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Structural Adjustment Policy Experiments: The Use of Philippine CGE Models

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Structural Adjustment Policy Experiments: The Use of Philippine CGE Models

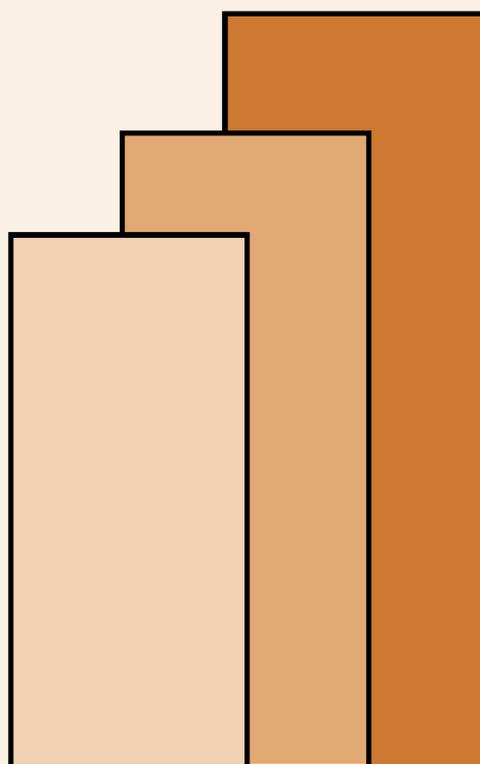
Caesar B. Cororaton

DISCUSSION PAPER SERIES NO. 94-03

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July 1994

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Philippine Institute for Development Studies

**Structural Adjustment Policy
Experiments: The Use of Philippine
CGE Models**

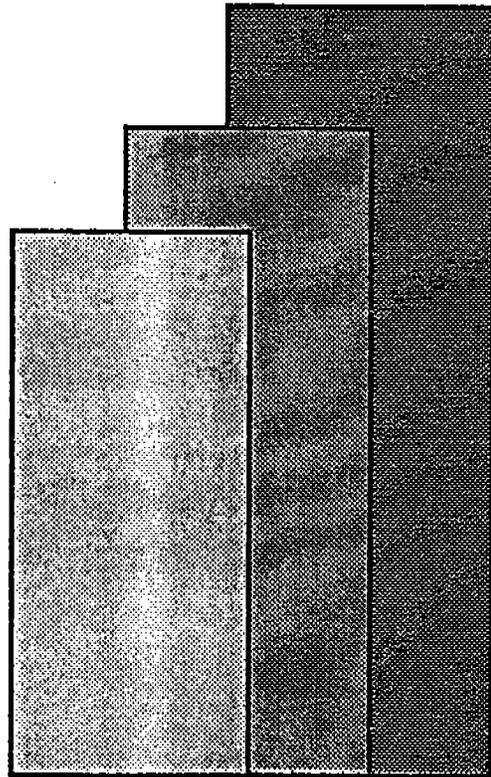
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STRUCTURAL ADJUSTMENT POLICY EXPERIMENTS: THE USE OF PHILIPPINE CGE MODELS*

*Caesar B. Cororaton***

I. INTRODUCTION

There are a number of computable general-equilibrium (CGE) models of the Philippine economy.¹ This paper assessed only four:

- 1) the APEX model;
- 2) Habito's second version of the PhilCGE model;
- 3) Cororaton's CGE model; and
- 4) Bautista's first CGE model.

These models were assessed by reviewing their general structure and by conducting actual simulations using the models of different policies under various economic environments.

This study selected these models for a number of reasons. First, since an assessment involves running the models, becoming familiar with both the structure of the models and the computer programs used to solve to models will take too much time. Second, these models are representative, in terms of sectoral coverage, of the range of constructed CGE models of the Philippine economy. They include the largest CGE model of the Philippine economy (APEX), two medium-size CGE models (PhilCGE and Cororaton's), and the smallest constructed general-equilibrium model (Bautista's). They also represent the two schools of thought in CGE modeling: the well-defined neoclassical, Walrasian, general-equilibrium school where the market-clearing variable is price, and the non-Walrasian or structuralist school, where the

*The paper is presented during the technical workshop of the Micro Impacts of Macroeconomic Adjustment Policies (MIMAP) Project Phase III held on February 17-18, 1994 at the Caylabne Bay Resort, Ternate, Cavite.

**Research Fellow, Philippine Institute for Development Studies (PIDS). Marly Cagalingan provided research assistance.

1. Among these are APEX (1992), Bautista, C. (1987, 1992), Bautista, R. (1986), Clarete (1984, 1991), Cororaton (1989), Gaspay (1993), Go (1988), Habito (1984, 1989), and Jainio and Vos (1993).

market-clearing variable is quantity.² The APEX, PhilCGE, and Cororaton models are based on the neoclassical general-equilibrium paradigm, while the Bautista model is based on the structuralist framework.

Lastly, the APEX and PhilCGE models are among the most recently constructed.³ Except for a document describing the APEX model, there are no published papers or written reports based on the APEX model simulations. Only Manasan (1989) reports simulation results based on the second version of PhilCGE. The simulation results of the Cororaton and the Bautista models, however, are documented.

This paper is divided into six sections. Section II discusses the structure of the APEX model and assesses the simulation results of policy experiments. Section III describes the structure of PhilCGE and conducts a number of policy experiment runs using the model. Section IV gives a general overview of the CGE model of Cororaton, its essential features, and simulation results. Section V presents the structure of Bautista's model and comments on structuralist CGE models.

The objective of the paper is to see whether existing CGE models of the Philippine economy can readily be adopted to assess and track down the micro impacts of structural adjustment policies. The paper will attempt to suggest necessary modifications if they cannot be readily adopted to address the concerns of the MIMAP project.

II. THE APEX MODEL

A. *The Analytics of the Model*

The Agricultural Policy Experiments (APEX) model is patterned after the Johansen (1962) class of applied general equilibrium models.⁴ The Johansen-type model is written as a system of linear equations in percentage changes of the variables.⁵ For example, rather than

$$(1) \quad Y = f(X_1, X_2),$$

2. There is an ongoing tension between these two schools because, although the neoclassical CGE models are built within the paradigm of the Arrow-Debreu general-equilibrium model, they omit many important structural features of developing countries. Structuralist CGE models, however, attempt to include these features.

3. The most recent CGE model is Gaspay's (1993). Unfortunately, the author got hold of the Gaspay model only when writing of this paper was almost done.

4. Another famous Johansen-type CGE model is the Orani model of the Australian economy, which is twice as big as the APEX model.

5. For a detailed treatment of a two-sector model, see Dixon *et al.* (1982).

where Y is output and X_1 and X_2 are inputs, a Johansen-type model is written in linear percentage change form

$$(2) \quad y - e_1x_1 - e_2x_2 = 0,$$

where e_i is the elasticity of output with respect to inputs of factor i , and y , x_1 and x_2 are the percentage changes in Y , X_1 , and X_2 .

In matrix notation, this type of model can be represented by

$$(3) \quad Az = 0,$$

where A is an $(m \times n)$ matrix of coefficients and z is an $(n \times 1)$ vector of percentage changes in the model's variables. Since the A matrix is assumed fixed, (3) provides only a local representation of the equations suggested by economic theory, i.e., this equation is valid only for "small" changes in X_1 and X_2 .

Through appropriate closure, z may be partitioned into a vector of endogenous variables (y^*) and a vector of exogenous variables (x^*).⁶ Once the choice of exogenous variables has been made, (3) can be rewritten as

$$(4) \quad A_1y^* + A_2x^* = 0.$$

Provided A_1 is invertible, one can proceed from (4) to the solution

$$(5) \quad y^* = -A_1^{-1}A_2x^*.$$

This equation expresses the percentage change in each endogenous variable as a linear function of the percentage changes in the exogenous variables.

The exogenous variables can be chosen in many different ways. In fact, much of the flexibility of the APEX, as well as the Orani model, in policy applications arises from the user's ability to swap exogenous and endogenous variables.

B. *General Description*⁷

To date, the APEX model is the most disaggregated applied general equilibrium or computable general equilibrium model of the Philippine economy. On the production side, the model has 50 producer goods and services sectors. Twelve are agricultural products, while the remainder are non-agricultural sectors (Table 1). All 50 sectors are produced in 41 industries.

