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The Impact of a Philippine-US FTA: The Case of Philippine Agriculture

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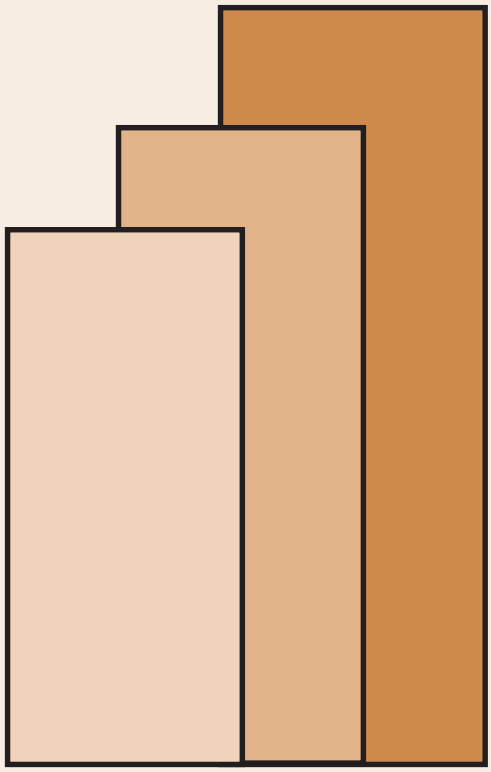
DISCUSSION PAPER SERIES NO. 2006-06



February 2006

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THE IMPACT OF AN RP-US FTA: THE CASE OF PHILIPPINE AGRICULTURE

U-Primo E. Rodriguez and Liborio S. Cabanilla

Abstract

The paper examines the effect of an RP-US FTA in the Philippine agricultural sector. Using an Applied General Equilibrium (AGE) Model, it analyzes the impact of the removal of tariffs on imports from the US on the various commodities in agriculture and food processing. The simulation results suggest that most of the commodities in these sectors experience gains in output and employment following the removal of Philippine tariffs on its imports from the U.S. It also shows that the benefits of agriculture and food processing from the FTA are larger with a comprehensive removal of tariffs.

Keywords: Philippine agriculture production, consumption and employment, foreign and domestic markets, tariff change and removal, economic modelling

This paper is part of the "RP-US FTA Research Project" of the Philippine APEC Study Center Network, Philippine Institute for Development Studies. The authors wish to thank Cielito Habito, Mario Lamberte and Erlinda Medalla for their comments on an earlier draft. The usual disclaimer applies.

THE IMPACT OF A PHILIPPINES-US FTA: THE CASE OF PHILIPPINE AGRICULTURE

U-Primo E. Rodriguez and Liborio S. Cabanilla

1. INTRODUCTION

This paper analyzes the implications of establishing a free trade area between the United States (US) and the Philippines. In particular, it evaluates the effects of the agreement on production, consumption and employment in Philippine agriculture and food processing.

The analysis is carried out using an Applied General Equilibrium (AGE) model. This tool has been widely used in the analysis of trade policies in general and regional trading arrangements in particular.[1] Its appeal arises from the explicit treatment substitution possibilities among various commodities in production and consumption. Moreover, AGE models capture the interaction between various agents and markets in an economy. Such models therefore facilitate the analysis of the effects of policies on a wide range of economic variables.

The remainder of this paper is organized as follows. Section 2 describes the model that will be used in the analysis. Section 3 discusses the different experiments and key outcomes. Section 4 concludes.

2. DESCRIPTION OF THE MODEL

The analysis uses a revised version of the AGE model developed by Inocencio et al. (2001). The original model was designed to evaluate the effects of economic policies,

[1] Examples of applications to regional trading agreements are Cororaton (2004), Wolf (2000), Oktaviani and Drynan (2000), Diao and Somwara (2000), Bandara and Yu (2001), Lewis et al. (1999), Lewis et al. (1995).

environmental policies and exogenous shocks on different economic variables. To address the concerns of this paper, the model was revised by disaggregating Philippine exports and imports by source and destination. In particular, it explicitly identifies Philippine trade with the US. The succeeding will paragraphs describe the basic features of the original model. This is followed by an account of the revisions that were made to suit the objectives of this paper.[2]

The original model

The original model is disaggregated into 40 goods and services. Eight of these commodities can be classified as part of *Agriculture, Fishery and Forestry*. These are (1) *Palay*, (2) *Corn*, (3) *Vegetables, fruits and nuts,*(4) *Coconut and Sugar cane,* (5) *Livestock, poultry and other animals,* (6) *Fishery*, (7) *Other Agricultural Production*, (8) *Forestry*. On the other hand, *Food processing* is composed of (1) *Rice and corn milling*, (2) *Milled Sugar*, (3) *Meat manufacturing*, (4) *Fish Manufacturing*, (5) *Beverage and tobacco manufacturing,* (6) *Other food manufacturing*. The remaining 26 commodities of the model belong to the (other) *Industry* and *Services* sectors.

The model has five major blocks. These are production, households, government, foreign trade and the environment.

Each commodity in the production block has a representative firm that uses capital, labor and intermediate goods to produce its gross output. This firm is assumed to be an optimizing agent (i.e., maximizes profits) that is operating in a perfectly

[2] The interested reader can consult the appendix for a listing of the equations, variable definitions and disaggregation of the model. For a more comprehensive discussion, also see Inocencio et al (2001).

competitive market. The outcomes from the optimization process are used to specify the input demand and output supply equations in the model.

The output of the representative firm is sold to domestic and foreign markets (export supply). These are determined by assuming that the firm seeks to maximize its revenues from selling to these markets. In doing so, the firm is assumed to be constrained by its gross output, prices and an aggregator represented by a constant elasticity of transformation (CET) function.

The household block is disaggregated into three income groups. These are low, middle and high income households. Each of these groups is assumed to have representative household that is endowed with capital and labor. Payments to capital and labor, along with net transfer payments, represent the income of these households. This income is then allocated for savings, taxes and consumption.

The consumption of goods and services is determined through an optimization process. The representative household is assumed to maximize its utility or satisfaction by selecting the quantities of goods and services it will consume subject to given prices and desired spending (income less taxes and savings).

The government generates revenues mainly through taxes on income, transactions and imports. Its collections are then allocated for goods and services and net transfers. Any discrepancy between government revenues and outlays is then reflected though the budget deficit.

The foreign trade block captures exports and imports. It is modeled under the assumption that the Philippines is a price taker in world markets. This assumption suggests that the import supply and export demand functions are perfectly elastic. Import demands are determined by imposing the Armington assumption – i.e., imports are differentiated by source.

The major blocks are integrated by means of equilibrium conditions. The supply side is composed of the output of domestic firms and imports. On the other hand, the demand side is composed of government spending on goods and services, household consumption, intermediate demand and exports (foreign demand). These equilibrium conditions determine domestic prices in the model.

The data for the model is based primarily on a Social Accounting Matrix (SAM) that was constructed using the 1994 Input-Output table.

Revisions to the basic model

The basic model does not disaggregate imports and exports by source and destination. The objectives of the paper therefore make it necessary to modify model in to explicitly account for Philippine imports coming from and exports going to the US.

