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Philippines-Japan Free Trade Agreement: Analyzing Its Potential Impact Using a Computable General Equilibrium Model

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Philippines-Japan Free Trade Agreement: Analyzing Its Potential Impact Using a Computable General Equilibrium Model

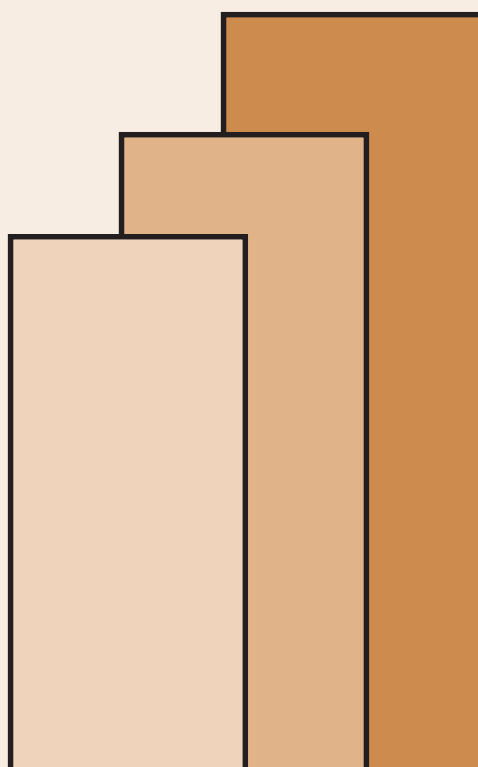
Taeko Yasutake

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| List of Projects under the Japan-Philippines Economic Partnership Research Project | | |
|--|---|--|
| Title of the Project | | Proponent |
| Impact analysis on the whole economy | | |
| 1. | Situationer on Japan-Philippines Economic Relations | Erlinda Medalla |
| 2. | Philippine-Japan Bilateral Agreements: Analysis of Possible Effects on Unemployment, Distribution and Poverty in the Philippines Using CGE-Microsimulation Approach | Caesar Cororaton |
| Impact analysis on specific sectors/ concerns | | |
| 3. | An Analysis of Industry and Sector- Specific Impacts of a Japan-Philippines Economic Partnership | AIM Policy Center (Royce Escolar) |
| 4. | Prospects and Problems of Expanding Trade with Japan: A Survey of Philippine Exporters | Rosalina Palanca-Tan |
| 5. | Towards a Strategy for Manufactured Exports to Japan | Peter Lee U and Ferdinand Maquito |
| 6. | Small and Medium Enterprise Development Experience and Policy in Japan and the Philippines: Lessons and Policy Implications | Cielito F. Habito |
| 7. | Developing the Japanese Market for Philippine Tourism and Retirement Services: Prospects and Impediments | Winston Conrad Padojinog and Cherry Lyn Rodolfo |
| 8. | Prospects of Services Trade Liberalization in Japan-RP Bilateral Agreement | Gloria Pasadilla |
| 9. | Movement of Natural Persons Between the Philippines and Japan: Issues and Prospects | Tereso S. Tullao Jr. |
| 10. | Toward a Philippines-Japan Economic Partnership in Agriculture | Amelia Bello and Zenaida Sumalde |
| 11. | Philippine-Japan Economic Linkage: A Case Study of Cebu | Victorina Zosa |
| Special Studies | | |
| 12. | A Comparative Study of the Bilateral FTA Arrangements: Applications to the Philippines | John Lawrence Avila |
| 13. | Philippines-Japan Economic Partnership: Where is the Philippines in Japan's Plan? | Lydia N. Yu-Jose |
| 14. | Understanding Japan's Motives for Pursuing an Economic Partnership Agreement with the Philippines | Ronald Rodriguez |
| 15. | Exploring Potentials of a Japan-Philippine Economic Partnership in Human Resource Development | Jose V. Camacho Jr., Jhoanna Alcalde, Nino Manalo, Rodger Valientes |
| 16. | The Dynamics of Philippines-Japan Economic Cooperation: The Case of Japan's Official Development Assistance (ODA) in the Philippines | Jose V. Camacho Jr. Agham C. Cuevas |
| 17. | Preferential Rules of Origin for the Japan-Philippine Economic Partnership: Issues and Prospects | George Manzano |
| 18. | Philippine - Japan Free Trade Agreement: Analyzing the Potential Impact using a Computable General Equilibrium Model | Taeko Yasutake |

**Philippines- Japan Free Trade Agreement: Analyzing its
Potential Impact using a Computable General Equilibrium
Model**

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University of the Philippines**

February 2004

Abstract

This study analyzes the potential impact of the Philippines-Japan Free Trade Agreement (FTA) on the Philippine economy in case of the Philippines' discriminately unilateral tariff reduction on import from Japan using a computable general equilibrium model for the Philippine economy. The result of the assessment of this study indicates that even only a reduction of tariff rates on imports from Japan would expand the Philippines' import from Japan and in total by 2.36-8.58 and 0.35-0.61 percent respectively. Consumer welfare measured in Compensated and Equivalent Variation increase in all of 5 households classified by income level, not in a proportional way for each household however. More favorable impact on all households would be expected if not only a tariff reduction but also other factors such as liberalization of foreign investment are included in the agreement.

Keywords: computable general equilibrium (CGE) analysis, Philippines-Japan FTA, unilateral tariff reduction, consumer welfare, foreign investments

Philippines- Japan Free Trade Agreement: Analyzing its Potential Impact using a Computable General Equilibrium Model

Taeko Yasutake

Objectives of the Study

The object of this study is to analyze the potential impact of the Philippines-Japan Free Trade Agreement (FTA) on the Philippine economy using a computable general equilibrium model.

Since the aim of bilateral free trade agreement would be to enhance economic relationship between the participant countries for mutual development, one of the objects of the agreement is to remove trade barriers such as tariff, quota, health or safety regulations etc. as well as to facilitate import/export by making its procedures easier bilaterally. Although many forms of trade liberalization could be realized bilaterally once the Philippines and Japan engage in a free trade agreement, this study will focus on analyzing the potential impact of the Philippines' unilateral tariff reduction on imports exclusively from Japan on the Philippine economy. For this purpose, this study uses a computable general equilibrium model for a single country model for the Philippines instead of a multi-country model.

Ordinal single country CGE model takes all of its trading partner as the rest of the world (ROW), but the model used for this study separates the specific trading partner, Japan, from the ROW to incorporate the discriminately tariff reduction by the Philippines.

The paper is presented as follows. First, the model structure is discussed and several assumptions and equations were laid out. Afterwards, results from the simulation were analyzed. Finally, conclusions are made based on the results. The equations for the model are provided on the Annex.

Structure of the Model

The model of this study specifies the following functions:

- Production functions for twelve producer goods and services produced in twelve industries, using intermediate inputs (Armington composites), three primary factors namely labor (skilled and unskilled), capital and land, and sector specific factors as inputs.
- Twelve functions for Armington composites, whose inputs consist of imported and locally produced producer goods.
- Seven consumer goods and services produced from Armington composites.
- Five households classified as quintiles in the personal income distribution, and the government as the consumers.