6. To solve this model $(n-m)$ variable must be declared exogenous.

7. Based on Clarete and Warr (1992).

TABLE 1
Sectoral Breakdown: The APEX Model

SECTOR
1 Irrigated Palay
2 Non-irrigated Palay
3 Corn
4 Coconut, incl. Copra
5 Sugarcane
6 Banana & Othr fruits & nuts
7 Vegetable
8 Rootcrops
9 Othr Commrc'l crops
10 Hogs
11 Chicken & Poultry Prods.
12 Other Livestock
13 Agricultural Services
14 Marine Fishing
15 Inland Fishing
16 Forestry & Logging
17 Crude Oil, Coal & Natural Gas
18 Other Mining
19 Rice & Corn Milling
20 Sugar Milling & Refining
21 Milk & Dairy
22 Oils & Fats
23 Meat & Meat Products
24 Flour Milling
25 Animal Feeds
26 Other Foods
27 Beverages & Tobacco
28 Textile & Knitting Mills
29 Other Made-up Textile Goods
30 Garments, Footwear, Leather & Rbr. Ftwr.
31 Wood Products
32 Paper Products
33 Fertilizer
34 Other Rubber, Plastic & Chem. Products excpt rub. ftwr.
35 Products of Coal & Petroleum
36 Non-ferrous Basic Metal Products
37 Cement, Basic Metals & Non-metallic Mineral Prods.
38 Semi-conductors
39 Metal Products & Non-electric Machineries
40 Electrical Machinery, Equipment & Parts
41 Transport Equipment
42 Miscellaneous Manufacturing
43 Construction
44 Electricity, Gas & Water
45 Transport & Communication Services
46 Trade, Storage & Warehousing
47 Banks & Non-banks
48 Life & Non-life Insurance & Real Estate
49 Government Services
50 Other Services

On the demand side, the model has seven categories of consumer goods and five household types.

Agricultural sector. The treatment of the agricultural sector is quite involved. It allows a regional dimension in the model. In fact, APEX is the first CGE model of the Philippine economy to have accounted for differences in production capacities in agricultural products in Luzon, Visayas, and Mindanao.

Differences in regional agricultural production capacities are incorporated in the model by allowing sector-specific fixed capital inputs. For example, the stock of irrigation capital facilities in a given time period is sector-specific capital input in agriculture and in a particular region. That is, these or other facilities are public goods specific to a given locality.

The three regions produce identical sets of products consisting of 12 agricultural crops and livestock products. However, they produce them in different proportions using region-specific production technologies and regional factors of production. Differences in production transformation frontiers are accounted for by the level of region-specific capital inputs such as irrigation, among other factors. Increased availability of these inputs increases the scale of production activity and therefore modifies the production contour of the region's transformation frontier, allowing geographical differences in agricultural production. Specifically, in terms of the design of agricultural production outputs are produced using both region-specific land and other region-specific inputs which are tied up to land, and inputs which are mobile across regions.

To better understand the structure of agricultural production, consider it as a process where production occurs on three levels, each taking place separately in the three regions. The steps are the following.

- 1) Composite regional agricultural output is produced from regional factors of production: fertilizer, unskilled labor, machinery and land.
- 2) The output of each of the seven regional agricultural sub-industries is determined from the regional composite output. Five of the seven regional sub-industries each produce a single commodity output. These are (with the APEX commodity number in parentheses) irrigated paddy (#1), coconut (#4), sugarcane (#5), bananas and other fruits (#6), and other commercial crops (#9).
- 3) The other two regional agricultural sub-industries each produce multiple output: rainfed crops and smallholder production.

The rainfed-crop sub-industry produces three commodities: non-irrigated paddy (#2), corn (#3), and rootcrops (#8). The smallholder sub-industry produces four commodities: vegetables (#7), hogs (#10), chicken and poultry (#11) and other livestock (#12).

The APEX model imposes the normal neoclassical technology assumptions of strictly concave, constant returns to scale production functions. Producers in each region maximize profits subject to the quantities of fixed factors of production, technology, and price of outputs and variable factors of production. Agricultural producers behave as price-takers in both factor and product markets.

Production decisions are shaped by three factors:

- 1) the commodity composition of regional output, which depends on (a) relative commodity prices, and (b) commodity-specific rates of technical change;
- 2) the composition of regional factor demand, which depends on (a) relative factor prices, and (b) factoral rates of technical change;
- 3) the level of composite regional output, which is determined by the supplies of region-specific factors of production, aggregate mobile factor supplies and by the prices of commodity output relative to those of the factors of production.

Other important features of the agricultural sector of the APEX model include:

- 1) regional producers face uniform prices, and
- 2) fertilizer is considered as primary factor input.

Regional producers, while producing agricultural products in different proportions, face uniform prices of commodities and unskilled labor. Influenced by the empirical literature on primary-factor inputs in agriculture, the APEX model treats fertilizer like a primary factor. This means that fertilizer is substituted with primary factors such as labor and land in crop production.

Non-agricultural production. There are 38 non-agricultural sectors in the model. All producers are assumed to maximize profits, treating commodities and factor prices as given. Production can be thought of as occurring in four levels.

- 1) The top level, which uses "value-added" and composite intermediate inputs to produce final output. The technology is "Leontief", which means that the above inputs are used in fixed proportions to produce output.⁸ The fixed proportions can be altered by technical change, but not by changes in relative commodity or factor prices.
- 2) Composite intermediate inputs of each commodity type, which are produced from their imported and domestic sources in proportion to their relative prices. The technology is

8. This assumption is standard in CGE models.

flexible function form, with properties similar to the "Armington" demand function for imported and domestic sources.

- 3) Value-added, which is produced from primary factors of production--specific capital variable and "composite labor."
- 4) Composite labor, which is produced from skilled and unskilled labor in a flexible function form.

Factors of production. Three primary factors are mobile among the various non-agricultural industries: variable capital, skilled and unskilled labor. Variable capital includes non-agricultural land and structures which are not necessarily devoted to any particular line of production activity, such as buildings and related fixed structures. Thus, when relative prices change, owners of such land and capital assets can rent them out to producers who face more favorable terms of trade. Unskilled labor is also freely mobile between non-agricultural and agricultural sectors of the economy. However, skilled labor and variable capital are not used in agriculture. Thus, skilled labor and variable capital are mobile only among the non-agricultural industries of the model.

Skilled labor is defined as workers who can perform tasks requiring more than a specified level of work experience, training, or both. While skilled labor can do unskilled tasks, the model treats these two kinds of labor as distinct.

Consumers and final demands. There are five households classified as quintiles in the personal income distribution. In the model, the first two deciles in the 1988 National Statistical Office (NSO) Family Income and Expenditure Survey (FIES) are combined to become the first quintile, the third and fourth decile as the second quintile, and so on until the fifth quintile.

Households are not distinguished by location (i.e., urban or rural). Each household is assumed to have its own respective endowments in the primary factors in the model. Each household derives its income from the sale of factor services and non-factor income. The sources of household income include labor income, returns to variable and fixed capital, and rental income from letting out farm lands in primary agricultural production. The household's non-factor income consists of lump sum net income transfers from the government.

The household incomes are the basis for computing personal income taxes collected by the government. The resulting disposable incomes are allocated by each household into current consumption and savings.

There are seven consumer goods and services which are directly consumed by the various households in the model (Table 2). They are used as arguments in the underlying utility functions of the various households of the model. Unlike producer goods, consumer goods production requires only intermediate goods as inputs, not primary factors.

TABLE 2
Family Disbursements by Income Quintile and Type of Disbursement
Philippines: 1988 (In Billion Pesos)

TYPE OF DISBURSEMENT	TOTAL DISBURSEMENT (IN PBILLION)	NATIONAL INCOME QUINTILE				
		FIRST	SECOND	THIRD	FOURTH	FIFTH
1. Cereals, roots, fruits, vegetables	78.83	8.92	12.40	14.97	18.01	24.53
2. Meat, dairy & marine products	65.85	4.29	7.17	10.15	15.08	29.15
3. Beverages, tobacco & miscellaneous food	40.01	2.80	4.85	7.03	9.80	15.53
4. Fuel, light, water, transp. & communication	33.89	2.09	3.24	4.44	6.68	17.44
5. Housing, household furniture	59.86	2.36	3.90	6.50	11.45	35.65
6. Clothing, other wear, personal care & effects	25.85	1.41	2.61	3.93	6.00	11.89
7. Other expenditures	38.30	1.10	2.32	3.84	7.44	23.60
TOTAL	342.58	22.98	36.50	50.86	74.45	157.79

Source of basic data: National Statistics Office, Unpublished Tables For Family Income and Expenditures Survey.