The modifications to the model equations were implemented by imposing the Armington assumption. This suggests that imports from the US are not perfectly substitutable with those coming from the rest of the world (ROW). Philippine exports to the US and ROW are also assumed to be differentiated.

The import demand equations, by source, are derived as follows. It is assumed that the objective of the domestic agent is to find the combination of the imports from the US and ROW that will minimize the total cost of imports. This optimizing process is implemented under the assumption that total imports and import prices (by source) are given. It also assumes that the total imports of a specific commodity is a Constant Elasticity of Substitution (CES) composite of imports from the US and ROW. The first order conditions from this process are used as the equations for the import demands from the US and ROW.

The key properties of the resulting equations are as follows. First, the import demand from a particular source is inversely related to its relative price. In other words, the Philippine demand for US-made goods will decline if there is an increase in the price of US imports relative to ROW imports. Second, the import demand from a particular source is positively related to the demand for total imports. That is, the demand for US imports (and ROW imports) will rise if the total imports higher.

The specification of the export supply equations, by destination, proceeds along the same lines. However, the objective of the firm is to find the combination of US and ROW exports which will maximize the revenues from exporting. The optimizing process is implemented under the assumption that total exports and export prices (by destination) are given. It also assumes that the total exports of a given commodity is a Constant Elasticity of Transformation (CET) composite of exports destined for the US and ROW. The first order conditions from this process are used as the export supply equations for the US and ROW.

The key properties of the export supply equations are as follows. First, exports to a particular destination are positively related to its relative price. In other words, domestic firms want to sell more to the US if there is an increase in US export prices relative to ROW export prices. Second, exports to a particular destination are positively related to total exports. That is, US exports (and ROW exports) will rise if total exports higher.

Apart from the revising the equations of the model, there was also a need to modify the SAM to capture the spatial features of exports and imports. This was implemented by computing the average share of the US in the Philippine exports and imports of each commodity. The average shares were calculated using disaggregated trade data from the Department of Trade and Industry for the period 2001-2003.[3] Exports to and imports from US were then obtained by multiplying the relevant shares to their respective totals in the SAM.

3. SIMULATION RESULTS

3.1 Description of experiments

In the absence of information regarding the final structure of the free area between the Philippines and US, six experiments were explored in the simulations. Experiment A assumes that all Philippine tariffs on US imports are removed. On the other hand, Experiments B and C focus on the selective removal of Philippine tariffs on US imports. Experiment B assumes that the tariff removal is confined only to agriculture and food processing. In contrast, Experiment C exempts these sectors from the tariff changes.

[3] The basic data was downloaded from http://tradeline.dti.gov.ph .

For each experiment, there is an additional simulation involving a one percent increase in a set of export prices. This is an attempt to capture the possible opening-up of US market to Philippine exports The changes in export prices follows the theme for each experiment. In Experiment A, the tariff cuts were augmented by an across the board increase in the export prices of goods destined for the US. On the other hand, only the export prices of agriculture and food processing were increased for Experiment B. Finally, only the export prices of goods and services that are not included in agriculture and food processing were allowed to change in Experiment C.

The model was solved under a Keynesian closure in which the wage rate is assumed to be exogenously determined.

3.2 Effects on Import Prices

Since the Philippines is assumed to be a small open economy, the elimination import tariffs will be directly reflected in changes in the domestic price of imports from the US. As larger tariff cuts lead to larger declines in import prices, the results presented here therefore reflect the extent to which the country's domestic markets receive tariff protection. With tariff rates on imports from the ROW held constant, the elimination of tariffs on US imports eventually affect the domestic of Philippine imports from all sources. The magnitude of these changes will now reflect the size of tariff cuts and the share of the US in total Philippine imports.

Table 1 shows the changes in the domestic prices of imported goods. Experiments A and B suggest a 32.21 and 26.08 percent decline in the share weighted average of US import prices of agriculture and food processing, respectively. In contrast, Experiment C,

as it exempts agriculture and food processing, indicates that US import prices remain constant.

Along with changes in tariff rates for other commodities, these changes translate to a decline of 2.05 to 17.59 percent in the average import price of all commodities sourced from the US. These results capture the fact that agriculture and food processing as a whole receive higher tariff protection than other goods and services. Moreover, smaller decline in the import prices of all commodities in Experiment B (= -2.05 percent) compared to in Experiment C (= -15.54 percent) suggests that imports agriculture and food processing account for a relatively small proportion of total US imports.

3.3 Production and employment

Table 2 shows the potential impacts of an FTA on output and employment. It indicates that the free trade area is likely to cause an increase in the output of agriculture (0.02 to 0.13 percent) and food processing (0.06 to 0.17 percent). This also translates into higher employment. The potential expansion for agriculture is between 0.06 to 0.33 percent. On the other hand, the increase in employment in food processing ranges from 0.22 to 0.52 percent.

The results suggest a number of patterns that are likely to emerge from the formation of a free trade area with the US. First, the expansion in the output of food processing is likely to be larger than agriculture. Second, the largest expansion in output is likely to be realized from a comprehensive elimination of tariffs. This can be seen by comparing the output responses in Experiment A with the other experiments. Third, confining the tariff changes to agriculture and food processing generates the least benefits

to these sectors. This follows from the finding that Experiment B has the smallest increases in the output and employment. Fourth, the bulk of the gains to agriculture and food processing are likely to come from the removal of tariffs elsewhere in the economy. This can be observed from the finding that the output gains in Experiment C are larger than in Experiment B. Fifth, the increase in export prices is likely to magnify the expansion in the aggregate outputs of agriculture and food processing. In Experiment A for example, the output of food processing is 0.02 percentage points higher in the case where export prices are allowed to increase.

A disaggregated analysis reveals that almost all commodities in agriculture and food processing are likely to expand with the formation of a free trade area (see Table 3). *Corn* is the only commodity that experiences a contraction. Moreover, *Meat Manufacturing* and *Livestock and Poultry* are likely to experience the largest gains in output. This result generally holds for all experiments. The only exception here is the relatively large expansion in *Fish Manufacturing* in Experiment C.

The contraction of *Corn* output occurs in Experiments A and B. Without going into the details, this can readily be attributed to the tariff cuts in *Corn* in particular and agriculture in general.[4] The basis for this statement is the result in Experiment C, which shows that *Corn* output expands when it is exempted from the tariff cuts.

The expansion in *Meat Manufacturing* and *Livestock and Poultry* may be explained by the increase in their respective net prices. This implies that producers of these commodities are receiving more for each unit of the good is sold. The fact that this

[4] Without going into the actual data in the model, this can be seen in Table 1 where the cut in the domestic prices of imported corn is among the largest following the tariff cuts.

happens despite the decline in the market prices of their output highlights the benefits of conducting an economywide analysis. The net price of a good is the market price less the price of intermediate inputs and indirect taxes. With indirect taxes held constant, the increase in the net price suggests that the prices of intermediate inputs must have declined by a larger proportion than the market price.

3.4 Results for consumption and household incomes

Table 4 shows that a free trade area with the US can lead to higher incomes for Philippine households. Moreover, the pattern of changes is similar to what was observed for outputs. That is, the benefits are largest for Experiments A and C.