The benchmark data used in this study was the APEX model which is empirically based CGE model for the Philippine economy established by Clarete and Warr (1994).

The APEX model is an applied computable general equilibrium model set in the Harberger and Johansen tradition. The model for the Philippine economy was originally specified by Clarete and Warr (1992), and recalibrated using the 1994 Social Accounting Matrix by Habito and Cororaton (2000).

The APEX model disaggregates the producer goods into 50 goods and services produced in 41 industries. In this study, however, the 50 sectors are reduced to 12 sectors in the model to make the computation straightforward but keeping the model adequate to capture the features of the Philippine economy.

Single country model with a specific trading partner

Intermediate inputs for the twelve producer goods and the seven consumer goods are called Armington aggregates, which consist of locally produced intermediate goods and imported intermediate goods. They are assumed to be heterogeneous and imperfect substitutes, with Armington elasticity of substitution. The functional form for this Armington aggregate in ordinal single-country CGE model is:

Armington aggregation functions

$$A_j = A_j(Q_j^A, M_j^A) \quad \text{for } j=I, N$$

where:

- A_j - the Armington input used in production of producer good j ,
- Q_j^A - the locally produced composite in the Armington input, and
- M_j^A - the imported composite in the Armington input.

To identify the specific trading partner (STP), this model separates the imported goods from the STP and from the ROW in this study. Domestic, imported types from the STP and from the ROW are assumed to be not perfect substitute for one another.

In the Armington aggregation function, import from the STP and the ROW are nested into a group with constant elasticities of substitution and then combined with locally produced input with Armington elasticities of substitution.

$$A_j = A_j(Q_j^A, M_{STP,j}^A, M_{ROW,j}^A) \quad \text{for } j=I, N$$

The Armington elasticity of substitution between the locally produced input and imported input are given exogenously using the Armington elasticity values for the APEX model, which is empirically calibrated from econometric work by Warr (1992).

The extent of substitutability between the ROW and the STP products with regards to imports plays an important role in this model. If there is a perfect substitutability between the ROW and the STP, the model reduces to a conventional single country open economy model with all trading partners as the ROW. At the other limit with zero substitutability, the STP has a fixed market share of the price-taking economy. With an imperfect substitutability, the model will have a more involved Armington feature. The imperfect substitutability can be rationalized as either

preference-based or partner-specific transport cost differences. If there is zero substitutability between the goods from the ROW and the STP, the demand shares of goods from each are based completely on preference.

In this single-country with specific partner model, imperfect substitutability between ROW and STP imports is assumed. The extent of change in import of each products from the STP and the ROW thus depends on the substitutability between goods from the two origins.

As for the export, preferences of trading partners for products coming from the price-taking economy and the ROW (and transportation cost also might) determine the substitutability between products from them. To capture the extent of substitutability of products from the price-taking economy versus those from the ROW, a regional model would be adequate from the point of view of the consumers in the STP. The same can be said for consumers in the ROW with regards to the STP versus the economy's products. In a single country model, however, destination of exports of the price taking economy between the STP and the ROW is determined as an outcome of a fixed market share basis.

$$E_{STP,j} = a_{STP,j} E_j$$

$$E_{ROW,j} = a_{ROW,j} E_j$$

$$\text{where: } 0 \leq a_{STP}, a_{ROW} \leq 1 \quad \text{for } j=1, N$$

a_{STP} and a_{ROW} are the fixed share of the export to each region, calculated from the data on the Philippines' export.

To capture the effect of discriminately tariff change on imports from the STP and the ROW, prices of imported goods from STP and ROW are treated differently as well.

$$P_{s,j}^M = \bar{e} p_{s,j}^M (1 + t_j^{M,s} + t_j^V + t_j^X) \quad \text{for } j=1, N; s = STP, ROW$$

The Philippines is assumed to be a “small country” which can buy import goods at the world price (or the exchange rate \bar{e} set as 1 in this model) as much as it wants in this model. On the other hand, Japan is assumed to be a “big country” which implies that the world price will increase as Japan bring in more of the import goods.

Since imports from the STP and the ROW are treated differently, profit functions, revenue from international trade, value added tax, balance of payment condition and fiscal condition balance are modified as follows.

Profit Function for Armington goods

$$p_j^A = p_j^A A_j - p_j^Q Q_j^A - p_{STP,j}^M M_{STP,j}^A - p_{ROW,j}^M M_{ROW,j}^A - M_{ROW,j}^A \quad \text{for } j=1, N$$

Revenue from International Trade Taxes

$$Y_G^M = \mathbf{e} \sum_{s=STP}^{ROW} \sum_{j=1}^N p_{s,j}^{-M} M_{s,j} (t_j^M + t_j^V + t_j^X)$$

Revenue from Value Added Taxes

$$Y_G^V = \sum_{j=1}^N t_j^V p_j^Q Q_j - \sum_{i=1}^N t_i^V (p_i^Q Q_{ij}^A + \sum_{s=STP}^{ROW} \mathbf{e} p_{s,i}^{-M} M_{s,i}^A)$$

Balance of Payments Condition

$$\sum_{j=1}^N p_{STP,j}^{-M} M_{STP,j}^A + p_{ROW,j}^{-M} M_{ROW,j}^A - p_j^{-E} E_j = 0$$

Fiscal Balance Condition

$$\begin{aligned} & \sum_{j=1}^N \mathbf{e} \sum_{s=STP}^{ROW} p_{s,j}^{-M} M_{s,j} (t_j^M + t_j^V + t_j^X) + \sum_{j=1}^N t_j^V p_j^Q Q_j - \sum_{i=1}^N t_i^V (p_i^Q Q_{ij}^A + \sum_{s=STP}^{ROW} \mathbf{e} p_{s,i}^{-M} M_{s,i}^A) \\ & + \sum_{j=1}^N t_j^X p_j^Q Q_j - Y_G^X + t^{CY} \sum_{j=1}^N w_j^F F_j \\ & + \sum_{h=1}^H t_h^{PY} \sum_{k=1}^K w_k^R R_k^h + \sum_{i=1}^N w_i^F F_{h,k} - Y_G = 0 \end{aligned}$$

From these modified conditions, the model solves for a set of prices and the levels of production activities **which satisfy** the Walrasian equilibrium conditions (i.e. all market clear, or total market demand equals the value of production and the endowment of the economy, and there is zero-profit in the constant-returns-to-**scale** case).

The data set used for the model is from the Social Accounting Matrix of the Philippines for 1994, which is the latest data available as of August 2003. However, the Philippine tariff rate has been lowered under the Tariff Reform Program since 1990's. To compare the counterfactual equilibria with the economic condition closer to the present condition, the tariff rate is modified to the 1998 tariff rate and solved for the counterfactual equilibria 1. After the model solved for this calibrated equilibria 1, three scenarios are solved as counterfactual equilibria 2: tariff rate on the import from Japan is lowered to 0, but keeping the 1998 tariff rate for the imports from the ROW in the counterfactual equilibrium for each scenario. The elasticities of substitution between goods from the STP and the ROW are exogenously given as 1.0, 0.5, and 2.0 in scenarios 1, 2, and 3, respectively. This is because of the lack of literature on the elasticities of substitution between imports from Japan and the ROW.