Household savings determine the total savings available for investment. The model assumes that only physical capital assets are obtainable using such savings. Financial assets such as bonds, equity, and bank deposits are not incorporated into the model. With this level of savings, additional units of physical capital are produced during the current period. This capital is then allocated to each sector-specific capital goods and the variable capital using their relative user cost.

An implicit financial assets market is assumed to exist whereby every household buys claims to every one of the fixed and variable capital stock. Such claims entitle the household to a portion of the newly produced capital during the current period. On the supply side of such a market are the respective supplies of fixed capital for each of the 50 sectors and the variable capital. Their respective entitlements are then used to update the household's endowment in capital inputs, both fixed and variable.

Foreign trade. Various industries of the model are classified as either export-oriented or import-competing according to the proportion of an industry's imports to its exports. If the ratio exceeds 1.5 then the industry is regarded as producing an importable. The observed exports of this industry are regarded as exogenous. However, if this ratio is less than 0.5, then the industry is export-oriented. For ratios between 0.5 and 1.5, other relevant information was used to classify the industry.

The APEX model assumes the country to be price-taker in imported goods. As in other CGE models, the APEX model imposes imperfect substitutability between imports and locally produced products through the use of the Armington trade elasticities.

Export demand functions in the model have large but finite elasticities. The country can be regarded as a price-taker in a particular commodity in the world markets if the price elasticity of the world demand for the product is very large.

Government sector. The model incorporates three types of indirect taxes: import tariffs, excise taxes, and value-added taxes. Value-added tax revenues are calculated by subtracting taxes on sales from taxes on intermediate input purchases.

In addition to indirect taxes, corporate income tax is incorporated in the model. Corporate income taxes are assessed on the profit generated in each of the non-agricultural industries, or equivalently, on the returns to sector-specific factors of the model. Personal income taxes are imposed on each of the five household types of the model. This and payroll taxes (e.g., social security contributions and medical insurance premiums) as well as several low-yielding tax measures and fees in the economy are treated as lump sum tax measures in the model.

Closure. The version of the model used to simulate the APEX model is Version 1.1 (September 4, 1992) in which a zero change in the balance of payments is imposed. By Walras's law, this restriction equates the economy's savings surplus (or the savings investment gap) to

the fiscal balance of the government. This means that the private sector finances the fiscal deficit of the government. The model does this by introducing a lump sum tax which assumes a positive (negative) value whenever the government incurs a deficit (surplus). This tax is captured in the model by introducing a personal income tax rate shifter. The shifter scales this rate up or down depending upon whether the government is in deficit or surplus.

Data requirements and parameter estimates. The APEX model maximizes the use of empirically estimated behavioral parameters entering its structure. Thus, almost all of the elasticities in the production, consumption, and trade sectors are estimated econometrically using Philippine data.⁹

The benchmark period of the model is 1989. The major sources of data used to calibrate the model are the following.

- 1) 1985 Input-Output Table. This is used to specify the production side of the economy. The 1985 IO table was updated to 1989 using the 1989 National Income Accounts of the Philippines.
- 2) *National Income Accounts for 1989.*
- 3) *1991 Philippine Statistical Yearbook.*
- 4) *1988 Family Income and Expenditure Survey.*
- 5) *1989 Foreign Trade Statistics of the Philippines.*

C. *Simulation Results*^{10, 11}

The version of the APEX model used to simulate the results reported in the paper has 6,895 equations and 10,946 variables.¹²

The paper conducted 14 runs of the APEX model. The runs involved adjustments in the tariff rate, foreign exchange rate, export and import prices in foreign currency, changes in the government borrowing requirements, and changes in the level of reserves (in foreign currency). Table 3 reports the results of eight simulation runs.

The model generates huge volume of numbers per simulation run. The paper presents only the results of a few variables. These are changes in

- 1) gross domestic product,
- 2) aggregate price index,

9. For a detailed discussion on the data set used to calibrate the model see Clarete and Cruz (1992).

10. The author is grateful to Dr. Aniceto Orbeta of PIDS for installing the APEX model in our computer system.

11. The author is aware that the creators of the APEX model are currently modifying it. All simulations reported here, however, are based on the previous specification of the model.

12. See the original documentation for the exact specification.

TABLE 3. Definition of Terms

nominal gdp	: current gross domestic product
nominal gdp	: current gross domestic product
real gdp	: real gross domestic product
pdef	: gdp deflator
cpi	: consumer price index
consexp	: aggregate consumption expenditure
rconsexp	: real consumption expenditure
mdollarv	: value of imports in foreign currency
mpesov	: value of imports in local currency
edollarv	: value of exports in foreign currency
e	: value of exports in local currency
cb	: change in BOP def (in levels, foreign currency)
cd	: change in current account def (in levels, foreign currency)
ck	: change in capital outflow (in levels, foreign currency)
hh1	: household type 1
hh2	: household type 2
hh3	: household type 3
hh4	: household type 4
hh5	: household type 5
EXP1	: tariff rate (across-the-board) up by 1
EXP2	: tariff rate (across-the-board) up by 20
EXP3	: tariff rate (across-the-board) down by -1
EXP5	: foreign exchange rate (forex) up by 1
EXP9	: export prices in foreign currency up by 1
EXP10	: import prices in foreign currency up by 1
EXP11	: tariff rate (across-the-board) down by -1 and forex up by 1
EXP12	: export prices and import prices in foreign currency both up by 1