Apart from higher incomes, the results for Experiments A and C suggest the potential for reducing income inequality. This can be seen from the finding that *Low Income* (*High Income*) households experience the largest (*smallest*) increase incomes. In contrast, the results for Experiment B indicate that the income increase in the *Low Income* household is the smallest among the different groups. This suggests that confining the removal of trade barriers to agriculture and food processing can actually be regressive.

Table 5 shows that the tariff changes lead to higher household consumption of commodities produced by agriculture and food Processing. In Experiment A, for example, the changes range from 0.09 percent in *Rice and Corn Milling* to 0.83 percent in *Corn*. As a whole, the increase in consumption is explained mostly by the increase in household incomes.

Differences in the magnitude of the changes across commodities are generally explained by the composite prices of the commodities.[5] In Experiment A, for example, *Rice and Corn Milling* experiences the smallest increase in consumption (=0.12 percent) because it experiences a relatively large increase in its composite price (=0.15 percent). On the other hand, *Corn* experiences the largest increase in consumption (=0.83 percent) because it experiences a relatively large decrease in its composite price (= - 0.59 percent).

Experiments A and B indicate the largest increases in consumption. This reflects the fact that tariffs on agriculture and food processing were removed in these experiments. Such a removal of tariff rates lead to relatively large declines (or small increases) in the composite price of goods. For example, the composite price of *Corn* declines by 0.59 and 0.54 percent in Experiments A and B, respectively. In contrast, the decline in the composite price of this commodity is only 0.05 percent in Experiment C.

The results also indicate that the increase in export prices may either raise or reduce the consumption of goods and services. In Experiment A for example, the removal of tariffs causes a 0.12 percent increase in the consumption of *Fish*. However, incorporating the increase in export prices causes a smaller increase in *Fish* consumption (0.04 percent). The same pattern is observed for all other commodities except *Meat Manufacturing* and *Rice and Corn Milling.*

3.5 Effects on Trade

As a whole, the free trade area leads to an expansion of trade. Moreover, the results indicate that the expansion is not limited to trade with the United States.

[5] The composite price of a commodity is the weighted average of its domestic and imported component.

Table 6 indicates the effects of the free trade area on the imports of agriculture and food processing. It shows that Experiments A and B generate the largest increases in total imports at 1.79 and 1.65 percent, respectively.[6] Despite being exempt from tariff cuts, total imports of agriculture and food processing also expand in Experiment C.

As expected, the removal of tariffs in Experiments A and B causes an increase in total imports from the US. This pattern, which is also observed for all commodities in Table 6, may be explained by two factors. First, the increase in domestic consumption tends to raise the demand for imports as a whole. Second, the removal of tariffs on US imports suggest a decline their prices relative to the ROW. Such changes induce a substitution away from ROW imports towards US imports.

Among the various activities, *Corn* and *Rice and Corn Milling* are expected to have the largest increases in imports (from all sources). This may be explained by the finding that these commodities are among the activities that experience the largest increase in imports from the US. Moreover, US imports in these activities account for a relatively large share of their total imports.[7]

In all cases, the tariff changes lead to a small expansion in the exports of agriculture and food processing. Table 7 shows that the change in total exports (to all countries) range from 0.01 to 0.04 percent. These changes are larger when export prices are also allowed to rise. For example, the increase in total exports (to all countries) in

[6] Introducing changes in export prices does not significantly alter this pattern.
[7] In the model, approximately 37 percent *Corn* and *Rice and Corn Milling* imports are sourced from the US.

Experiment A is 0.29 percentage points (*=0.33 – 0.04*) higher in the presence of higher export prices.

A disaggregated analysis indicates the mixed responses for exports. Ignoring the increase in export prices for the moment, *Meat Manufacturing, Livestock and Poultry* and *Fish Manufacturing* consistently experience an expansion in exports. The opposite is true for *Other Agriculture, Milled Sugar, Rice and Corn Milling, Beverage and Tobacco* and *Other food.*

The expansion in the outputs of all the commodities cited in the previous paragraph exerts upward pressure on their respective exports. As such, differences in the export changes can be explained mostly by changes in relative prices. With export prices held constant, changes in the market price emerge as the key variable in explaining the results. *Meat Manufacturing*, for example, had relatively large declines in market prices for all experiments.[8] This implies that the activity experienced the largest increase in the relative price of exports. In contrast, *Other Food* had relatively large increases in market prices for all experiments. This suggests that the relative prices of its exports experienced relatively large declines.

Introducing changes in export prices generally leads to higher exports of the different sectors. In Experiment A for example, the most noticeable of these changes are for *Fish*, *Milled Sugar* and *Other agriculture.* Once again, changes in output and relative prices help explain these findings. First, in most cases, the increase in export prices also leads to larger increases in outputs. Ceteris paribus, this stimulates exports. A similar result

[8] Recall that the effects on market prices are shown in Table 3.

occurs when export prices rise because this makes it more attractive to sell overseas compared to the domestic market.

4. CONCLUDING REMARKS

The results from the experiments suggest that the formation of a free trade area is likely to benefit agriculture and food processing. This is reflected in the finding that the removal of tariff barriers on US imports generally leads to higher output and trade for these sectors. Moreover, benefits are likely to be larger once effects of changes in export prices are factored into the analysis.

The simulations also suggest that the coverage of the free trade area has important implications for agriculture and food processing. Tariff changes confined only to these sectors do little by way of stimulating output and trade. The gains are likely to be larger with a comprehensive removal of trade barriers between the US and the Philippines.

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TABLES

Table 1. Changes in import prices, percent deviation from the base

Item	US Imports			All sources		
	A	B	C	A	B	C
Agriculture	-32.21	-32.21	0.00	-3.47	-3.47	0.00
of which						
Corn	-33.36	-33.36	0.00	-13.36	-13.36	0.00
Fishery	-23.03	-23.03	0.00	-0.56	-0.56	0.00
Forestry	-15.79	-15.79	0.00	0.00	0.00	0.00
Fruits, vegetables and nuts	-33.15	-33.15	0.00	-2.80	-2.80	0.00
Livestock and Poultry	-30.27	-30.27	0.00	-1.66	-1.66	0.00
Other agriculture	-25.25	-25.25	0.00	-0.76	-0.76	0.00
Palay	n.a.	n.a.	n.a.	0.00	0.00	0.00
Food Processing	-26.08	-26.08	0.0	-4.66	-4.66	0.00
of which						
Rice and Corn Milling	-33.32	-33.32	0.00	-13.34	-13.34	0.00
Milled Sugar	-33.33	-33.33	0.00	-4.72	-4.72	0.00
Meat Manufacturing	-26.63	-26.63	0.00	-4.76	-4.76	0.00
Fish Manufacturing	0.00	0.00	0.00	0.00	0.00	0.00
Beverage and Tobacco	-30.17	-30.17	0.00	-4.62	-4.62	0.00
Other food	-27.85	-27.85	0.00	-3.07	-3.07	0.00
All commodities	-17.59	-2.05	-15.54	-2.44	-0.29	-2.15

Table 2. Effects on sectoral output and employment, percent deviation from the base