From each of the two equilibria, 1 and 2, percentage change in output, price, utility, incomes, etc., in relation to the benchmark data of 1994 Philippine economy are calculated. To see the impact of the tariff change from 1998 level to zero on imports from Japan, the percentage changes in the equilibria 2 is deducted from the percentage changes in the equilibria 1.

Results and Discussion

Table 1 shows the benchmark equilibrium data set of the producer goods production sector for the Philippine economy for the year 1994, and the tariff rate as of 1998.

The Philippines' total output of local producer goods is characterized by high proportion of services, agriculture processing, and crops (include fruits and vegetables). Livestock and fisheries followed. However, exports of the last three sectors are relatively small. The main exports of the Philippines were in the areas of services, electrical products, garments and textiles, and agricultural processing. As for imports, metal products topped followed by other industries, chemical products, services, and electrical products.

In relation to Japan, the share of both imports and exports of metal products and electronics are about 38 percent each of the total. This could be attributed to the increasing intra-industry trade between Japan and Japanese companies in the Philippines. The share of export of livestock and fisheries to Japan is also high (32 percent).

The tax rates are calibrated based on the border tax revenue as recorded in the PSIC data. Crops are levied the highest tax rate of 28.32 percent. Garments and textiles followed with the rate of 15.78 percent. These sectors with tariff rates above 15 percent would be defined to accord significant protection. The large share of these sectors in total output and that of textiles in export might reflect this protection. Since no tariff data for Other Industries and Services were available, 5 percent tariff rate are applied in the model run for these two sectors, as uniform 5 percent tariff rate are planned to be applied to all imports according to the Tariff Reform Program (TRP) of the Philippines.

In terms of tariff revenue, electrical products are the biggest source of the tariff revenue of the Philippines despite its considerably low tariff rate (4.05%).

The simulation result of the unilateral tariff elimination on the imports only from Japan is shown on succeeding tables. The numbers are differences in percentage changes in the counterfactual 1 with 1998 tariff rate to all imports in relation to the benchmark equilibria (of 1994 Philippine economy), and percentage changes in the counterfactual 2 with zero tariff to imports from Japan and 1998 level tariff rate to imports from the rest of the world (ROW) in relation to the benchmark equilibria. Elasticity of substitution between imports from Japan and the ROW is set as 1.0 in case 1; 0.5 in case 2, and 2.0 in case 3, respectively. As for the elasticity of substitution between local inputs and imported inputs, the set of Armington elasticities used in the APEX model for the Philippines is employed.

Production

The result shows that the impact of the tariff reduction to zero on imports from Japan on the Philippines' total output of producer goods is not significant in all the three cases. However, total export and imports increased from 0.42-0.72 percent and 0.35-0.61 percent, respectively. Export of metal products (METL), electric products (ELCE), and Other Industries (OTHI) increased aside from that of services, whereas export of petroleum products shrink by 0.63 percent. On the other hand, total imports of all products increased.

The output is destined for local use and exports (see the Producer Goods Production Function in the Model Structure). The small impact on the total output with positive effects on exports in each sector implies that the use of local producer goods as inputs is replaced by imported inputs.

Looking at the major impact by sectors, services increases the most in the simulation. However, the original data is only from the Input-Output table for the Philippine economy, and the actual tariff data or trade data for the services are not available, there is a doubt on the credibility of the simulation results about the services sector. But from the fact that the trade in services is the biggest source of Philippine national income, the elimination of tariff on imports must be large as the results shows. Aside from the services, total import of garments and textiles, the second most protected sector, increased from 0.52-0.64 percent. Its export, which is one of the major exports of the Philippines, (12.5 percent of the total exports) contracts by 0.12-0.14 percent.

The most protected sector, crops (includes fruits and vegetables) shows different effects on imports and exports. Its import increased by about 0.36-0.57 percent and total exports declined by 0.12-0.24 percent.

In relation to trade with Japan, imports from Japan expand by 4.19 percent, or 6.43 billion pesos, which is more than the increase in total imports (0.6 percent increase, or 4.21 billion pesos) in case of the elasticity of substitution between import from Japan and the ROW is assumed to be 1. When higher elasticity is assumed (2 in case 3), the change was about 8.58 percent.

The biggest increase in imports from Japan is from the crops subsector, but this might have minimal actual impact since the share of crop imports in total imports from Japan is merely 0.01 percent. More important sectors in Philippine-Japan trade are the chemical, metal products, electrical products and other industries subsectors. Imports in chemical and metal products' sectors increase by more than 10% in cases where higher elasticity are assumed.

On the contrary, export to Japan expands almost as much as the total export (0.34-0.53 percent) since the share of Japan in total export is defined as fixed in the model.

This expansion in imports and exports with slight contraction in total domestic output implies that the local producer goods for domestic use declined in some sectors as a result of the tariff elimination on imports from Japan. Because more imported inputs are used to produce local producer goods and consumer goods with cheaper cost,

productions of local goods with less competitiveness will contract. Although producers in less competitive sectors will be worse off in this case, resource reallocation to more competitive sectors from less competitive sectors might increase production efficiency in the economy.

Changes in factor allocations are estimated by changes in the output of local producer goods since the unit input of variable factors in each production sector is assumed to be constant in the model. The result showed that the output of locally produced goods decreased but only by a minimal 0.01-0.02 percent in total, with slightly positive change in wood and contract in other sectors. Factor prices are assumed to be one over all factors and full-employment of all factors are assumed in this model, but if these assumptions are modified, there should be more impact on local production.

Prices

Table 4 represents the change in prices in producer goods, consumer goods, and the primary factor which is equal for all primary factors. On the average, prices of producer goods decreased by 0.25-0.38 percent. The decrease in prices of consumer goods by 0.41-0.86 percent on the average, benefit all households with increased utilities. Prices for primary factors increased by 1.21-1.83 percent. This increase in factor prices will improve the incomes of some households as will be shown later.

Consumer Welfare

Table 5 reports the result in income change per households. Wherein total outputs of local production do now show much increase and the endowments of factors by households remains the original level, the income change are derived from the changes in prices of primary factors and sector specific factors. Higher income Households 4 and 5 increase their incomes in all cases, while incomes of lower income classes, Households 1 and 2 deteriorate in all the cases. Households 3's income decreases when the elasticity of substitution between imports from Japan and the ROW is assumed to be 1, while it increases when the elasticity is assumed to be higher (2) or lower (0.5).

Although the incomes of lower income households deteriorate slightly (but less than 0.5 percent), the increase in imports from Japan with zero tariff results in increased welfare for all households. The welfare effects are estimated by Compensated Variation (CV) and Equivalent Variation (EV). The positive CV and EV for all households imply that all households are better off in terms of welfare. The percent changes in CV and EV between the benchmark and counterfactual equilibria presented in Table 6 show that the welfare expand in all households as a result of the reduction of tariff rates on imports from Japan. This increase in welfare in all households seems to be derived from the decrease in the prices of consumer goods.