TABLE 3 (cont'd): Simulations Using the APEX model

Line No.		EXP1	EXP2	EXP3	EXP5	EXP9	EXP10	EXP11	EXP12	
1	nominal gdp	-0.0043	-0.0856	0.0043	1.0000	0.2675	-0.6421	1.0043	-0.3746	
2	real gdp	0.0107	0.2138	-0.0107	0.0000	0.1858	-0.2869	-0.0107	-0.1011	
3	pdef	-0.0150	-0.2994	0.0150	1.0000	0.0818	-0.3552	1.0150	-0.2735	
4	cpi	-0.0096	-0.1914	0.0096	1.0000	0.0864	-0.2941	1.0096	-0.2077	
5	consexp	-0.0092	-0.1835	0.0092	1.0000	0.3082	-0.7282	1.0092	-0.4200	
6	rconsexp	0.0004	0.0079	-0.0004	0.0000	0.2218	-0.4341	-0.0004	-0.2123	
7	mdollarv	-0.0397	-0.7934	0.0397	0.0000	-0.0019	0.5519	0.0397	0.5500	
8	mpesov	-0.0397	-0.7934	0.0397	1.0000	-0.0019	0.5519	1.0397	0.5500	
9	edollarv	-0.0414	-0.8282	0.0414	0.0000	-0.0020	0.5762	0.0414	0.5742	
10	e	-0.0414	-0.8282	0.0414	1.0000	-0.0020	0.5762	1.0414	0.5742	
11	cb	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
12	cd	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
13	ck	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
14	<i>income of HHs from the ownership of factors</i>									
15	1 hh1	-0.0349	-0.6978	0.0349	1.0000	0.0842	-0.6132	1.0349	-0.5290	
16	2 hh2	-0.0360	-0.7197	0.0360	1.0000	0.0869	-0.6323	1.0360	-0.5454	
17	3 hh3	-0.0371	-0.7411	0.0371	1.0000	0.0870	-0.6459	1.0371	-0.5588	
18	4 hh4	-0.0383	-0.7659	0.0383	1.0000	0.0852	-0.6576	1.0383	-0.5724	
19	5 hh5	-0.0442	-0.8833	0.0442	1.0000	0.0954	-0.7533	1.0442	-0.6580	
20	<i>nonfactor income of households</i>									
21	1 hh1	-0.0078	-0.1553	0.0078	1.0000	0.0701	-0.2385	1.0078	-0.1685	
22	2 hh2	-0.0078	-0.1553	0.0078	1.0000	0.0701	-0.2385	1.0078	-0.1685	
23	3 hh3	-0.0078	-0.1553	0.0078	1.0000	0.0701	-0.2385	1.0078	-0.1685	
24	4 hh4	-0.0078	-0.1553	0.0078	1.0000	0.0701	-0.2385	1.0078	-0.1685	
25	5 hh5	-0.0078	-0.1553	0.0078	1.0000	0.0701	-0.2385	1.0078	-0.1685	
26	<i>disposable income of households</i>									
27	1 hh1	-0.0048	-0.0962	0.0048	1.0000	0.3030	-0.6627	1.0048	-0.3597	
28	2 hh2	-0.0061	-0.1211	0.0061	1.0000	0.3057	-0.6836	1.0061	-0.3779	
29	3 hh3	-0.0069	-0.1389	0.0069	1.0000	0.3057	-0.6948	1.0069	-0.3890	
30	4 hh4	-0.0077	-0.1548	0.0077	1.0000	0.3038	-0.7007	1.0077	-0.3969	
31	5 hh5	-0.0119	-0.2385	0.0119	1.0000	0.3124	-0.7717	1.0119	-0.4593	
32	<i>gross income of households</i>									
33	1 hh1	-0.0333	-0.6661	0.0333	1.0000	0.0834	-0.5913	1.0333	-0.5080	
34	2 hh2	-0.0346	-0.6910	0.0346	1.0000	0.0861	-0.6123	1.0346	-0.5262	
35	3 hh3	-0.0354	-0.7089	0.0354	1.0000	0.0861	-0.6234	1.0354	-0.5374	
36	4 hh4	-0.0362	-0.7247	0.0362	1.0000	0.0841	-0.6293	1.0362	-0.5452	
37	5 hh5	-0.0404	-0.8084	0.0404	1.0000	0.0928	-0.7004	1.0404	-0.6076	
38	<i>labor income of households</i>									
39	1 hh1	-0.0326	-0.6529	0.0326	1.0000	0.0500	-0.5151	1.0326	-0.4651	
40	2 hh2	-0.0349	-0.6978	0.0349	1.0000	0.0553	-0.5538	1.0349	-0.4985	
41	3 hh3	-0.0366	-0.7321	0.0366	1.0000	0.0594	-0.5833	1.0366	-0.5239	
42	4 hh4	-0.0384	-0.7682	0.0384	1.0000	0.0637	-0.6144	1.0384	-0.5508	
43	5 hh5	-0.0496	-0.9930	0.0496	1.0000	0.0902	-0.8081	1.0496	-0.7179	
44	<i>income of households from variable capital</i>									
45	1 hh1	-0.0496	-0.9928	0.0496	1.0000	0.0394	-0.7164	1.0496	-0.6769	
46	2 hh2	-0.0496	-0.9928	0.0496	1.0000	0.0394	-0.7164	1.0496	-0.6769	
47	3 hh3	-0.0496	-0.9928	0.0496	1.0000	0.0394	-0.7164	1.0496	-0.6769	
48	4 hh4	-0.0496	-0.9928	0.0496	1.0000	0.0394	-0.7164	1.0496	-0.6769	
49	5 hh5	-0.0496	-0.9928	0.0496	1.0000	0.0394	-0.7164	1.0496	-0.6769	
50	<i>income from sector specific capital in agriculture</i>									
51	1 hh1	-0.0171	-0.3419	0.0171	1.0000	0.1286	-0.4943	1.0171	-0.3657	
52	2 hh2	-0.0171	-0.3419	0.0171	1.0000	0.1286	-0.4943	1.0171	-0.3657	
53	3 hh3	-0.0171	-0.3419	0.0171	1.0000	0.1286	-0.4943	1.0171	-0.3657	
54	4 hh4	-0.0171	-0.3419	0.0171	1.0000	0.1286	-0.4943	1.0171	-0.3657	
55	5 hh5	-0.0171	-0.3419	0.0171	1.0000	0.1286	-0.4943	1.0171	-0.3657	
56	<i>income from sector specific capital in non agriculture</i>									
57	1 hh1	-0.0421	-0.8428	0.0421	1.0000	0.1231	-0.7789	1.0421	-0.6558	
58	2 hh2	-0.0421	-0.8428	0.0421	1.0000	0.1231	-0.7789	1.0421	-0.6558	
59	3 hh3	-0.0421	-0.8428	0.0421	1.0000	0.1231	-0.7789	1.0421	-0.6558	
60	4 hh4	-0.0421	-0.8428	0.0421	1.0000	0.1231	-0.7789	1.0421	-0.6558	
61	5 hh5	-0.0421	-0.8428	0.0421	1.0000	0.1231	-0.7789	1.0421	-0.6558	
62	<i>income from the ownership of land</i>									
63	1 hh1	-0.0102	-0.2049	0.0102	1.0000	0.2092	-0.5920	1.0102	-0.3828	
64	2 hh2	-0.0102	-0.2049	0.0102	1.0000	0.2092	-0.5920	1.0102	-0.3828	
65	3 hh3	-0.0102	-0.2049	0.0102	1.0000	0.2092	-0.5920	1.0102	-0.3828	
66	4 hh4	-0.0102	-0.2049	0.0102	1.0000	0.2092	-0.5920	1.0102	-0.3828	