Item	No change in export prices			With change in export prices		
	A	B	C	A	B	C
Output						
Agriculture Fishery and Forestry	0.12	0.02	0.10	0.13	0.03	0.10
Food Processing	0.15	0.06	0.09	0.17	0.08	0.10
Employment						
Agriculture Fishery and Forestry	0.29	0.06	0.23	0.33	0.08	0.24
Food Processing	0.52	0.22	0.30	0.63	0.29	0.35

Table 3. Effects on output and prices, percent deviation from the base

Item	No change in export prices			With change in export prices		
	A	B	C	A	B	C
Output						
Beverage and Tobacco	0.05	0.02	0.03	0.06	0.02	0.03
Coconut and Sugar	0.06	0.01	0.05	0.10	0.04	0.06
Corn	-0.04	-0.11	0.06	-0.04	-0.10	0.07
Fish Manufacturing	0.21	0.02	0.18	0.32	0.12	0.20
Fishery	0.10	0.01	0.09	0.14	0.05	0.09
Forestry	0.09	0.01	0.08	0.15	0.01	0.14
Fruits and Vegetables	0.14	0.03	0.11	0.14	0.03	0.11
Livestock and Poultry	0.25	0.09	0.17	0.25	0.08	0.18
Meat Manufacturing	0.39	0.18	0.21	0.41	0.18	0.23
Milled Sugar	0.08	0.04	0.04	0.1	0.05	0.04
Other Agriculture	0.09	0.02	0.08	0.10	0.02	0.08
Other Food	0.05	0.03	0.02	0.06	0.04	0.02
Palay	0.03	0.01	0.02	0.03	0.01	0.02
Rice and Corn Milling	0.03	0.01	0.02	0.03	0.01	0.02
Market price						
Beverage and Tobacco	0.39	0.20	0.19	0.41	0.21	0.20
Coconut and Sugar	-0.02	0.00	-0.03	0.00	0.02	-0.02
Corn	-0.08	-0.03	-0.05	-0.08	-0.03	-0.05
Fish Manufacturing	0.00	-0.01	0.01	0.05	0.04	0.01
Fishery	0.11	0.00	0.11	0.19	0.07	0.12
Forestry	0.49	0.03	0.46	0.84	0.04	0.80
Fruits and Vegetables	0.13	0.04	0.09	0.14	0.04	0.10
Livestock and Poultry	-0.02	-0.03	0.01	-0.01	-0.02	0.01
Meat Manufacturing	-0.07	-0.05	-0.02	-0.08	-0.05	-0.03
Milled Sugar	0.33	0.13	0.20	0.46	0.25	0.21
Other Agriculture	0.12	0.03	0.09	0.14	0.04	0.10
Other Food	0.56	0.36	0.20	0.66	0.44	0.21
Palay	-0.05	0.00	-0.05	-0.05	0.00	-0.04
Rice and Corn Milling	0.30	0.09	0.21	0.30	0.08	0.22
Net price						
Beverage and Tobacco	1.79	0.71	1.07	1.83	0.72	1.11
Coconut and Sugar	0.04	0.01	0.04	0.07	0.03	0.04
Corn	0.00	0.00	0.00	0.00	0.00	0.00
Fish Manufacturing	0.22	0.03	0.20	0.34	0.13	0.21
Fishery	0.23	0.02	0.21	0.32	0.11	0.21
Forestry	0.67	0.04	0.63	1.11	0.06	1.06
Fruits and Vegetables	0.27	0.05	0.22	0.28	0.06	0.22
Livestock and Poultry	0.12	0.04	0.08	0.13	0.04	0.09
Meat Manufacturing	0.15	0.07	0.08	0.15	0.07	0.08
Milled Sugar	1.55	0.71	0.84	1.95	1.06	0.88
Other Agriculture	0.21	0.04	0.17	0.22	0.05	0.17
Other Food	2.13	1.25	0.88	2.42	1.49	0.93
Palay	0.00	0.00	0.00	0.00	0.00	0.00
Rice and Corn Milling	1.28	0.49	0.78	1.30	0.48	0.82

Table 4. Effects on household income, percent deviation from baseline

Item	No change in export prices			With change in export prices		
	A	B	C	A	B	C
Gross Income						
Low Income	0.28	0.00	0.28	0.27	-0.01	0.29
Middle Income	0.25	0.01	0.25	0.25	0.00	0.25
High Income	0.24	0.01	0.23	0.24	0.00	0.24
Net Income						
Low Income	0.27	0.00	0.27	0.26	-0.01	0.28
Middle Income	0.24	0.01	0.23	0.24	0.00	0.24
High Income	0.22	0.01	0.22	0.22	0.00	0.22

Table 5. Effects on national consumption, percent deviation from baseline

Item	No change in export prices			With change in export price		
	A	B	C	A	B	C
Consumption spending						
Beverage and Tobacco	0.23	0.18	0.05	0.21	0.16	0.05
Corn	0.83	0.55	0.28	0.82	0.54	0.28
Fish	0.12	0.01	0.12	0.04	-0.07	0.11
Fish Manufacturing	0.23	0.02	0.22	0.19	-0.04	0.23
Fruits and Vegetables	0.16	0.02	0.14	0.15	0.02	0.14
Livestock and Poultry	0.28	0.07	0.21	0.27	0.05	0.22
Meat Manufacturing	0.58	0.33	0.25	0.59	0.32	0.26
Milled Sugar	0.35	0.31	0.04	0.24	0.19	0.05
Other Agriculture	0.13	0.00	0.14	0.11	-0.02	0.13
Other Food	0.56	0.48	0.07	0.48	0.41	0.07
Rice & Corn Milling	0.09	0.07	0.02	0.09	0.07	0.02
Composite price						
Beverage and Tobacco	0.01	-0.17	0.18	0.02	-0.17	0.18
Corn	-0.59	-0.54	-0.05	-0.59	-0.54	-0.05
Fish	0.11	0.00	0.11	0.19	0.07	0.12
Fish Manufacturing	0.00	-0.01	0.01	0.04	0.04	0.01
Fruits and Vegetables	0.07	-0.02	0.09	0.08	-0.02	0.10
Livestock and Poultry	-0.05	-0.06	0.01	-0.04	-0.05	0.01
Meat Manufacturing	-0.35	-0.32	-0.02	-0.35	-0.32	-0.03
Milled Sugar	-0.12	-0.30	0.18	0.00	-0.19	0.19
Other Agriculture	0.10	0.01	0.09	0.12	0.02	0.10
Other Food	-0.32	-0.48	0.16	-0.25	-0.41	0.16
Rice & Corn Milling	0.15	-0.06	0.21	0.15	-0.07	0.21