One concern should be in the degree of the positive welfare impact among the five households. The welfare effect is much bigger in higher-income households (maximum 49 percent) than in lower-income households (minimum of 2.31 percent). In terms of equality, the result indicates that there is a possibility of a deterioration of inequality. From the fact that 34 percent of the entire population have per capita incomes below the poverty threshold (the amount of money required to satisfy food and non-food

basic needs) in the year 2000, the impact of the free trade agreement with Japan should not be big enough to ameliorate the poverty in the Philippines if the agreement will be only on the tariff reduction.

Conclusion

Removing tariffs on imports from Japan results in 2.36-8.58 percent increase in total imports from Japan. In total, imports would expand by 0.35-0.61 percent while total exports would increase by 0.42-0.72 percent.

Although increases are large in imports of crops and agriculture processing (as much as 63.29 percent for crops and 23.36 percent for agriculture processing), the actual effects should not be significant since the share of imports from Japan of these goods are merely 0.01 percent and 0.51 percent. More important sectors in Philippine-Japan Trade are the electronics and other industries, metal, and chemical sectors. Imports of these sectors from Japan increase by 2-14.9 percent. On the other hand, the total output of producer goods will not change significantly.

In relation to factor re-allocation, not much re-allocation were found in the simulation result due to the assumption of equal prices for all factors except sector specific factors and the full-employment assumption. If these assumptions were modified, more impact on production side as well as incomes of households would be observed.

Households' income increased for Households 4 and 5, but dropped for Households 1 and 2 (the change in income for Households 3 depends on the elasticity of substitution between import from Japan and the ROW). The decline in incomes for Households 1 and 2 can be attributed to a decline in prices of some sector specific factors which are not shown in the tables.

Despite the decline in income for some households, welfare measured in Compensated and Equivalent Variation increase in every household in any cases due to the decrease in prices of consumer goods. The positive Equivalent Variations change is observed for all households, but not in proportional ways among the households. Having the simulation result that the richer households are much better off than the lower income households, the implication of this study is that the elimination of tariff on imports from Japan does not necessary ameliorate the distribution inequality. This might be because only households with higher incomes can enjoy the cheaper consumer goods while the impact on consumption by households who have little factors as their source of incomes would be minimal unless their income increase.

In this model, the impact of tariff removal alone on Philippines economy in static sense is assessed. The result of the assessment of this study indicates that even only reduction of tariff on imports from Japan benefit the economy in terms of consumer welfare. More favorable impact on all households would be expected if the assumption of full-employment is modified and the free trade agreement bring about increase in total production accompanied by increases in employment. The dynamic economic impacts of other factors such as foreign direct investment and factor mobility between the two countries including capital and labor, and natural persons would benefit all households to greater extent.

Appendix

The Structure of the Model

The Model

The model used for this study is a 12-sector Philippines Computable General Equilibrium Model, using a benchmark dataset for the APEX model for the Philippine economy originally specified by Clarete and Warr (1992). The benchmark data was recalibrated using the 1994 Social Accounting Matrix by Habito and Cororaton (2000). The features of the data for the APEX model are:

- Fifty producer goods and services produced by 41 industries.
- Three primary factors, labor (skilled and unskilled), capital and land.
- Five households classified as quintiles in the personal income distribution.
- Seven consumer goods and services.

The crucial assumption is that domestically produced goods and similar imported goods used as intermediate inputs are treated as heterogeneous (Armington assumption). The 50 producer goods and Armington intermediate sectors are reduced to 12 sectors for this model to make the computation straightforward.

The model of this study set in Shoven-Whallay model was written by GAMs software and processed in MPS-CGE model.

The Structure of the Model

The Production Sector

Production sectors of the model consist of producer goods production sector, Armington aggregate production sector and consumer goods production sector. Each sector's production functions are specified as below.

The producer goods production sectors are assumed to produce 12 goods and services that are intended for domestic use (Q_j) and for exports (E_j). The output transformation function, T_j is assumed to take the constant elasticity of transformation (CET) form. Domestic and export goods are assumed to be imperfect substitutes.

Each production sector utilizes primary factors, namely, labor (skilled and unskilled), capital, land, sector specific factors, and intermediate inputs. The production function specifies the input requirements of value-added and intermediate goods in Leontief form. Intermediate goods (Armington aggregation) compose of locally produced goods and imported goods. They are substitutable but imperfect because the inputs from different origin (locally produced or imported) are treated differently by Armington assumption.

Producer Goods Production Functions

$$T_j(Q_j, E_j) - \min \left(\frac{A_{1j}^T}{a_{1j}}, \frac{A_{2j}^T}{a_{2j}}, \dots, \frac{A_{Nj}^T}{a_{Nj}}, \frac{V_j^T}{v_j} \right) = 0 \quad \text{for } j=I, N$$

where:

$$a_{ij} = \frac{A_{ij}^T}{T_j} \quad \text{for } i, j=I, N$$

$$v_j = \frac{V_j^T}{T_j} \quad \text{for } j=I, N$$

T_j is the gross output of industry j transformed to local use (Q_j) and export (E_j),

V_{jt} is the value-added inputs used in industry j ,

v_j is the value-added requirement per unit output T_j ,

A_{ij} is the use of the Armington good i in industry j , and

a_{ij} is the requirement of the Armington good i per unit output of good T_j .

Value added functions represent the factor input requirement defining substitution possibilities over variable factors in each industry. In the model, four variable factors are grouped into a nest in Cobb-Douglas form then the resulting aggregate V_j (valued added goods) enters a top-level nest together with Armington input in Leontief form. Armington inputs are modeled in a separate sector to produce Armington aggregates in CES form and enters the Producer Goods functions as Armington inputs.

Value Added Functions

$$V_j = V_j(R_{1,j}^V, R_{2,j}^V, \dots, R_{K,j}^V; F_j^V) \quad \text{for } j=I, N$$

where:

R_{kj} are variable factors (k =unskilled labor, skilled labor, capital and land), used in production j , and

F_j is a fixed sector specific factor in production j .

The elasticity of substitution between the variable factors is set to 1 in the model.

Armington aggregation functions

$$A_j = A_j(Q_j^A, M_j^A) \quad \text{for } j=I, N$$

where:

A_j is the Armington input used in production of producer good j ,

Q_j^A is the locally produced composite in the Armington input, and

M_j^A is the imported composite in the Armington input.

The elasticity of substitution between locally produced goods and imported input is taken from the Armington elasticities used in the APEX model.

Consumer goods production functions

In the Consumer goods producing sector, seven consumer goods are produced from 12 Armington composite goods. The function takes the Leontief form with fixed input requirement per unit output.

$$C_j = \min \left(\frac{A_{1,j}^C}{b_{1,j}}, \frac{A_{2,j}^C}{b_{2,j}}, \dots, \frac{A_{N,j}^C}{b_{N,j}} \right) \quad \text{for } j=1,L$$

$$b_{i,j}^C = \frac{A_{i,j}^C}{C_j} \quad \text{for } i=1,N ;$$

$j=1,L$

where:

$A_{N,j}^C$ is the use of Armington aggregate N in producing consumer good C_j , and
 $b_{N,j}$ is the input requirement of Armington aggregate per unit of output of consumer goods C_j .

The External Sector

Export is derived from the producer goods transformation function and imports enter the Armington composite. Exports and import prices are fixed in foreign currency terms and expressed in local currency terms based on their world prices, multiplied by the exchange rate e and the corresponding tariff rates, whenever applicable.