TABLE 3 (cont'd): Simulations Using the APEX model									
Line No.		EXP1	EXP2	EXP3	EXP5	EXP9	EXP10	EXP11	EXP12
67	5 hh5	-0.0102	-0.2049	0.0102	1.0000	0.2092	-0.5920	1.0102	-0.3828
68	<i>consumption expenditures of households</i>								
69	1 hh1	-0.0048	-0.0962	0.0048	1.0000	0.3030	-0.6627	1.0048	-0.3597
70	2 hh2	-0.0061	-0.1211	0.0061	1.0000	0.3057	-0.6836	1.0061	-0.3779
71	3 hh3	-0.0069	-0.1389	0.0069	1.0000	0.3057	-0.6948	1.0069	-0.3890
72	4 hh4	-0.0077	-0.1548	0.0077	1.0000	0.3038	-0.7007	1.0077	-0.3969
73	5 hh5	-0.0119	-0.2385	0.0119	1.0000	0.3124	-0.7717	1.0119	-0.4593
74	<i>supply of commodities, domestic (xcom)</i>								
75	[1] 1 (irice,dom)	0.0094	0.1883	-0.0094	0.0000	0.0653	-0.1275	-0.0094	-0.0621
76	[2] 2 (rrice,dom)	-0.0081	-0.1615	0.0081	0.0000	0.0839	-0.2555	0.0081	-0.1716
77	[3] 3 (corn,dom)	0.0084	0.1683	-0.0084	0.0000	-0.0152	0.1349	-0.0084	0.1197
78	[4] 4 (cnut,dom)	0.0161	0.3214	-0.0161	0.0000	-0.0452	0.2844	-0.0161	0.2393
79	[5] 5 (sugar,dom)	0.0249	0.4971	-0.0249	0.0000	-0.0835	0.4763	-0.0249	0.3928
80	[6] 6 (fruits,dom)	0.0186	0.3711	-0.0186	0.0000	-0.0516	0.3172	-0.0186	0.2656
81	[7] 7 (veg,dom)	-0.0059	-0.1187	0.0059	0.0000	0.1101	-0.2723	0.0059	-0.1621
82	[8] 8 (roots,dom)	-0.0120	-0.2390	0.0120	0.0000	0.0955	-0.3183	0.0120	-0.2228
83	[9] 9 (ccrops,dom)	0.0109	0.2178	-0.0109	0.0000	0.0087	0.1090	-0.0109	0.1178
84	[10] 10 (hogs,dom)	-0.0024	-0.0471	0.0024	0.0000	0.1449	-0.3258	0.0024	-0.1809
85	[11] 11 (poultry,dom)	-0.0204	-0.4079	0.0204	0.0000	0.1316	-0.5241	0.0204	-0.3924
86	[12] 12 (lives,dom)	0.0025	0.0498	-0.0025	0.0000	0.1680	-0.3151	-0.0025	-0.1471
87	[13] 13 (agservices..)	0.0010	0.0198	-0.0010	0.0000	0.0414	-0.0835	-0.0010	-0.0421
88	[14] 14 (marine,dom)	0.0335	0.6693	-0.0335	0.0000	-0.0645	0.5568	-0.0335	0.4923
89	[15] 15 (inland,dom)	0.0793	1.5855	-0.0793	0.0000	-0.2367	1.4432	-0.0793	1.2065
90	[16] 16 (forestry,d..)	-0.0236	-0.4727	0.0236	0.0000	0.0110	-0.2903	0.0236	-0.2792
91	[17] 17 (crude,dom)	-0.0007	-0.0134	0.0007	0.0000	0.2224	-0.4504	0.0007	-0.2280
92	[18] 18 (omining,dom)	0.0034	0.0670	-0.0034	0.0000	-0.1325	0.2970	-0.0034	0.1645
93	[19] 19 (rcmilling,..)	-0.0018	-0.0352	0.0018	0.0000	0.1088	-0.2231	0.0018	-0.1143
94	[20] 20 (smilling,d..)	0.0272	0.5445	-0.0272	0.0000	-0.1028	0.5445	-0.0272	0.4416
95	[21] 21 (dairy,dom)	-0.0362	-0.7235	0.0362	0.0000	0.0850	-0.6253	0.0362	-0.5403
96	[22] 22 (oils,dom)	0.0093	0.1854	-0.0093	0.0000	-0.1154	0.3189	-0.0093	0.2036
97	[23] 23 (meat,dom)	-0.0030	-0.0610	0.0030	0.0000	0.1523	-0.3487	0.0030	-0.1963
98	[24] 24 (fmilling,d..)	-0.1263	-2.5268	0.1263	0.0000	-0.1099	-1.3180	0.1263	-1.4279
99	[25] 25 (afeeds,dom)	0.0478	0.9556	-0.0478	0.0000	0.0042	0.5282	-0.0478	0.5324
100	[26] 26 (ofoods,dom)	-0.5719	-11.4379	0.5719	0.0000	-0.9335	-5.1366	0.5719	-6.0702
101	[27] 27 (bevtabacco..)	-0.0075	-0.1501	0.0075	0.0000	0.2157	-0.5130	0.0075	-0.2974
102	[28] 28 (textile,dom)	0.0529	1.0580	-0.0529	0.0000	0.0643	0.5642	-0.0529	0.6284
103	[29] 29 (otextile,d..)	0.0150	0.2997	-0.0150	0.0000	-0.1878	0.8872	-0.0150	0.6994
104	[30] 30 (garments,d..)	0.1049	2.0986	-0.1049	0.0000	-0.3463	2.2322	-0.1049	1.8859
105	[31] 31 (woodp,dom)	-0.0552	-1.1038	0.0552	0.0000	-0.2928	-0.0212	0.0552	-0.3141
106	[32] 32 (paperp,dom)	0.0080	0.1608	-0.0080	0.0000	0.1207	-0.1788	-0.0080	-0.0582
107	[33] 33 (fertilizer..)	0.0058	0.1151	-0.0058	0.0000	0.0170	-0.0013	-0.0058	0.0158
108	[34] 34 (orubber,dom)	0.0035	0.0700	-0.0035	0.0000	0.1422	-0.2304	-0.0035	-0.0882
109	[35] 35 (coalp,dom)	0.0017	0.0350	-0.0017	0.0000	0.2095	-0.3895	-0.0017	-0.1800
110	[36] 36 (basicmEtal..)	0.0367	0.7347	-0.0367	0.0000	-0.0553	0.5724	-0.0367	0.5172
111	[37] 37 (cement,dom)	0.0061	0.1227	-0.0061	0.0000	0.0436	-0.0795	-0.0061	-0.0358
112	[38] 38 (semicon,dorr)	-0.0390	-0.7798	0.0390	0.0000	-0.2472	0.2576	0.0390	0.0104
113	[39] 39 (mEtalp,dom)	-0.0307	-0.6144	0.0307	0.0000	-0.0451	-0.4027	0.0307	-0.4478
114	[40] 40 (elecmech,dorr)	0.0188	0.3758	-0.0188	0.0000	0.0885	-0.0383	-0.0188	0.0502
115	[41] 41 (transport,..)	0.0305	0.6104	-0.0305	0.0000	0.0499	0.1665	-0.0305	0.2164
116	[42] 42 (miscmfg,dorr)	0.0258	0.5154	-0.0258	0.0000	0.0589	0.1593	-0.0258	0.2182
117	[43] 43 (constructi..)	-0.0346	-0.6927	0.0346	0.0000	-0.2178	-0.0413	0.0346	-0.2591
118	[44] 44 (egw,dom)	-0.0052	-0.1046	0.0052	0.0000	0.1099	-0.2836	0.0052	-0.1736
119	[45] 45 (tcservices..)	-0.0038	-0.0764	0.0038	0.0000	0.1442	-0.3396	0.0038	-0.1954
120	[46] 46 (tsw,dom)	-0.0030	-0.0608	0.0030	0.0000	0.0416	-0.1137	0.0030	-0.0721
121	[47] 47 (banks,dom)	0.0050	0.1005	-0.0050	0.0000	0.2559	-0.4554	-0.0050	-0.1995
122	[48] 48 (insurance,..)	0.0002	0.0041	-0.0002	0.0000	0.2670	-0.5352	-0.0002	-0.2683
123	[49] 49 (gservices,..)	-0.0009	-0.0188	0.0009	0.0000	0.0369	-0.0864	0.0009	-0.0496
124	[50] 50 (oservices,..)	0.0072	0.1448	-0.0072	0.0000	0.1474	-0.2059	-0.0072	-0.0585
125	<i>supply of commodities, imported (xcom)</i>								
126	[51] 1 (irice,imp)	-0.5052	-10.1034	0.5052	0.0000	0.3514	-3.9596	0.5052	-3.6082
127	[52] 2 (rrice,imp)	-0.0571	-1.1418	0.0571	0.0000	0.3603	-2.9913	0.0571	-2.6310
128	[53] 3 (corn,imp)	-0.0455	-0.9090	0.0455	0.0000	-0.0360	-0.5890	0.0455	-0.6250
129	[54] 4 (cnut,imp)	-0.0017	-0.0333	0.0017	0.0000	0.0467	-1.0272	0.0017	-0.9806
130	[55] 5 (sugar,imp)	-0.0017	-0.0331	0.0017	0.0000	0.0467	-0.1108	0.0017	-0.0641
131	[56] 6 (fruits,imp)	-0.1395	-2.7894	0.1395	0.0000	-0.0681	-1.0806	0.1395	-1.1487
132	[57] 7 (veg,imp)	-0.0519	-1.0383	0.0519	0.0000	-0.0800	-0.5266	0.0519	-0.6066