Table 6. Effects on imports, percent deviation from baseline

Item	No change in export prices			With change in export prices		
	A	B	C	A	B	C
Imports from all countries						
Total	1.79	1.65	0.15	1.79	1.63	0.15
Beverage and Tobacco	1.79	1.69	0.11	1.79	1.68	0.11
Corn	4.82	4.77	0.05	4.83	4.77	0.05
Fish	0.36	0.2	0.16	0.37	0.2	0.17
Fish Manufacturing	0.21	0.01	0.2	0.21	0	0.2
Forestry	0.26	0.02	0.24	0.43	0.02	0.41
Fruits and Vegetables	1.17	1.00	0.17	1.18	1	0.17
Livestock and Poultry	0.81	0.63	0.17	0.81	0.63	0.18
Meat Manufacturing	2.00	1.8	0.2	2.01	1.79	0.21
Milled Sugar	1.85	1.72	0.13	1.83	1.69	0.14
Other Agriculture	0.39	0.28	0.11	0.41	0.29	0.12
Other Food	1.43	1.29	0.14	1.40	1.25	0.15
Palay	0.02	0.01	0.00	0.02	0.01	0.01
Rice & Corn Milling	5.03	4.93	0.09	5.03	4.93	0.09
Imports from US						
Total	16.74	16.57	0.15	16.73	16.56	0.15
Beverage and Tobacco	18.97	18.84	0.11	18.96	18.83	0.11
Corn	19.52	19.46	0.05	19.53	19.47	0.05
Fish	14.07	13.89	0.16	14.08	13.89	0.17
Fish Manufacturing	0.21	0.01	0.20	0.21	0	0.2
Forestry	9.25	8.99	0.24	9.44	8.99	0.41
Fruits and Vegetables	21.99	21.79	0.17	22	21.79	0.17
Livestock and Poultry	19.71	19.51	0.17	19.72	19.5	0.18
Meat Manufacturing	16.21	15.98	0.20	16.22	15.97	0.21
Milled Sugar	21.77	21.61	0.13	21.74	21.58	0.14
Other Agriculture	15.68	15.55	0.11	15.69	15.55	0.12
Other Food	17.56	17.40	0.14	17.53	17.36	0.15
Palay	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Rice & Corn Milling	19.73	19.62	0.09	19.73	19.62	0.09
Imports from ROW						
Total	-0.49	-0.63	0.15	-0.49	-0.65	0.15
Beverage and Tobacco	-0.58	-0.69	0.11	-0.59	-0.7	0.11
Corn	-2.43	-2.48	0.05	-2.43	-2.47	0.05
Fish	0.08	-0.08	0.16	0.09	-0.08	0.17
Fish Manufacturing	0.21	0.01	0.20	0.21	0	0.2
Forestry	0.25	0.02	0.24	0.43	0.02	0.41
Fruits and Vegetables	-0.26	-0.42	0.17	-0.25	-0.42	0.17
Livestock and Poultry	-0.03	-0.21	0.17	-0.03	-0.21	0.18
Meat Manufacturing	-0.45	-0.65	0.20	-0.45	-0.66	0.21
Milled Sugar	-0.58	-0.71	0.13	-0.6	-0.73	0.14
Other Agriculture	0.01	-0.10	0.11	0.02	-0.09	0.12
Other Food	-0.14	-0.28	0.14	-0.17	-0.31	0.15
Palay	0.02	0.01	0	0.02	0.01	0.01
Rice & Corn Milling	-2.23	-2.32	0.09	-2.23	-2.32	0.09

Table 7. Effects on exports, percent deviation from baseline

Item	No change in export prices			With change in export prices		
	A	B	C	A	B	C
Exports to all countries						
Total	0.04	0.01	0.04	0.33	0.28	0.05
Beverage and Tobacco	-0.51	-0.27	-0.25	-0.06	0.2	-0.25
Coconut and Sugar	0.10	0.00	0.09	0.58	0.01	0.57
Corn	0.08	-0.06	0.14	0.27	0.13	0.14
Fish	-0.04	0.01	-0.04	0.22	0.27	-0.05
Fish Manufacturing	0.21	0.03	0.17	0.46	0.27	0.19
Fruits and Vegetables	-0.02	-0.02	0.00	-0.02	-0.02	-0.01
Livestock and Poultry	0.28	0.14	0.15	0.27	0.12	0.15
Meat Manufacturing	0.49	0.25	0.24	0.67	0.4	0.27
Milled Sugar	-0.37	-0.14	-0.23	0.55	0.79	-0.24
Other Agriculture	-0.08	-0.02	-0.06	0.05	0.12	-0.07
Other Food	-0.65	-0.41	-0.23	-0.32	-0.08	-0.24
Rice and Corn Milling	-0.42	-0.12	-0.29	-0.24	0.07	-0.3
Exports to US						
Total	-0.08	-0.04	-0.04	1.56	1.54	0.02
Beverage and Tobacco	-0.51	-0.27	-0.25	1.28	1.54	-0.25
Coconut and Sugar	0.10	0.00	0.09	1.90	0.01	1.89
Corn	0.08	-0.06	0.14	2.04	1.89	0.14
Fish	-0.04	0.01	-0.04	1.70	1.76	-0.05
Fish Manufacturing	0.21	0.03	0.17	2.01	1.82	0.19
Fruits and Vegetables	-0.02	-0.02	0.00	1.98	1.99	-0.01
Livestock and Poultry	0.28	0.14	0.15	2.28	2.12	0.15
Meat Manufacturing	0.49	0.25	0.24	2.47	2.19	0.27
Milled Sugar	-0.37	-0.14	-0.23	0.97	1.22	-0.24
Other Agriculture	-0.08	-0.02	-0.06	1.85	1.92	-0.07
Other Food	-0.65	-0.41	-0.23	0.97	1.22	-0.24
Rice and Corn Milling	-0.42	-0.12	-0.29	1.52	1.83	-0.30
Exports to ROW						
Total	0.08	0.02	0.06	-0.08	-0.14	0.06
Beverage and Tobacco	-0.51	-0.27	-0.25	-0.72	-0.46	-0.25
Coconut and Sugar	0.10	0.00	0.09	-0.1	0.01	-0.11
Corn	0.08	-0.06	0.14	0.03	-0.12	0.14
Fish	-0.04	0.01	-0.04	-0.3	-0.25	-0.05
Fish Manufacturing	0.21	0.03	0.17	0	-0.19	0.19
Fruits and Vegetables	-0.02	-0.02	0.00	-0.03	-0.02	-0.01
Livestock and Poultry	0.28	0.14	0.15	0.27	0.11	0.15
Meat Manufacturing	0.49	0.25	0.24	0.45	0.18	0.27
Milled Sugar	-0.37	-0.14	-0.23	-1.01	-0.78	-0.24
Other Agriculture	-0.08	-0.02	-0.06	-0.16	-0.08	-0.07
Other Food	-0.65	-0.41	-0.23	-1.02	-0.78	-0.24
Rice and Corn Milling	-0.42	-0.12	-0.29	-0.48	-0.18	-0.3

APPENDIX
MODEL EQUATIONS, VARIABLES AND DISAGGREGATION

A. MODEL EQUATIONS

Production block

1. Production function (40 equations)

$$X_i = \alpha_i \cdot (\beta_i \cdot L_i^{-\rho_i} + (1-\beta_i) \cdot K_i^{-\rho_i})^{-\frac{1}{\rho_i}}; \qquad i \in I$$

2. Labor demand (40 equations)

$$L_i = X_i \cdot \beta_i^{\sigma_{1i}} \cdot \left(\frac{NP_i}{W}\right)^{\sigma_i}; \qquad i \in I$$