Prices

Prices are expressed in user prices in production sectors and in source prices in the Household Endowment Matrix.

User price of imported goods

$$p_j^M = \hat{a} \bar{p}_j^M (1 + t_j^M + t_j^V + t_j^X) \quad \text{for } j=1,N$$

where:

t_j^M is the import tax (custom, tariff) on good j,

t_j^V is the value added tax on good j,

t_j^X is the exercise tax on good j, and

\bar{p}_j^M is the given world price for a price taking economy (=world price)

User price of exports

$$p_j^E = \bar{a} \bar{p}_j^E \quad \text{for } j=I, N$$

where \bar{p}_j^E is the given export world price of good j .

User price of locally produced product

$$p_j^Q = p_j^Q (1 + t_j^V + t_j^X) \quad \text{for } j=I, N$$

where p_j^Q is the producer price.

Source price of sector-specific factors

Source price of sector-specific factors is the user price of factor-specific factors w_j^F (price paid for using the factor) deflated by a corporate income tax t^{CY} .

$$w_j^{F'} = \frac{w_j^F}{(1 + t^{CY})} \quad \text{for } j=I, N$$

Source price of variable factors

Source price of variable factors is the user price of variable factors w_k^R deflated by personal income tax t_h^{PY} for each household h .

$$w_{h,k}^{R'} = \frac{w_k^R}{(1 + t_h^{PY})} \quad \text{for } h = I, H ; k = I, K$$

Profit Functions

Profit Functions for Locally Produced Producer Goods

Profit in the production of local producer good j is the revenue from the final output minus the cost of Armington inputs and value added inputs (factor inputs) = user price of sector specific factor times the economy's endowment of sector j specific factor.

$$\begin{aligned} \delta_j^T &= p_j^Q Q_j + \bar{e} \bar{p}_j^E E_j - \sum_{i=1}^N p_i^A A_{i,j}^T - p_j^V V_j^T \\ &= w_j^F \sum_{h=1}^H F_{h,j} = w_j^F F_j \end{aligned} \quad \text{for } j=I, N$$

Profit functions for value added functions

Profit from the value added is the income from the value added minus the payment to the variable factors and factor specific factors.

$$\delta_j^V = p_j^V V_j - \sum_{k=1}^K w_k^R R_{kj}^V - w_j^F F_j^V \quad \text{for } j=1, N$$

Profit function for Armington functions

Profit from the Armington aggregate j is the income from the Armington good j minus the payment to the use of domestically produced and imported inputs imported.

$$\delta_j^A = p_j^A A_j - p_j^Q Q_j^A - p_j^M M_j^A \quad \text{for } j=1, N$$

Profit functions for consumer goods functions

Profit from consumer good j is the income from the good minus the sum of the payment to the use of the Armington inputs.

$$\delta_j^C = p_j^C C_j - \sum_{i=1}^N p_i^A A_{ij}^C \quad \text{for } j=1, L$$

The Demand

Total demand is composed of three components: private consumption of consumer goods, government consumption of consumer goods, and intermediate input demanded for the productions of the producer goods and consumer goods. Intermediate input demand is derived from the Leontief fixed coefficient assumption in productions as previously illustrated.

Private demands for consumer goods of the representative agent (five households in the model) satisfy utility maximizing consumption behavior in the Constant Elasticity of Substitution (CES) form. Each of the five households has an endowment of variable factors, sector specific factors and foreign exchange. The consumer goods demands are derived from the utility maximization subject to their household income from these endowments.

Household Utility Functions

$$U_h = U_h(C_{h,1}^U, C_{h,2}^U, \dots, C_{h,L}^U) \quad \text{for } h=1, H$$

where $C_{h,L}^U$ is the consumption of consumer good L by a household h .

Household Resource Endowment Matrix (Variable and Sector Specific Resources)

$$\begin{bmatrix} R_{1,1} & R_{1,2} & \dots & R_{1,K} & F_{1,1} & F_{1,2} & \dots & F_{1,N} \\ R_{2,1} & R_{2,2} & \dots & R_{2,K} & F_{2,1} & F_{2,2} & \dots & F_{2,N} \\ \vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \ddots & \vdots \\ R_{H,1} & R_{H,2} & \dots & R_{H,K} & F_{H,1} & F_{H,2} & \dots & F_{H,N} \end{bmatrix}$$

Household Income Functions

Household h earns income Y_h from its endowment of variable factors and sector specific factors.

$$\begin{aligned} Y_h &= \sum_{k=1}^K w_k^R R_{h,k} + \sum_{i=1}^N w_i^F F_{h,i} \\ &= \sum_{k=1}^K \frac{w_k^R}{(1+t_h^{PY})} R_{h,k} + \sum_{i=1}^N \frac{w_i^F}{(1+t^{CY})} F_{h,i} \end{aligned} \quad \text{for } h=1,H$$

Government demand is a Leontief aggregates across composite Armington goods on imports and domestically produced goods. The government demand is derived from the government utility maximization subject to its income, the total revenue from the International Trade Taxes (import tariff, export tariff and valued added tax on imports), the Value Added Tax and the Excise Tax on locally produced goods, Corporate Tax on factor employment, and Personal Income Tax.

Government utility function

$$U_G = U_G(A_1^G, A_2^G, \dots, A_N^G) \quad \text{for } G = \text{government}$$

Revenue from international trade taxes

$$\tilde{O}_G^M = \bar{a} \sum_{j=1}^N \bar{p}_j^M M_j (t_j^M + t_j^V + t_j^X)$$

Revenue from value-added taxes on locally produced products

The net revenue from locally produced goods is the total revenue minus the revenue from Value Added Taxes on intermediates inputs.

$$\tilde{O}_G^V = \sum_{j=1}^N t_j^V p_j^Q Q_j - \sum_{i=1}^N t_i^V (p_i^Q Q_{ij} + \bar{\phi}_i^M M_{ij}^A)$$

Revenue from excise taxes on locally produced goods

$$Y_G^X = \sum_{j=1}^N t_j^X p_j^Q Q_j$$

Corporate tax revenue

$$Y_G^{CY} = t^{CY} \sum_{j=1}^N w_j^F F_j$$

Revenues from personal income taxes

Personal income tax is levied according to the income level of household h .

$$Y_G^{PY} = \sum_{h=1}^H t_h^{PY} \sum_{k=1}^K \frac{w_k^R}{(1+t_h^{PY})} R_k^h + \sum_{i=1}^N \frac{w_i^F}{(1+t^{CY})} F_{h,i}$$

Governments' income

$$\tilde{O}_G = \tilde{O}_G^M + \tilde{O}_G^V + \tilde{O}_G^X + \tilde{O}_G^{CY} + \tilde{O}_G^{PY}$$

Walras' Law

By Walras' Law, total demand (private + government consumption and input demand) equals the value of the economy's endowments and tax revenue. In other words, the value of market excess demand equals zero at all prices.

