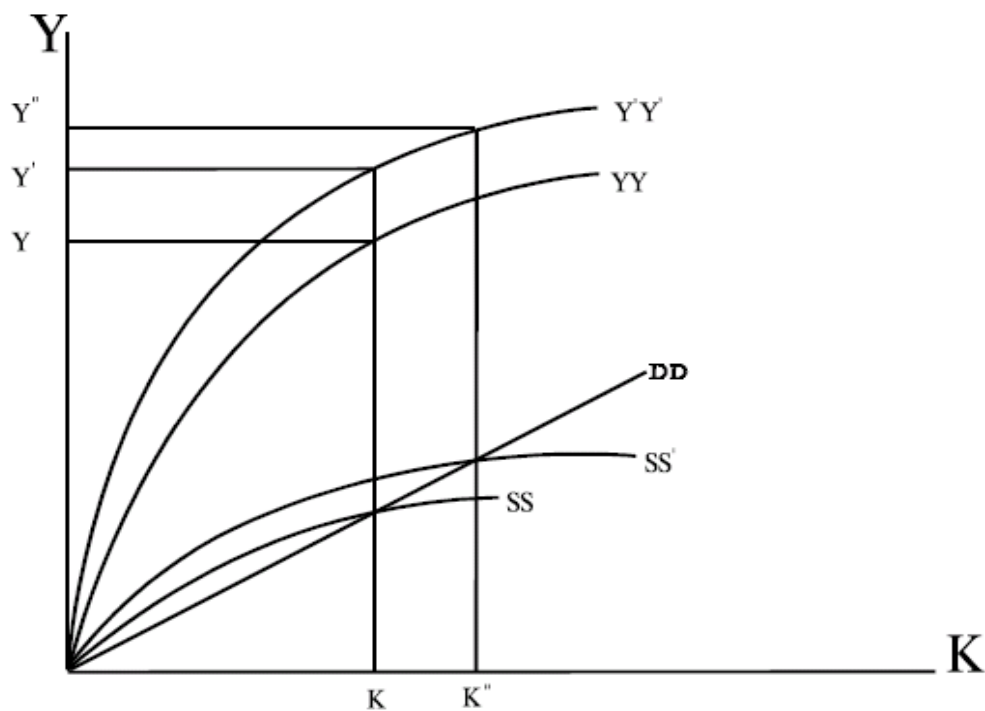


Appendix 2: Baldwin dynamic specification

According to Baldwin (1989, 1992) and Francois, et. al. (1996), the following specification is applied to the model of simulation. The first element is a aggregate production function linking output (Y) at time t to the amount of capital (K) and labor (L) employed:

$$Y = F(A, K, L)$$

where A is an overall productivity parameter, and the production function F is linearly homogeneous and diminishing returns with respect to capital (K) and labor (L). The relation between the stock of capital and output is plotted as YY in the figure below. Note the curvature of YY reflecting diminishing return to capital when the labor force is held constant.



For a given flow of investment, the capital stock evolves over time according to

$$K_{t+1} = (1 - \delta) K_t + I_t$$

where δ is the depreciation rate of the capital stock each year, and I_t is the flow of gross investment. The capital stock will be higher next period if today's investment is sufficiently large to both replace worn out capital and add new units to the stock. To complete the model, we must specify how much of current output is set aside for savings and investment. We adopt the classical assumption that consumers save a fixed share (s) of income,

$$S = s Y_t$$

where S is total saving. Abstracting from international capital flows, savings equals to investment. Furthermore, since savings depends on income that in turn depends on the capital stock, savings depends (indirectly) on the stock of capital. The savings function is plotted as SS in the figure. The final relation plotted in figure 1 is $DD = \delta K$, the amount of investment needed to replace worn out capital in each period. The capital stock grows over time if savings and investment are larger than the rate at which capital depreciates ($SS > DD$), it is constant if savings and investment are just enough to replace depreciated capital ($SS = DD$), and it falls otherwise ($SS < DD$).

Starting from a low capital stock with high returns on investment, income will grow over time as capital is accumulated through savings and investment. In the absence of technical progress, this process will eventually come to an end because of the diminishing returns of adding more capital per worker. In the long-run, growth in per capita income will stop at the point where savings is just enough to replace depreciated capital. The "steady state" capital stock and output (distinguished by absence of time subscripts) are eventually reached.