3. Net price or price of value added (40 equations)

$$NP_i = \left(1-\tau_{1i}\right) \cdot P_i - \Gamma_{1i} - \Gamma_{2i} - \Gamma_{3i}; \qquad i \in I$$

where: $\Gamma_{1i} = \sum_j \alpha_{ji} \cdot CP_j; \qquad i \in I, j \in M$

$$\Gamma_{2i} = \sum_j \alpha_{ji} \cdot P_j; \qquad i \in I, j \in N$$

$$\Gamma_{3i} = \sum_j \tau_{4j} \cdot \psi_{ij} \qquad i \in I, j \in F$$

4. Return to fixed capital (40 equations)

$$PIE_i = NP_i \cdot X_i - W \cdot L_i; \qquad i \in I$$

Household Block

5. Aggregate wage revenues (1 equation)

$$WR = \sum_i W \cdot L_i + TR_{l,row} - TR_{row,l}; \qquad i \in I$$

6. Regional wage revenues (2 equations)

$$WR_i = \chi_{1i} \cdot WR; \qquad i \in Z$$

7. Wage revenues of the household (3 households x 2 regions = 6 equations)

$$WR_{ij} = \upsilon_{1ij} WR_j; \qquad i \in H, j = Z$$

8. Net operating surplus (1 equation)

$$NOS = \sum_i PIE_i + TR_{sur,gov} + TR_{sur,row} + TR_{sur,h3}; \qquad i \in I$$

9. Regional Net operating surplus, net of corporate taxes and savings (2 equations)

$$NOS_i = \chi_{2i} \cdot \left(NOS - TR_{sur,row}\right) \cdot (1-\eta_2) \cdot (1-\tau_3); \quad i \in Z$$

10. Net operating surplus of households (3 households x 2 regions = 6 equations)

$$WR_{ij} = \upsilon_{ij} \cdot WR_j; \quad i \in H, j \in Z$$

11. Gross income of households (3 equations)

$$GY_i = \sum_j WR_{ij} + \sum_j NOS_{ij}; \quad i \in H; j \in Z$$

12. Household spending (3 equations)

$$NY_i = (1-\eta_{1i}) \cdot (1-\tau_{2i}) \cdot GY_i + TR_{i,gov} + TR_{i,row} - TR_{i,sur}; \quad i \in H$$

13. Consumption of importable goods (3 households x 33 goods = 99 equations)

$$CON_{ij} = \frac{\gamma_{ij} \cdot NY_i}{CP_j}; \quad i \in H; j \in M$$

14. Consumption of non-traded goods (3 households x 7 goods = 21 equations)

$$CON_{ij} = \frac{\gamma_{ij} \cdot NY_i}{P_j}; \quad i \in H; j \in N$$

Government Block

15. Government revenues (1 equation)

$$GR = \Gamma_1 + \Gamma_2 + \Gamma_3 + \Gamma_4 + \Gamma_5 + \Gamma_6 + \Gamma_7$$

where: $\Gamma_1 = \sum_i \tau_{1i} \cdot P_i \cdot X_i; \quad i \in I$

$$\Gamma_2 = \sum_i \tau_{2i} \cdot GY_i \qquad i \in H$$

$$\Gamma_3 = \tau_3 \cdot \sum_i NOS_i; \quad i \in Z$$

$$\Gamma_4 = \sum_i \tau\_us_i \cdot IMP_i \cdot ER \cdot WIP\_US_i; \qquad i \in MUS$$

$$\Gamma_5 = \sum_i \tau\_row_i \cdot IMP_i \cdot ER \cdot WIP\_ROW_i; \qquad i \in M$$

$$\Gamma_6 = \sum_i \tau_{5i} \cdot \left(\sum_j EMIT_{ij} \right); \quad i \in F, j \in I$$

$$\Gamma_7 = TR_{gov,row}$$

16. Government spending (1 equation)

$$GS = \sum_i P_i \cdot GC_i + \sum_j TR_{j,gov} + TR_{row,gov}; \qquad i \in G; j \in h$$

17. Government surplus (1 equation)

$$GSR = GR - GS$$

Foreign Trade Block

18. Domestic price of imports from the US (32 equations)

$$DP\_US_i = \left(1+\tau\_us_i\right)\cdot WIP\_US_i \cdot ER; \qquad i \in MUS$$

19. Domestic price of imports from the rest of the world (33 equations)

$$DP\_ROW_i = \left(1+\tau\_ROW_i\right)\cdot WIP\_ROW_i \cdot ER; \qquad i \in M$$

20. Domestic price of aggregate imports (33 equations)

$$DP_i = \frac{IMP\_US_i \cdot DP\_US_i + IMP\_ROW_i \cdot DP\_ROW_i}{IMP_i}; \qquad i \in MUS$$

$$DP_i = DP\_ROW_i; \qquad i \in NMUS$$

21. Aggregate imports (33 equations)

$$IMP_i = A_i \cdot \left[\frac{\delta_{1i}}{\left(1-\delta_{1i}\right)} \cdot \frac{P_i}{DP_i}\right]^{\sigma_{2m}}; \qquad i \in M$$

22. Imports from the US (33 equations)

$$IMP\_US_i = IMP_i \cdot \left(\frac{DP_i}{DP\_US_i}\right)^{\sigma_{4i}} \cdot \delta_{3,i}^{\sigma_{4i}}; \qquad i \in MUS$$

$$IMP\_US_i = 0; \qquad I \in NMUS$$

23. Imports from the rest of the world (33 equations)

$$IMP\_ROW_i = IMP_i \cdot \left(\frac{DP_i}{DP\_ROW_i}\right)^{\sigma_{4i}} \cdot \delta_{4i}^{\sigma_{4i}}; \qquad i \in MUS$$

$$IMP\_ROW_i = IMP_i; \qquad i \in NMUS$$

24. Domestic price of exports (35 equations)

$$WEP_i = \frac{WEP\_US_i \cdot EXP\_US_i + WEP\_ROW_i \cdot EXP\_ROW_i}{EXP_i}; \qquad i \in E$$