$$\begin{aligned} & \sum_{h=1}^H \sum_{i=1}^L p_i^C C_{h,i}^U - \sum_{k=1}^K \frac{w_k^R}{(1+t_h^{PY})} R_{h,k} - \sum_{i=1}^N \frac{w_i^F}{(1+t^{CY})} F_{h,i} + \sum_{j=1}^N p_j^A A_j^G - \tilde{O}_G = 0 \\ & \sum_{i=1}^L p_i^C C_i^d + \sum_{j=1}^N p_j^A A_j^G - \sum_{h=1}^H \sum_{k=1}^K \frac{w_k^R}{(1+t_h^{PY})} R_{h,k} - \sum_{i=1}^N \frac{w_i^F}{(1+t^{CY})} F_i - \tilde{O}_G + \\ & \sum_{j=1}^N \delta_j^T - p_j^Q Q_j - \tilde{a} p_j^E + \sum_{i=1}^N p_i^A A_{i,j}^T + p_j^V V_j^T + \\ & \sum_{j=1}^N \delta_j^V - p_j^V V_j + \sum_{k=1}^K w_k^R R_{k,j}^V + w_j^F F_j^V + \\ & \sum_{j=1}^N \delta_j^A - p_j^A A_j + p_j^Q Q_j^A + p_j^M M_j^A + \sum_{j=1}^L \delta_j^C - p_j^C C_j + \sum_{i=1}^N p_i^A A_{i,j}^C = 0 \end{aligned}$$

Zero profit assumption

By the assumption of perfect competition, profit function for locally produced goods, value-added functions, Armington functions, and consumer goods are all equal to zero.

It is assumed that there is no excess demand in consumer goods, locally produced goods, Armington goods, and value added (all resources are used). Fiscal balance must also hold.

$$\begin{aligned}
& \sum_{j=1}^L p_j^C (C_j^U - C_j) + \sum_{j=1}^N p_j^Q (Q_j^A - Q_j) + \sum_{j=1}^N p_j^A (A_j^T + A_j^C + A_j^G - A_j) + \sum_{j=1}^N p_j^V (V_j^T - V_j) + \\
& \sum_{k=1}^K w_k^R (R_k^V - R_k) + \sum_{j=1}^N w_j^F (F_j^V - F_j) + \sum_{j=1}^N \bar{p}_j^M M_j^A - \bar{p}_j^E E_j + \sum_{j=1}^N \bar{\phi}_j^M M_j (t_j^M + t_j^V + t_j^X) - \tilde{O}_G^M + \\
& \sum_{j=1}^N t_j^V p_j^Q Q_j - \sum_{i=1}^N t_i^V (p_i^Q Q_{ij}^A + \bar{\phi}_i^M M_{ij}^A) - \tilde{O}_G^V + \sum_{j=1}^N t_j^X p_j^Q Q_j - \tilde{O}_G^X + \\
& t^{CY} \sum_{j=1}^N w_j^F F_j - \tilde{O}_G^{CY} + \sum_{h=1}^H t_h^{PY} \sum_{k=1}^K w_k^R R_k^h + \sum_{i=1}^N w_i^F F_{h,k} - \tilde{O}_G^{PY} + \sum_{j=1}^N \delta_j^T + \sum_{j=1}^N \delta_j^V + \sum_{j=1}^N \delta_j^A + \sum_{j=1}^L \delta_j^C = 0
\end{aligned}$$

Equilibrium conditions call for (1) market clearance in all markets (the first six equations below); (2) zero profit conditions for all production sectors (equations 8-11); (3) external sector balance (eq.7); and (4) fiscal balance (eq.12). Market clearance implies that sum of the output and initial endowment equals intermediate plus final demands. All market clears simultaneously. Zero profit meanwhile implies that the profits of the firms in the long run will sum up to zero in all industries.

Fiscal balance condition observes the equality between the level of expenditure and the value of income from sales of factor endowments, tax revenues and other payments.

From this, the general equilibrium conditions of the basic model are:

1. $C_j^U - C_j = 0$ \forall consumer good j
2. $A_j^T + A_j^C + A_j^G - A_j = 0$ \forall Armington good j
3. $Q_j^A - Q_j = 0$ \forall locally produced import substitute j
4. $V_j^T - V_j = 0$ \forall value added j
5. $R_k^V - R_k = 0$ \forall variable factor k
6. $F_j^V - F_j = 0$ \forall sector-specific factor j
7. $\sum_{j=1}^N \bar{p}_j^M M_j^A - \bar{p}_j^E E_j = 0$ balance of payments condition
8. $p_j^C = 0$ \forall consumer good production activity j
9. $p_j^A = 0$ \forall Armington good production activity j
10. $p^T = 0$ \forall local production activity j
11. $p_j^V = 0$ \forall value added activity j
12. $\sum_{j=1}^N \bar{\phi}_j^M M_j (t_j^M + t_j^V + t_j^X) + \sum_{j=1}^N t_j^V p_j^Q Q_j - \sum_{i=1}^N t_i^V (p_i^Q Q_{ij}^A + \bar{\phi}_i^M M_{ij}^A) + \sum_{j=1}^N t_j^X p_j^Q Q_j - \tilde{O}_G^X + t^{CY} \sum_{j=1}^N w_j^F F_j + \sum_{h=1}^H t_h^{PY} \sum_{k=1}^K w_k^R R_k^h + \sum_{i=1}^N w_i^F F_{h,k} - \tilde{O}_G = 0$ fiscal balance condition

These are solved for the following equilibrium values:

$$p_i^C, p_j^V, p_j^A, p_j^Q, w_j^F, w_k^R, e, C_i, V_j, A_j, Q_j, Y_G \quad \text{for } i=1,L; j=1,N; k=1,K$$

The first four p 's denote the prices of consumer goods, value added goods, Armington goods, and locally produced products, respectively. w_j^F is the user price of sector specific factors and w_k^R is the user price of variable factors. Exchange rate e is assumed as 1 in the model. C, V, A, Q are the quantities supplied and demanded in the economy and Y denotes the total government income.

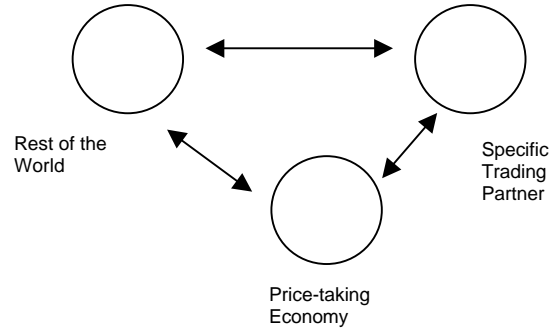
The model with specified functions solves for the general equilibrium with those values. The result replicates the given data set.

Model with Specific Trading Partners

The model above has all trading partners as rest of the world (ROW hereafter). To model the case of free trade agreement with a subset of specific trading partner (STP hereafter), there is a need to identify the specific trading partner from the ROW. An extension of the basic model provides this feature of the model. The followings are the modifications of the above model.

Armington Aggregation Function

The imported goods from the STP are differentiated by those from the ROW in this study. Domestic, imported types from the STP and from the ROW are not perfect substitute for one other.