TABLE 3 (cont'd): Simulations Using the APEX model

Line No		EXP1	EXP2	EXP3	EXP5	EXP9	EXP10	EXP11	EXP12	
133	[58] 8 (roots,imp)	-0.0017	-0.0331	0.0017	0.0000	0.0467	-0.1108	0.0017	-0.0641	
134	[59] 9 (ccrops,imp)	-0.0420	-0.8390	0.0420	0.0000	-0.0002	-0.5634	0.0420	-0.5637	
135	[60] 10 (hogs,imp)	-0.0153	-0.3061	0.0153	0.0000	0.0426	-0.3337	0.0153	-0.2911	
136	[61] 11 (poultry,imp)	-0.1333	-2.6658	0.1333	0.0000	0.1738	-1.4693	0.1333	-1.2956	
137	[62] 12 (lives,imp)	-0.0636	-1.2720	0.0636	0.0000	0.1246	-1.0571	0.0636	-0.9325	
138	[63] 13 (agservices..)	-0.0017	-0.0331	0.0017	0.0000	0.0467	-0.1108	0.0017	-0.0641	
139	[64] 14 (marine,imp)	-0.0437	-0.8736	0.0437	0.0000	-0.0459	-0.4059	0.0437	-0.4518	
140	[65] 15 (inland,imp)	-0.0012	-0.0244	0.0012	0.0000	0.0576	-0.1775	0.0012	-0.1199	
141	[66] 16 (forestry,i..)	-0.0367	-0.7347	0.0367	0.0000	-0.0457	-0.4720	0.0367	-0.5177	
142	[67] 17 (crude,imp)	-0.0300	-0.6007	0.0300	0.0000	-0.0423	-0.3974	0.0300	-0.4397	
143	[68] 18 (omining,imp)	-0.0385	-0.7703	0.0385	0.0000	-0.0479	-0.4531	0.0385	-0.5010	
144	[69] 19 (rcmilling,..)	-0.0442	-0.8834	0.0442	0.0000	0.2963	-3.3088	0.0442	-3.0126	
145	[70] 20 (smilling,i..)	-0.4510	-9.0204	0.4510	0.0000	-0.0598	-2.9261	0.4510	-2.9859	
146	[71] 21 (dairy,imp)	-0.0593	-1.1868	0.0593	0.0000	-0.0049	-0.7641	0.0593	-0.7690	
147	[72] 22 (oils,imp)	-0.1219	-2.4379	0.1219	0.0000	-0.0630	-1.1235	0.1219	-1.1865	
148	[73] 23 (meat,imp)	-0.0263	-0.5266	0.0263	0.0000	0.0057	-0.3999	0.0263	-0.3942	
149	[74] 24 (fmilling,i..)	-0.2296	-4.5912	0.2296	0.0000	-0.3092	-2.2177	0.2296	-2.5269	
150	[75] 25 (afeeds,imp)	-0.1201	-2.4026	0.1201	0.0000	0.0585	-1.5441	0.1201	-1.4855	
151	[76] 26 (ofoods,imp)	-0.0786	-1.5721	0.0786	0.0000	-0.0902	-0.8422	0.0786	-0.9324	
152	[77] 27 (bevtabacco..)	-0.0326	-0.6519	0.0326	0.0000	0.0041	-0.4425	0.0326	-0.4385	
153	[78] 28 (textile,imp)	-0.0308	-0.6170	0.0308	0.0000	0.0049	-0.3516	0.0308	-0.3467	
154	[79] 29 (otextile,i..)	-0.0517	-1.0334	0.0517	0.0000	0.0022	-0.5242	0.0517	-0.5220	
155	[80] 30 (garments,i..)	-0.0295	-0.5906	0.0295	0.0000	-0.0219	-0.4089	0.0295	-0.4307	
156	[81] 31 (woodp,imp)	-0.0215	-0.4307	0.0215	0.0000	0.0009	-0.3374	0.0215	-0.3365	
157	[82] 32 (paperp,imp)	-0.0361	-0.7220	0.0361	0.0000	0.0444	-0.5156	0.0361	-0.4712	
158	[83] 33 (fertilizer..)	-0.0267	-0.5341	0.0267	0.0000	0.0111	-0.6404	0.0267	-0.6293	
159	[84] 34 (orubber,imp)	-0.0200	-0.3997	0.0200	0.0000	-0.0116	-0.2957	0.0200	-0.3073	
160	[85] 35 (coalp,imp)	-0.0299	-0.5979	0.0299	0.0000	0.0147	-0.4718	0.0299	-0.4571	
161	[86] 36 (basicEtal..)	-0.0759	-1.5182	0.0759	0.0000	-0.1057	-0.7792	0.0759	-0.8849	
162	[87] 37 (cement,imp)	-0.0472	-0.9443	0.0472	0.0000	-0.0146	-0.5288	0.0472	-0.5434	
163	[88] 38 (semicon,imp)	-0.0390	-0.7798	0.0390	0.0000	-0.2472	0.2576	0.0390	0.0104	
164	[89] 39 (mEtalp,imp)	-0.0860	-1.7209	0.0860	0.0000	-0.0136	-0.3033	0.0860	-0.3169	
165	[90] 40 (elecmech,imp)	-0.0506	-1.0123	0.0506	0.0000	-0.0126	-0.4472	0.0506	-0.4598	
166	[91] 41 (transport,..)	-0.0322	-0.6447	0.0322	0.0000	0.0222	-0.4254	0.0322	-0.4032	
167	[92] 42 (miscmfg,imp)	-0.0303	-0.6060	0.0303	0.0000	0.0266	-0.4590	0.0303	-0.4324	
168	[93] 43 (constructi..)	-0.0265	-0.5296	0.0265	0.0000	-0.0334	-0.3577	0.0265	-0.3911	
169	[94] 44 (egw,imp)	-0.0017	-0.0331	0.0017	0.0000	0.0467	-0.1108	0.0017	-0.0641	
170	[95] 45 (tcservices..)	-0.0290	-0.5800	0.0290	0.0000	-0.0259	-0.4127	0.0290	-0.4386	
171	[96] 46 (tsw,imp)	-0.0017	-0.0331	0.0017	0.0000	0.0467	-0.1108	0.0017	-0.0641	
172	[97] 47 (banks,imp)	-0.0017	-0.0331	0.0017	0.0000	0.0467	-0.1108	0.0000	-0.0541	
173	[98] 48 (insurance,..)	-0.0123	-0.2462	0.0123	0.0000	0.0783	-0.3503	0.0123	-0.2721	
174	[99] 49 (gservices,..)	-0.0017	-0.0331	0.0017	0.0000	0.0467	-0.1108	0.0017	-0.0641	
175	[100] 50 (oservices..)	-0.0188	-0.3758	0.0188	0.0000	0.0098	-0.3300	0.0188	-0.3201	
176	<i>supply of commodities, total*</i>									
177	[1] 1 (irice,dom)	-0.4958	-9.9151	0.4958	0.0000	0.4167	-4.0871	0.4958	-3.6703	
178	[2] 2 (rrice,dom)	-0.0652	-1.3033	0.0652	0.0000	0.4442	-3.2468	0.0652	-2.8026	
179	[3] 3 (corn,dom)	-0.0371	-0.7407	0.0371	0.0000	-0.0512	-0.4541	0.0371	-0.5053	
180	[4] 4 (cnut,dom)	0.0144	0.2881	-0.0144	0.0000	0.0015	-0.7428	-0.0144	-0.7413	
181	[5] 5 (sugar,dom)	0.0232	0.4640	-0.0232	0.0000	-0.0368	0.3655	-0.0232	0.3287	
182	[6] 6 (fruits,dom)	-0.1209	-2.4183	0.1209	0.0000	-0.1197	-0.7634	0.1209	-0.8831	
183	[7] 7 (veg,dom)	-0.0578	-1.1570	0.0578	0.0000	0.0301	-0.7989	0.0578	-0.7687	
184	[8] 8 (roots,dom)	-0.0137	-0.2721	0.0137	0.0000	0.1422	-0.4291	0.0137	-0.2869	
185	[9] 9 (ccrops,dom)	-0.0311	-0.6212	0.0311	0.0000	0.0085	-0.4544	0.0311	-0.4459	
186	[10] 10 (hogs,dom)	-0.0177	-0.3532	0.0177	0.0000	0.1875	-0.6595	0.0177	-0.4720	
187	[11] 11 (poultry,dom)	-0.1537	-3.0737	0.1537	0.0000	0.3054	-1.9934	0.1537	-1.6880	
188	[12] 12 (lives,dom)	-0.0611	-1.2222	0.0611	0.0000	0.2926	-1.3722	0.0611	-1.0796	
189	[13] 13 (agservices..)	-0.0007	-0.0133	0.0007	0.0000	0.0881	-0.1943	0.0007	-0.1062	
190	[14] 14 (marine,dom)	-0.0102	-0.2043	0.0102	0.0000	-0.1104	0.1509	0.0102	0.0405	
191	[15] 15 (inland,dom)	0.0781	1.5611	-0.0781	0.0000	-0.1791	1.2657	-0.0781	1.0866	
192	[16] 16 (forestry,d..)	-0.0603	-1.2074	0.0603	0.0000	-0.0347	-0.7623	0.0603	-0.7969	
193	[17] 17 (crude,dom)	-0.0307	-0.6141	0.0307	0.0000	0.1801	-0.8478	0.0307	-0.6677	
194	[18] 18 (omining,dom)	-0.0351	-0.7033	0.0351	0.0000	-0.1804	-0.1561	0.0351	-0.3365	
195	[19] 19 (rcmilling,..)	-0.0460	-0.9186	0.0460	0.0000	0.4051	-3.5319	0.0460	-3.1269	
196	[20] 20 (smilling,d..)	-0.4238	-8.4759	0.4238	0.0000	-0.1626	-2.3816	0.4238	-2.5443	
197	[21] 21 (dairy,dom)	-0.0955	-1.9103	0.0955	0.0000	0.0801	-1.3894	0.0955	-1.3093	
198	[22] 22 (oils,dom)	-0.1126	-2.2525	0.1126	0.0000	-0.1784	-0.8046	0.1126	-0.9829	