25. Aggregate Exports (40 equations)

$$EX_i = A_i \cdot \left[\frac{\delta_{2i}}{1-\delta_{2i}} \cdot \frac{WEP_i \cdot ER}{P_i} \right]^{\sigma_{3i}}; \qquad i \in E$$

$$EX_i = 0; \qquad i \in NE$$

26. Exports to the US (35 equations)

$$EXP\_US_I = EXP_i \cdot \left(\frac{WEP\_US_i}{WEP_i} \right)^{\sigma_{5i}} \cdot \delta_{5i}^{\sigma_{5i}}; \qquad i \in EUS$$

$$EXP\_US_i = 0; \qquad i \in NEUS$$

27. Exports to ROW (35 equations)

$$EXP\_ROW_I = EXP_i \cdot \left(\frac{WEP\_ROW_i}{WEP_i} \right)^{\sigma_{5i}} \cdot \delta_{6i}^{\sigma_{5i}}; \qquad i \in EUS$$

$$EXP\_ROW_i = EXP_i; \qquad i \in NEUS$$

28. Trade deficit (1 equation)

$$BAL = \Gamma_1 + \Gamma_2 - \Gamma_3 - \Gamma_4$$

where: $\Gamma_1 = \sum_i WIP\_US_i \cdot ER \cdot IMP\_US_i$; $\quad i \in MUS$

$\Gamma_2 = \sum_i WIP\_ROW_i \cdot ER \cdot IMP\_ROW_i$; $\quad i \in M$

$\Gamma_3 = \sum_i WEP\_US_i \cdot ER \cdot EXP\_US_i$; $\quad i \in EUS$

$\Gamma_4 = \sum_i WEP\_ROW_i \cdot ER \cdot EXP\_ROW_i$; $\quad i \in E$

Environmental Block

29. Emissions per sector (11 x 40 = 440 equations)

$$EMIT_{ij} = \psi_{ij} \cdot X_i; \qquad i \in F; j \in I$$

30. Total emissions (11 equations)

$$EMIT_i = \sum_j EMIT_{ij}; \qquad i \in F; j \in I$$

Other Equations

31. Equilibrium condition for importable goods (33)

$$A_i + IMP_i = CON_i + KF_i + GC_i + \sum_j \alpha_{ij} \cdot X_j; \qquad i \in M; j \in I$$

32. Equilibrium condition for non-importable goods (7 equations)

$$A_i = CON_i + GC_i + KF_i + \sum_j \alpha_{ij} \cdot X_j \; ; \qquad i \in N; j \in I$$

33. Total employment (1 equation)

$$L = \sum_i L_i \; ; \qquad i \in I$$

34. Price index (1 equation)

$$\prod_i \left(\frac{P_i}{\theta_{i,h1}} \right)^{\theta_{i,h1}} = 1; \quad i \in I$$

35. Domestically consumed domestic output (40 equations)

$$A_i = X_i - EX_i \; ; \quad i \in I$$

36. Total savings (1 equation)

$$TSAV = \Gamma_1 + \Gamma_2 + GSR - BAL$$

where: $\Gamma_1 = \eta_2 \cdot (1 - \tau_3) \cdot \sum_i NOS_i \; ; \qquad i \in Z$

$$\Gamma_2 = \sum_i \eta_{1i} \cdot (1 - \tau_{2i}) \cdot GY_i \qquad i \in H$$

37. Capital formation (40 equations)

$$KF_i = \frac{\varphi_i \cdot TSAV}{CP_i}; \quad i \in M$$

$$KF_i = \frac{\varphi_i \cdot TSAV}{P_i}; \quad i \in N$$

38. Composite price (33 equations)

$$CP_i = \frac{DP_i \cdot IMP_i + P_i \cdot A_i}{IMP_i + A_i}; \qquad i \in M$$

B. SETS AND VARIABLE DEFINITIONS

Endogenous variables (total = 1256)

Variables	Domain	Count	Description
A_i	$i \in I$	40	domestic consumption of the domestically produced good
BAL		1	trade balance
CON_{ij}	$i \in I, j \in H$	120	consumption of good i by household j
CP_i	$i \in M$	33	composite price of commodity i
DP_ROW_i	$i \in M$	33	domestic price of imports from the rest of the world
DP_US_i	$i \in MUS$	32	domestic price of imports from the US
DP_i	$i \in M$	33	domestic price of importable commodity i
$EMIT_i$	$i \in F$	11	total of emission i
$EMIT_{ij}$	$i \in F, j \in I$	440	emission of i from sector j
EX_i	$i \in I$	40	exports of good i
EXP_ROW_i	$i \in E$	35	exports of good i to the rest of the world
EXP_US_i	$i \in E$	35	exports of good i to the US
GR		1	government revenues
GS		1	government spending
GSR		1	government surplus
GY_i	$i \in H$	3	gross income of household i
IMP_ROW_i	$i \in M$	33	imports of good i from the rest of the world
IMP_US_i	$i \in M$	33	imports of good i from the US
IMP_i	$i \in M$	33	imports of commodity i
KF_i	$i \in I$	40	capital formation for sector i
L		1	total employment
L_i	$i \in I$	40	labor demand in sector i
NOS		1	net operating surplus
NOS_i	$i \in Z$	2	net operating surplus from region i, less corporate savings and corporate taxes
NOS_{ij}	$i \in$ H, j $\in$ Z	6	net operating surplus of household i from region j
NP_i	$i \in I$	40	net price of sector/commodity i
NY_i	$i \in H$	3	total spending of household i
P_i	$i \in I$	40	domestic price of commodity i
PIE_i	$i \in I$	40	return to capital in sector i
$TSAV$		1	total savings
WEP_i	$i \in E$	35	world price of exports
WR		1	aggregate wage revenues
WR_i	$i \in Z$	2	wage revenues of region i
WR_{ij}	$i \in H, j \in Z$	6	wage revenue of household i from region i
X_i	$i \in I$	40	output of sector/commodity *i*

Exogenous variables and parameters

Variables	Domain	Description
ER		exchange rate
K_i	$i \in I$	capital stock in sector *i*
$TR_{gov,row}$		transfers to the government from the rest of the world
$TR_{i,gov}$	$i \in H$	transfers to household i from the government
$TR_{i,row}$	$i \in H$	transfers to household i from the rest of the world
$TR_{i,sur}$	$i \in H$	transfers to household i from surplus
$TR_{l,row}$		transfers of wage earnings from the rest of the world
$TR_{row,l}$		transfers of wage earnings to the rest of the world
$TR_{sur,gov}$		transfers of surplus from government
$TR_{sur,h3}$		transfers of surplus from the 3rd household group
$TR_{sur,row}$		transfers of surplus from the rest of the world
W		wage rate
WEP_ROW_i	$i \in E$	foreign price of exports to the ROW
WEP_US_i	$i \in EUS$	foreign price of exports to the US
WIP_ROW_i	$i \in M$	foreign price of imports from the ROW
WIP_US_i	$i \in MUS$	foreign price of imports from the US
α_i	$i \in I$	Constant in the production function
α_{ij}	$i \in I, j \in I$	input-output coefficient
β_i	$i \in I$	weights in the production function
δ_{1i}	$i \in M$	share parameter in the Armington function
δ_{2i}	$i \in M$	share parameter in the transformation function (i.e., between exports and domestic output)
δ_{3i}	$i \in MUS$	share parameter for the US in the US-ROW Armington function
δ_{4i}	$i \in MUS$	share parameter for the ROW in the US-ROW Arminton function
δ_{5i}	$i \in EUS$	share parameter for the US in the US-ROW transformation function
δ_{6i}	$i \in EUS$	share parameter for the ROW in the US-ROW transformation function
γ_{ij}	$i \in H, i \in I$	share of spending of good n or m in the total spending of household *i*
η_{1i}	$i \in H$	savings rate of household *i*
η_2		corporate savings rate
φ_i	$i \in I$	share of capital formation in total savings
$\theta_{i,h3}$	$i \in I$	share of good *i* in the total spending of household 3
ρ_i	$i \in I$	$=\left(1-\sigma_{1i}\right)^{-1}$
σ_{1i}	$i \in I$	elasticity of substitution between capital and labor in the production function
σ_{2i}	$i \in M$	elasticity of substitution between domestic goods and imports
σ_{3i}	$i \in E$	elasticity of transformation between domestic goods and exports
σ_{4i}	$i \in MUS$	elasticity of substitution between US and ROW imports
σ_{5i}	$i \in EUS$	elasticity of transformation between US and ROW exports