In the Armington aggregation function, import from the STP and ROW are nested into a group with constant elasticities of substitution and then combined with locally produced input with Armington elasticities of substitution.

$$A_j = A_j(Q_j^A, M_{STP,j}^A, M_{ROW,j}^A) \quad \text{for } j=1,N$$

Exports

$$E_{STP,j} = \mathbf{a}_{STP,j} E_j$$

$$E_{ROW,j} = \mathbf{a}_{ROW,j} E_j$$

where: $0 \leq \mathbf{a}_{STP}, \mathbf{a}_{ROW} \leq 1$

for $j=I,N$

\mathbf{a}_{STP} and \mathbf{a}_{ROW} are the fixed share of the export to each region given by the data.

Prices of Imported Goods, By Origin

To capture the effect of discriminately tariff change on imports from the STP and the ROW, prices of imported goods from STP and ROW are treated differently.

$$p_{s,j}^M = \bar{a} p_{s,j}^{-M} (1 + t_j^{M,s} + t_j^V + t_j^X) \quad \text{for } j = I, N; s = STP, ROW$$

Since imports from STP and ROW are treated differently, profit functions, revenue from international trade, value added tax, balance of payment condition and fiscal condition balance are modified as the following.

Profit Function for Armington goods

$$\delta_j^A = p_j^A A_j - p_j^Q Q_j^A - p_{STP,j}^M M_{STP,j}^A - p_{ROW,j}^M M_{ROW,j}^A \quad \text{for } j = I, N$$

Revenue from International Trade Taxes

$$Y_G^M = \mathbf{e} \sum_{s=STP}^{ROW} \sum_{j=1}^N p_{s,j}^{-M} M_{s,j} (t_j^M + t_j^V + t_j^X)$$

Revenue from Value Added Taxes

$$Y_G^V = \sum_{j=1}^N t_j^V p_j^Q Q_j^A - \sum_{i=1}^N t_i^V (p_i^Q Q_{ij}^A + \sum_{s=STP}^{ROW} \mathbf{e} p_{s,i}^{-M} M_{s,i}^A)$$

Balance of Payments Condition

$$\sum_{j=1}^N \bar{p}_{STP,j}^{-M} M_{STP,j}^A + \bar{p}_{ROW,j}^{-M} M_{ROW,j}^A - \bar{p}_j^{-E} E_j = 0$$

Fiscal Balance Condition

$$\begin{aligned} & \sum_{j=1}^N \mathbf{e} \sum_{s=STP}^{ROW} p_{s,j}^{-M} M_{s,j} (t_j^M + t_j^V + t_j^X) + \sum_{j=1}^N t_j^V p_j^Q Q_j^A - \sum_{i=1}^N t_i^V (p_i^Q Q_{ij}^A + \sum_{s=STP}^{ROW} \mathbf{e} p_{s,i}^{-M} M_{s,i}^A) \\ & + \sum_{j=1}^N t_j^X p_j^Q Q_j^A - Y_G^X + t^{CY} \sum_{j=1}^N w_j^F F_j \\ & + \sum_{h=1}^H t_h^{PY} \sum_{k=1}^K w_k^R R_k^h + \sum_{i=1}^N w_i^F F_{h,k} - Y_G = 0 \end{aligned}$$

From this modified conditions, the model solves for the following:

$$p_{STP,j}^A, p_{ROW,j}^A, A_j, Q_j, M_{STP,j}, M_{ROW,j} \quad \text{for } i=L; j=L,N; k=L,K$$

Table 1. Benchmark Total Output and Import *(in billions)

| Commodity | Local Production | Exports to the World | Exports to Japan | % of Export to Japan | Total Import | Total Imports from Japan | % of Imports from Japan | Tariff rate (as of '98)** |
|----------------------------------|------------------|----------------------|------------------|----------------------|--------------|--------------------------|-------------------------|---------------------------|
| 1 Crops (CRPS) | 198.21 | 15.38 | 2.98 | 3.23 | 4.88 | 0.02 | 0.01 | 28.32 |
| 2 Livestock and Fisheries (LIVE) | 204.16 | 16.58 | 5.34 | 5.78 | 4.30 | 0.79 | 0.51 | 3.42 |
| 3 Natural Resources (NATR) | 41.00 | 13.96 | 1.93 | 2.09 | 45.37 | 2.09 | 1.37 | 3.61 |
| 4 Agriculture Processing (AGPR) | 522.13 | 45.50 | 7.67 | 8.30 | 47.71 | 0.78 | 0.51 | 9.39 |
| 5 Garments and Textiles (TEXT) | 136.72 | 64.79 | 6.99 | 7.56 | 48.60 | 2.26 | 1.48 | 15.78 |
| 6 Wood Products (WOOD) | 67.75 | 18.47 | 4.45 | 4.82 | 33.06 | 1.46 | 0.96 | 9.64 |
| 7 Chemical Products (CHEM) | 113.00 | 17.27 | 3.43 | 3.71 | 85.32 | 11.78 | 7.72 | 5.93 |
| 8 Petroleum Products (PETR) | 231.21 | 4.59 | 0.78 | 0.84 | 26.22 | 3.23 | 2.12 | 7.91 |
| 9 Metal Products (METL) | 124.69 | 37.81 | 11.99 | 12.98 | 125.91 | 31.08 | 20.37 | 7.52 |
| 10 Electrical Products (ELEC) | 113.84 | 83.90 | 23.05 | 24.95 | 84.95 | 29.70 | 19.46 | 4.05 |
| 11 Other Industries (OTHI) | 83.73 | 41.97 | 3.62 | 3.91 | 109.73 | 39.12 | 25.63 | 5.00 |
| 12 Services (SERV) | 1,717.96 | 234.06 | 20.16 | 21.82 | 85.04 | 30.32 | 19.86 | 5.00 |
| SUM | 3,554.39 | 594.27 | 92.38 | 100.00 | 701.06 | 152.62 | 100.00 | |

* Calibrated from 1994 APEX data with 98 tariff rate. Elasticity of substitution between imports from Japan and the ROW is assumed as 1.

** Weighted average of 98 tariff rate for sectors 1-10. 5% tariff is assumed for 11 Other Industries and 12 Services since the tariff rate is planned to be uniform 5% under the Philippine Tariff Reform program IV.

Table 2. Percent changes on total output of producer goods, export and imports

(%changes in the counterfactual 2-% changes in the counterfactual 2)