Now, consider the impact of efficiency-enhancing changes, i.e. tariff reduction in this study. We assume that the region we are modeling is initially in a steady-state, and that the changes enhances the efficiency of capital and labor by moving resources into sectors where they are more valuable at the margin. In the figure, this is represented by an increase in the economy-wide productivity parameter A , which shifts out the production function from YY to $Y'Y'$ for any given level of capital and labor. That is, the same amount of labor and capital can now produce more than before, as illustrated by the difference between Y' and Y in the figure. This is the short-run or static gain. Part of the additional income will be saved and invested in new capital, which in turn yields an additional income gain. (Note the positive difference between $S'S'$ and DD for the initial capital stock K , implying positive net investments). The economy will, over time, move up to a new higher steady state capital stock and corresponding higher output, marked in the figure by K'' and Y'' respectively.

Decomposing the total income gain into static and induced (medium-run) gains we have

$$(Y'' - Y)/Y = (Y' - Y)/Y + (Y'' - Y')/Y$$

where the first part is the static income gain and the second part is the induced (medium-run) gain. It turns out that the latter is simply a multiple of the static gain.

$$(Y'' - Y')/Y = (a/1-a)(Y' - Y)/Y$$

That is, for each percentage increase in static income one gets an additional fraction in induced income gain over the medium-run. (Of course, *any* policy change that improves productivity will induce higher incomes with a savings-investment linkage). The size of the induced income gain depends on the curvature of the YY schedule, which in turn depends on the elasticity of output with respect to capital, measured by the parameter " a " in the production function. The larger the output capital elasticity, the less the curvature of the YY schedule, and the larger the induced gain in income.

Appendix 3: Sector and Region Aggregation

1. Sector Aggregation

#	Code	Contents
1	GRN	Paddy rice; Wheat; Other cereal grains
2	CROP	Vegetables, fruit, nuts; Oil seeds; Sugar cane, sugar beet; Plant-based fibers; Other crops
3	LSK	Cattles; Animal products; Raw milk; Wool, silk-worm cocoons; Meats; Meat products; Dairy products
4	FRS	Forestry
5	FSH	Fishing
6	MNG	Coal; Oil; Gas; Other minerals
7	FDP	Vegetable oils and fats; Processed rice; Sugar; Other food products; Beverages and tobacco products.
8	TEX	Textiles
9	WAP	Wearing apparel; Leather products
10	CHM	Petroleum, coal products; Chemical, rubber, plastic prods
11	MET	Mineral products (excluding coal, oil, gas and other extracted minerals); Ferrous metals; Other metals; Metal products.
12	MVH	Motor vehicles and parts.
13	OTN	Other transport equipment
14	ELE	Electronic equipment
15	OME	Other machinery and equipment
16	OMF	Wood products; Paper products, publishing; Other manufactures
17	EGW	Electricity; Gas manufacture, distribution; Water
18	CNS	Construction
19	TRD	Trade
20	TRS	Transport
21	CMN	Communication
22	FIN	Financial services; Insurance.
23	PRS	Other business services; Recreation and other services
24	OFS	PubAdmin/ Defence/ Health/ Education
25	DWE	Dwellings.

2. Region Aggregation

#	Code	Countries and Regions
1	AUS	Australia
2	NZL	New Zealand
3	CHN	China
4	HKG	Hong Kong
5	JPN	Japan
6	KOR	Korea
7	TWN	Taiwan
8	IDN	Indonesia
9	MYS	Malaysia
10	PHL	Philippines
11	SGP	Singapore
12	THA	Thailand
13	VNM	Vietnam
14	XSE	Rest of Southeast Asia
15	IND	India
16	XSA	Bangladesh; Sri Lanka; Rest of South Asia
17	CAN	Canada
18	USA	United States
19	MEX	Mexico
20	PER	Peru
21	CHL	Chile
22	EU15	Austria; Belgium; Denmark; Finland; France; Germany; United Kingdom; Greece; Ireland; Italy; Luxembourg; Netherlands; Portugal; Spain; Switzerland
23	RUS	Russian Federation; Rest of Former Soviet Union
24	ROW	Rest of the World