TABLE 3 (cont'd): Simulations Using the APEX model

Line No.		EXP1	EXP2	EXP3	EXP5	EXP9	EXP10	EXP11	EXP12	
199	[23] 23 (meat,dom)	-0.0293	-0.5876	0.0293	0.0000	0.1580	-0.7486	0.0293	-0.5905	
200	[24] 24 (fmilling,d..	-0.3559	-7.1180	0.3559	0.0000	-0.4191	-3.5357	0.3559	-3.9548	
201	[25] 25 (afeeds,dom)	-0.0723	-1.4470	0.0723	0.0000	0.0627	-1.0159	0.0723	-0.9531	
202	[26] 26 (ofoods,dom)	-0.6505	-13.0100	0.6505	0.0000	-1.0237	-5.9788	0.6505	-7.0026	
203	[27] 27 (bevtabacco..	-0.0401	-0.8020	0.0401	0.0000	0.2198	-0.9555	0.0401	-0.7359	
204	[28] 28 (textile,dom)	0.0221	0.4410	-0.0221	0.0000	0.0692	0.2126	-0.0221	0.2817	
205	[29] 29 (otextile,d..	-0.0367	-0.7337	0.0367	0.0000	-0.1856	0.3630	0.0367	0.1774	
206	[30] 30 (garments,d..	0.0754	1.5080	-0.0754	0.0000	-0.3682	1.8233	-0.0754	1.4552	
207	[31] 31 (woodp,dom)	-0.0767	-1.5345	0.0767	0.0000	-0.2919	-0.3566	0.0767	-0.6506	
208	[32] 32 (paperp,dom)	-0.0281	-0.5612	0.0281	0.0000	0.1651	-0.6944	0.0281	-0.5294	
209	[33] 33 (fertilizer..	-0.0209	-0.4190	0.0209	0.0000	0.0281	-0.6417	0.0209	-0.6135	
210	[34] 34 (orubber,dom)	-0.0165	-0.3297	0.0165	0.0000	0.1306	-0.5261	0.0165	-0.3955	
211	[35] 35 (coalp,dom)	-0.0282	-0.5629	0.0282	0.0000	0.2242	-0.8613	0.0282	-0.6371	
212	[36] 36 (basicmEtal..	-0.0392	-0.7835	0.0392	0.0000	-0.1610	-0.2068	0.0392	-0.3677	
213	[37] 37 (cement,dom)	-0.0411	-0.8216	0.0411	0.0000	0.0290	-0.6083	0.0411	-0.5792	
214	[38] 38 (semicon,dorr	-0.0780	-1.5596	0.0780	0.0000	-0.4944	0.5152	0.0780	0.0208	
215	[39] 39 (mEtalp,dom)	-0.1167	-2.3353	0.1167	0.0000	-0.0587	-0.7060	0.1167	-0.7647	
216	[40] 40 (elecmech,dorr	-0.0318	-0.6365	0.0318	0.0000	0.0759	-0.4855	0.0318	-0.4096	
217	[41] 41 (transport,..	-0.0017	-0.0343	0.0017	0.0000	0.0721	-0.2589	0.0017	-0.1868	
218	[42] 42 (miscmfg,dorr	-0.0045	-0.0906	0.0045	0.0000	0.0855	-0.2997	0.0045	-0.2142	
219	[43] 43 (constructi..	-0.0611	-1.2223	0.0611	0.0000	-0.2512	-0.3990	0.0611	-0.6502	
220	[44] 44 (egw,dom)	-0.0069	-0.1377	0.0069	0.0000	0.1566	-0.3944	0.0069	-0.2377	
221	[45] 45 (tcservices..	-0.0328	-0.6564	0.0328	0.0000	0.1183	-0.7523	0.0328	-0.6340	
222	[46] 46 (tsw,dom)	-0.0047	-0.0939	0.0047	0.0000	0.0883	-0.2245	0.0047	-0.1362	
223	[47] 47 (banks,dom)	0.0033	0.0674	-0.0033	0.0000	0.3026	-0.5662	-0.0050	-0.2636	
224	[48] 48 (insurance,..	-0.0121	-0.2421	0.0121	0.0000	0.3453	-0.8855	0.0121	-0.5404	
225	[49] 49 (gservices,..	-0.0026	-0.0519	0.0026	0.0000	0.0836	-0.1972	0.0026	-0.1137	
226	[50] 50 (oservices,..	-0.0116	-0.2310	0.0116	0.0000	0.1572	-0.5359	0.0116	-0.3786	
227	<i>producer price of commodities, domestic (ppcom)</i>									
228	[1] 1 (irice,dom)	-0.0076	-0.1519	0.0076	0.0000	0.1336	-0.4837	1.0076	-0.3500	
229	[2] 2 (rrice,dom)	-0.0345	-0.6908	0.0345	0.0000	0.1954	-0.7947	1.0345	-0.5993	
230	[3] 3 (corn,dom)	-0.0021	-0.0421	0.0021	0.0000	0.0029	-0.0321	1.0021	-0.0292	
231	[4] 4 (cnut,dom)	0.0000	-0.0001	0.0000	0.0000	0.0000	-0.0001	1.0000	-0.0001	
232	[5] 5 (sugar,dom)	0.0082	0.1631	-0.0082	0.0000	-0.0190	0.1283	0.9918	0.1092	
233	[6] 6 (fruits,dom)	0.0000	-0.0004	0.0000	0.0000	0.0000	-0.0003	1.0000	-0.0003	
234	[7] 7 (veg,dom)	-0.0237	-0.4744	0.0237	0.0000	0.1598	-0.5661	1.0237	-0.4062	
235	[8] 8 (roots,dom)	-0.0402	-0.8048	0.0402	0.0000	0.2121	-0.8856	1.0402	-0.6736	
236	[9] 9 (ccrops,dom)	-0.0002	-0.0033	0.0002	0.0000	-0.0002	-0.0015	1.0002	-0.0017	
237	[10] 10 (hogs,dom)	-0.0222	-0.4437	0.0222	0.0000	0.2173	-0.7093	1.0222	-0.4920	
238	[11] 11 (poultry,dom)	-0.0418	-0.8369	0.0418	0.0000	0.2310	-0.9993	1.0418	-0.7683	
239	[12] 12 (lives,dom)	-0.0177	-0.3547	0.0177	0.0000	0.2722	-0.7851	1.0177	-0.5129	
240	[13] 13 (agservices..	-0.0201	-0.4010	0.0201	0.0000	0.0655	-0.4127	1.0201	-0.3472	
241	[14] 14 (marine,dom)	-0.0001	-0.0020	0.0001	0.0000	-0.0001	-0.0010	1.0001	-0.0011	
242	[15] 15 (inland,dom)	-0.0011	-0.0225	0.0011	0.0000	0.0051	-0.0240	1.0011	-0.0189	
243	[16] 16 (forestry,d..	-0.0372	-0.7447	0.0372	0.0000	0.0511	-0.5413	1.0372	-0.4903	
244	[17] 17 (crude,dom)	0.0025	0.0508	-0.0025	0.0000	0.1350	-0.2292	0.9975	-0.0942	
245	[18] 18 (omining,dom)	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	
246	[19] 19 (rcmilling,..	-0.0208	-0.4153	0.0208	0.0000	0.1219	-0.5621	1.0208	-0.4402	
247	[20] 20 (smilling,d..	0.0000	-0.0003	0.0000	0.0000	0.0001	-0.0004	1.0000	-0.0003	
248	[21] 21 (dairy,dom)	0.0260	0.5199	-0.0260	0.0000	0.0352	0.2647	0.9740	0.2999	
249	[22] 22 (oils,dom)	0.0000	-0.0002	0.0000	0.0000	0.0001	-0.0002	1.0000	-0.0002	
250	[23] 23 (meat,dom)	-0.0291	-0.5823	0.0291	0.0000	0.1864	-0.7410	1.0291	-0.5546	
251	[24] 24 (fmilling,d..	0.0217	0.4338	-0.0217	0.0000	0.0107	0.0003	0.9783	0.0111	
252	[25] 25 (afeeds,dom)	0.0019	0.0382	-0.0019	0.0000	0.0547	-0.1521	0.9981	-0.0974	
253	[26] 26 (ofoods,dom)	0.0003	0.0068	-0.0003	0.0000	0.0006	0.0029	0.9997	0.0035	
254	[27] 27 (bevtabacco..	0.0195	0.3891	-0.0195	0.0000	0.0730	0.0950	0.9805	0.1680	
255	[28] 28 (textile,dom)	0.0090	0.1809	-0.0090	0.0000	0.0561	-0.1305	0.9910	-0.0744	
256	[29] 29 (otextile,d..	0.0000	-0.0001	0.0000	0.0000	0.0001	-0.0004	1.0000	-0.0003	
257	[30] 30 (garments,d..	0.0000	-0.0004	0.0000	0.0000	0.0001	-0.0005	1.0000	-0.0004	
258	[31] 31 (woodp,dom)	0.0000	0.0002	0.0000	0.0000	0.0001	0.0000	1.0000	0.0000	
259	[32] 32 (paperp,dom)	0.0018	0.0367	-0.0018	0.0000	0.0730	-0.1298	0.9982	-0.0568	
260	[33] 33 (fertilizer..	-0.0074	-0.1471	0.0074	0.0000	0.0582	-0.2089	1.0074	-0.1506	
261	[34] 34 (orubber,dom)	0.0173	0.3465	-0.0173	0.0000	0.0600	0.1169	0.9827	0.1759	
262	[35] 35 (coalp,dom)	-0.0082	-0.1636	0.0082	0.0000	0.1117	-0.3103	1.0082	-0.1986	
263	[36] 36 (basicmEtal..	0.0000	-0.0003	0.0000	0.0000	0.0000	-0.0002	1.0000	-0.0002	
264	[37] 37 (cement,dom)	0.0106	0.2128	-0.0106	0.0000	0.0442	0.0813	0.9894	0.1256	