| Commodity | Total output of producer goods (% change) | | | Total Export (% change) | | | Total Import (% change) | | | Import from Japan | | | Export to Japan | | |
|--------------------------------|---|--------|--------|-------------------------|--------|--------|-------------------------|--------|--------|-------------------|--------|--------|-----------------|--------|--------|
| | case 1 | case 2 | case 3 | case 1 | case 2 | case 3 | case 1 | case 2 | case 3 | case 1 | case 2 | case 3 | case 1 | case 2 | case 3 |
| Crops (CRPS) | -0.00 | -0.00 | -0.00 | -0.12 | -0.24 | -0.22 | 0.36 | 0.54 | 0.57 | 27.81 | 13.44 | 63.29 | -0.12 | -0.24 | -0.22 |
| Livestock and Fisheries (LIVE) | 0.00 | -0.00 | -0.00 | 0.18 | -0.11 | -0.08 | 0.31 | 0.58 | 0.58 | 3.14 | 2.00 | 6.32 | 0.18 | -0.11 | -0.08 |
| Natural Resources (NATR) | 0.00 | 0.00 | 0.00 | 0.06 | 0.06 | 0.06 | 0.04 | 0.04 | 0.04 | 3.56 | 1.78 | 7.19 | 0.06 | 0.06 | 0.06 |
| Agriculture Processing (AGPR) | -0.00 | 0.00 | 0.00 | -0.15 | -0.27 | -0.26 | 0.58 | 0.82 | 0.82 | 11.34 | 6.09 | 23.36 | -0.15 | -0.27 | -0.26 |
| Garments and Textiles (TEXT) | -0.01 | -0.01 | -0.01 | -0.14 | -0.12 | -0.12 | 0.58 | 0.52 | 0.64 | 15.79 | 7.87 | 33.20 | -0.13 | -0.12 | -0.12 |
| Wood Products (WOOD) | 0.01 | 0.00 | 0.01 | 0.19 | 0.12 | 0.15 | 0.00 | 0.04 | 0.06 | 9.22 | 4.55 | 19.30 | 0.19 | 0.12 | 0.15 |
| Chemical Products (CHEM) | 0.00 | 0.00 | 0.00 | 0.13 | 0.05 | 0.07 | 0.20 | 0.22 | 0.25 | 5.34 | 2.77 | 10.75 | 0.13 | 0.05 | 0.07 |
| Petroleum Products (PETR) | -0.01 | -0.00 | -0.00 | -0.63 | -0.54 | -0.52 | 0.52 | 0.47 | 0.53 | 7.49 | 3.90 | 14.87 | -0.63 | -0.54 | -0.52 |
| Metal Products (METL) | 0.01 | 0.01 | 0.01 | 0.90 | 0.87 | 0.91 | 0.24 | 0.25 | 0.33 | 5.80 | 3.01 | 11.66 | 0.90 | 0.87 | 0.91 |
| Electrical Products (ELEC) | -0.01 | -0.01 | -0.01 | 0.27 | 0.27 | 0.28 | 0.38 | 0.36 | 0.39 | 3.02 | 1.67 | 5.70 | 0.27 | 0.27 | 0.28 |
| Other Industries (OTHI) | -0.04 | -0.04 | -0.04 | 0.55 | 0.54 | 0.55 | 0.29 | 0.32 | 0.37 | 3.51 | 1.93 | 6.86 | 0.55 | 0.54 | 0.55 |
| Services (SERV) | -0.05 | -0.03 | -0.03 | 1.53 | 0.84 | 0.93 | 2.64 | 0.56 | 0.52 | 2.64 | 2.03 | 6.48 | 1.53 | 0.84 | 0.93 |
| SUM | -0.02 | -0.01 | -0.02 | 0.72 | 0.42 | 0.46 | 0.61 | 0.35 | 0.39 | 4.19 | 2.36 | 8.58 | 0.53 | 0.34 | 0.37 |

Table 3

Difference in value in case 1

(value in the counterfactual 2-value in the counterfactual 1)

(Billion unit)

| Commodity | Import | | Export | |
|--------------------------------|--------|----------|--------|--------|
| | Total | From JPN | Total | To JPN |
| Crops (CRPS) | 0.02 | 0.01 | -0.02 | 0.00 |
| Livestock and Fisheries (LIVE) | 0.01 | 0.02 | 0.03 | 0.01 |
| Natural Resources (NATR) | 0.02 | 0.07 | 0.01 | 0.00 |
| Agriculture Processing (AGPR) | 0.24 | 0.08 | -0.07 | -0.01 |
| Garments and Textiles (TEXT) | 0.28 | 0.35 | -0.09 | -0.01 |
| Wood Products (WOOD) | 0.00 | 0.13 | 0.04 | 0.01 |
| Chemical Products (CHEM) | 0.17 | 0.62 | 0.02 | 0.00 |
| Petroleum Products (PETR) | 0.14 | 0.24 | -0.03 | 0.00 |
| Metal Products (METL) | 0.30 | 1.81 | 0.34 | 0.11 |
| Electrical Products (ELEC) | 0.32 | 0.88 | 0.23 | 0.06 |
| Other Industries (OTHI) | 0.31 | 1.35 | 0.23 | 0.02 |
| Services (SERV) | 2.41 | 0.86 | 3.53 | 0.30 |
| SUM | 4.21 | 6.43 | 4.21 | 0.49 |

Table 4. Price changes in producer goods, consumer goods and primary factor

| | case 1 | case 2 | case 3 |
|---------|--------|--------|--------|
| y.CRPS | 0.15 | 0.30 | 0.28 |
| y.LIVE | -0.22 | 0.13 | 0.10 |
| y.NATR | -0.08 | -0.08 | -0.08 |
| y.AGPR | 0.16 | 0.29 | 0.27 |
| y.TEXT | 0.24 | 0.22 | 0.21 |
| y.WOOD | -0.25 | -0.16 | -0.19 |
| y.CHEM | -0.14 | -0.06 | -0.08 |
| y.PETR | 0.66 | 0.57 | 0.55 |
| y.METL | -1.27 | -1.23 | -1.28 |
| y.ELEC | -1.00 | -1.00 | -1.02 |
| y.OTHI | -1.09 | -1.05 | -1.08 |
| y.SERV | -1.74 | -0.96 | -1.06 |
| average | -0.38 | -0.25 | -0.28 |
| c.CERL | -0.26 | 0.01 | -0.02 |
| c.MDMP | -0.02 | 0.19 | 0.17 |
| c.BTMF | -0.62 | -0.24 | -0.28 |
| c.UTIL | -1.17 | -0.67 | -0.73 |
| c.HOUS | -1.50 | -0.81 | -0.89 |
| c.WEAR | -0.81 | -0.48 | -0.54 |
| c.OTEX | -1.64 | -0.88 | -0.97 |
| average | -0.86 | -0.41 | -0.47 |
| f.USLAB | 1.83 | 1.21 | 1.32 |

Table 5. Income change per households

| Household | (% change) | | |
|-----------|------------|--------|--------|
| | case 1 | case 2 | case 3 |
| HH1 | -0.53 | -0.03 | -0.09 |
| HH2 | -0.51 | -0.02 | -0.08 |
| HH3 | -0.30 | 0.08 | 0.04 |
| HH4 | 0.08 | 0.28 | 0.26 |
| HH5 | 0.01 | 0.24 | 0.23 |

Table 6. Welfare change in terms of compensated variation and equivalent variation

| Household | CV | | | EV | | |
|-----------|--------|--------|--------|--------|--------|--------|
| d | case 1 | case 2 | case 3 | case 1 | case 2 | case 3 |
| HH1 | 1.72 | 6.96 | 6.37 | 2.31 | 7.19 | 6.64 |
| HH2 | 3.93 | 8.30 | 7.82 | 4.57 | 8.55 | 8.12 |
| HH3 | 15.96 | 15.61 | 15.83 | 16.73 | 15.92 | 16.19 |
| HH4 | 47.56 | 34.90 | 36.91 | 48.64 | 35.31 | 37.40 |
| HH5 | 48.43 | 35.50 | 37.48 | 49.77 | 36.07 | 38.14 |