τ_row_i	$i \in M$	tariff rate on ROW imports of good i
τ_us_i	$i \in MUS$	tariff rate on US imports of good i
τ_{1i}	$i \in I$	indirect tax rate on sector i
τ_{2i}	$i \in H$	income tax rate for household *h*
τ_3		corporate tax rate
τ_{5i}	$i \in F$	tax rate on emission *f* (pesos per ton)
ψ_{ij}	$i \in F, j \in I$	emissions of pollutant f from the production of good *i* (in tons per million pesos)

Sets

Symbol	Description	Relationships
E	exportable commodities	$E \subset I$
EUS	commodities exported to the US	$EUS \subset E$
F	emissions	
G	commodities consumed by government	$G \subset I$
H	households	
I	all commodities	
M	importable commodities	$M \subset I$
MUS	commodities imported from the US	$MUS \subset M$
N	non-importable commodities	$N \subset I;\ M \cap N = 0$
NE	commodities non-exported	$NE \subset I;\ NE \cap E = 0$
NEUS	commodities not exported to the US	$NEUS \subset E;\ NEUS \cap EUS = 0$
NMUS	commodities not imported from the US	$NMUS \subset M;\ NMUS \cap MUS = 0$
Z	regions	

Set Composition

Set	Count	Elements
E	35	CORN, FRVE, COCSUG, LIVPOUL, FISH, OAGRI, MINE, RICECORN, MSUGAR, MEATMAN, FISHMAN, BEVTOB, OFOOD, TLEATAN, GARLEAMAN, WOOD, PAPER, CHEM, PETRO, CEMENT, ONONMET, METAL, ELEC, TRAMAN, OMAN, CONST, ELECGAS, WATER, TRANSER, TRADE, FINANCE, INSUR, PRIVEDU, PRIVHEA, OSERV
EUS	33	CORN, FRVE, COCSUG, LIVPOUL, FISH, OAGRI, MINE, RICECORN, MSUGAR, MEATMAN, FISHMAN, BEVTOB, OFOOD, TLEATAN, GARLEAMAN, WOOD, PAPER, CHEM, PETRO, CEMENT, ONONMET, METAL, ELEC, TRAMAN, OMAN, CONST, TRANSER, TRADE, FINANCE, INSUR, PRIVEDU, PRIVHEA, OSERV
F	11	BOD5, SS, TDS, OIL, N, P, PM, SOX, NOX, VOC, CO
G	3	PUBEDU, PUBHEA, GENGOV
H	3	HH1, HH2, HH3
I	40	PAL, CORN, FRVE, COCSUG, LIVPOUL, FISH, OAGRI, FORR, MINE, RICECORN, MSUGAR, MEATMAN, FISHMAN, BEVTOB, OFOOD, TLEATAN, GARLEAMAN, WOOD, PAPER, CHEM, PETRO, CEMENT, ONONMET, METAL, ELEC, TRAMAN, OMAN, CONST, ELECGAS, WATER, TRANSER, TRADE, FINANCE, INSUR, PRIVEDU, PRIVHEA, PUBEDU, PUBHEA, GENGOV, OSERV
M	33	PAL, CORN, FRVE, LIVPOUL, FISH, OAGRI, FORR, MINE, RICECORN, MSUGAR, MEATMAN, FISHMAN, BEVTOB, OFOOD, TLEATAN, GARLEAMAN, WOOD, PAPER, CHEM, PETRO, CEMENT, ONONMET, METAL, ELEC, TRAMAN, OMAN, CONST, TRANSER, FINANCE, INSUR, PRIVEDU, PRIVHEA, OSERV
NMUS	1	PAL
N	7	COCSUG, ELECGAS, WATER, TRADE, PUBEDU, PUBHEA, GENGOV
NE	5	PAL, FORR, PUBEDU, PUBHEA, GENGOV
NEUS	2	ELECGAS, WATER
MUS	32	CORN, FRVE, LIVPOUL, FISH, OAGRI, FORR, MINE, RICECORN, MSUGAR, MEATMAN, FISHMAN, BEVTOB, OFOOD, TLEATAN, GARLEAMAN, WOOD, PAPER, CHEM, PETRO, CEMENT, ONONMET, METAL, ELEC, TRAMAN, OMAN, CONST, TRANSER, FINANCE, INSUR, PRIVEDU, PRIVHEA, OSERV
Z	2	RURAL, URBAN

C. DISAGGREGATION OF THE MODEL

Commodity disaggregation

	Code	Description
1	PAL	Palay
2	CORN	Corn
3	FRVE	Vegetables, fruits and nuts (excluding coconut)
4	COCSUG	Coconut and sugarcane
5	LIVPOUL	Livestock, poultry and other animal products
6	FISH	Fishery
7	OAGRI	Other agricultural production
8	FORR	Forestry
9	MINE	Mining
10	RICECORN	Rice and corn milling
11	MSUGAR	Milled sugar
12	MEATMAN	Meat manufacturing
13	FISHMAN	Fish manufacturing
14	BEVTOB	Beverage and tobacco manufacturing
15	OFOOD	Other food manufacturing
16	TLEATAN	Textile and leather tanning
17	GARLEAMAN	Garments and leather manufacturing
18	WOOD	Wood manufacturing
19	PAPER	Paper and paper products
20	CHEM	Chemicals and plastic products
21	PETRO	Petroleum refineries and misc. products of petrol and coal
22	CEMENT	Cement manufacturing
23	ONOMET	Other non-metallic manufacturing
24	METAL	Metal manufacturing
25	ELEC	Electrical equipment manufacturing
26	TRAMAN	Transport and other machinery manufacturing
27	OMAN	Other manufacturing
28	CONST	Construction
29	ELECGAS	Electricity and gas
30	WATER	Water
31	TRANSER	Transport and Communication services
32	TRADE	Trade, storage and warehousing
33	FINANCE	Financial sector
34	INSUR	Life and non-life insurance and real estate
35	PRIVEDU	Private education services
36	PRIVHEA	Private health services
37	PUBEDU	Public education services
38	PUBHEA	Public health services
39	GENGOV	General government services
40	OSERV	Other services

Household disaggregation

	Symbol	Description
1	HH1	Low Income Household, 1st to 3rd decile
2	HH2	Middle Income Household, 4th – 7th decile
3	HH3	High Income Household, 8 – 10th decile

Emissions

	Symbol	Description
1	BOD5	bio-oxygen demand for 5 days
2	CO	carbon monoxide
3	N	nitrogen
4	NOX	nitrogen oxide
5	OIL	oil
6	P	phosphorus
7	PM	particulate matter
8	SOX	sulfur oxide
9	SS	suspended solids
10	TDS	total suspended solids
11	VOC	volatile organic compounds