TABLE 3 (cont'd): Simulations Using the APEX model

Line No		EXP1	EXP2	EXP3	EXP5	EXP9	EXP10	EXP11	EXP12	
265	[38] 38 (semicon,dorr	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	
266	[39] 39 (mEtalp,dom)	0.0659	1.3176	-0.0659	0.0000	0.0026	0.8815	0.9341	0.8841	
267	[40] 40 (elecmmch,dorr	0.0208	0.4157	-0.0208	0.0000	0.0271	0.1855	0.9792	0.2126	
268	[41] 41 (transport,..	0.0288	0.5761	-0.0288	0.0000	0.0340	0.2713	0.9712	0.3053	
269	[42] 42 (miscmfg,dorr	0.0062	0.1245	-0.0062	0.0000	0.0523	-0.1144	0.9938	-0.0621	
270	[43] 43 (constructi..	0.0001	0.0018	-0.0001	0.0000	0.0008	-0.0003	0.9999	0.0005	
271	[44] 44 (egw,dom)	-0.0197	-0.3938	0.0197	0.0000	0.0977	-0.4293	1.0197	-0.3316	
272	[45] 45 (tcservices..	-0.0251	-0.5024	0.0251	0.0000	0.1056	-0.5163	1.0251	-0.4108	
273	[46] 46 (tsw,dom)	-0.0306	-0.6129	0.0306	0.0000	0.0933	-0.5609	1.0306	-0.4677	
274	[47] 47 (banks,dom)	-0.0281	-0.5620	0.0281	0.0000	0.1172	-0.5254	1.0281	-0.4082	
275	[48] 48 (insurance,..	-0.0302	-0.6035	0.0302	0.0000	0.1927	-0.7734	1.0302	-0.5808	
276	[49] 49 (gservices,..	-0.0460	-0.9209	0.0460	0.0000	0.0898	-0.7527	1.0460	-0.6629	
277	[50] 50 (oservices,..	-0.0120	-0.2393	0.0120	0.0000	0.0885	-0.3222	1.0120	-0.2337	
278	<i>producer price of commodities, imported (ppcom)</i>									
279	[51] 1 (irice,imp)	0.1862	3.7245	-0.1862	0.0000	0.0000	1.0000	0.8138	1.0000	
280	[52] 2 (rrice,imp)	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
281	[53] 3 (corn,imp)	0.0839	1.6772	-0.0839	0.0000	0.0000	1.0000	0.9161	1.0000	
282	[54] 4 (cnut,imp)	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
283	[55] 5 (sugar,imp)	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	
284	[56] 6 (fruits,imp)	0.1862	3.7245	-0.1862	0.0000	0.0000	1.0000	0.8138	1.0000	
285	[57] 7 (veg,imp)	0.1570	3.1392	-0.1570	0.0000	0.0000	1.0000	0.8430	1.0000	
286	[58] 8 (roots,imp)	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
287	[59] 9 (ccrops,imp)	0.1346	2.6918	-0.1346	0.0000	0.0000	1.0000	0.8654	1.0000	
288	[60] 10 (hogs,imp)	0.0438	0.8753	-0.0438	0.0000	0.0000	1.0000	0.9562	1.0000	
289	[61] 11 (poultry,imp)	0.1679	3.3588	-0.1679	0.0000	0.0000	1.0000	0.8321	1.0000	
290	[62] 12 (lives,imp)	0.0946	1.8913	-0.0946	0.0000	0.0000	1.0000	0.9054	1.0000	
291	[63] 13 (agservices..	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
292	[64] 14 (marine,imp)	0.1027	2.0534	-0.1027	0.0000	0.0000	1.0000	0.8973	1.0000	
293	[65] 15 (inland,imp)	0.1271	2.5424	-0.1271	0.0000	0.0000	1.0000	0.8729	1.0000	
294	[66] 16 (forestry,i..	0.0750	1.5007	-0.0750	0.0000	0.0000	1.0000	0.9250	1.0000	
295	[67] 17 (crude,imp)	0.0638	1.2768	-0.0638	0.0000	0.0000	1.0000	0.9362	1.0000	
296	[68] 18 (omining,imp)	0.0886	1.7727	-0.0886	0.0000	0.0000	1.0000	0.9114	1.0000	
297	[69] 19 (rcmilling,..	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
298	[70] 20 (smilling,i..	0.1862	3.7245	-0.1862	0.0000	0.0000	1.0000	0.8138	1.0000	
299	[71] 21 (dairy,imp)	0.0880	1.7590	-0.0880	0.0000	0.0000	1.0000	0.9120	1.0000	
300	[72] 22 (oils,imp)	0.1422	2.8433	-0.1422	0.0000	0.0000	1.0000	0.8578	1.0000	
301	[73] 23 (meat,imp)	0.1423	2.8460	-0.1423	0.0000	0.0000	1.0000	0.8577	1.0000	
302	[74] 24 (fmilling,i..	0.1108	2.2156	-0.1108	0.0000	0.0000	1.0000	0.8892	1.0000	
303	[75] 25 (afeeds,imp)	0.0947	1.8943	-0.0947	0.0000	0.0000	1.0000	0.9053	1.0000	
304	[76] 26 (ofoods,imp)	0.1708	3.4150	-0.1708	0.0000	0.0000	1.0000	0.8292	1.0000	
305	[77] 27 (bevtabacco..	0.1672	3.3440	-0.1672	0.0000	0.0000	1.0000	0.8328	1.0000	
306	[78] 28 (textile,imp)	0.1531	3.0618	-0.1531	0.0000	0.0000	1.0000	0.8469	1.0000	
307	[79] 29 (otextile,i..	0.1708	3.4157	-0.1708	0.0000	0.0000	1.0000	0.8292	1.0000	
308	[80] 30 (garments,i..	0.1589	3.1778	-0.1589	0.0000	0.0000	1.0000	0.8411	1.0000	
309	[81] 31 (woodp,imp)	0.1430	2.8595	-0.1430	0.0000	0.0000	1.0000	0.8570	1.0000	
310	[82] 32 (paperp,imp)	0.1226	2.4529	-0.1226	0.0000	0.0000	1.0000	0.8774	1.0000	
311	[83] 33 (fertilizer..	0.0224	0.4474	-0.0224	0.0000	0.0000	1.0000	0.9776	1.0000	
312	[84] 34 (orubber,imp)	0.1068	2.1361	-0.1068	0.0000	0.0000	1.0000	0.8932	1.0000	
313	[85] 35 (coalp,imp)	0.0653	1.3057	-0.0653	0.0000	0.0000	1.0000	0.9347	1.0000	
314	[86] 36 (basicmEtal..	0.0770	1.5402	-0.0770	0.0000	0.0000	1.0000	0.9230	1.0000	
315	[87] 37 (cement,imp)	0.1054	2.1087	-0.1054	0.0000	0.0000	1.0000	0.8946	1.0000	
316	[88] 38 (semicon,imp)	0.0960	1.9198	-0.0960	0.0000	0.0000	1.0000	0.9040	1.0000	
317	[89] 39 (mEtalp,imp)	0.1301	2.6010	0.0000	0.0000	0.0000	1.0000	0.8699	1.0000	
318	[90] 40 (elecmmch,imp)	0.1215	2.4294	-0.1301	0.0000	0.0000	1.0000	0.8785	1.0000	
319	[91] 41 (transport,..	0.1020	2.0405	-0.1215	0.0000	0.0000	1.0000	0.8980	1.0000	
320	[92] 42 (miscmfg,imp)	0.1123	2.2462	-0.1020	0.0000	0.0000	1.0000	0.8877	1.0000	
321	[93] 43 (constructi..	0.0000	0.0000	-0.1123	0.0000	0.0000	1.0000	1.0000	1.0000	
322	[94] 44 (egw,imp)	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
323	[95] 45 (tcservices..	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
324	[96] 46 (tsw,imp)	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
325	[97] 47 (banks,imp)	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
326	[98] 48 (insurance,..	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
327	[99] 49 (gservices,..	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
328	[100] 50 (oservices..	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	
329	<i>producer price of commodities, total*</i>									
330	[1] 1 (irice,dom)	0.1786	3.5726	-0.1786	0.0000	0.1336	0.5163	1.8214	0.6500	

TABLE 3 (cont'd): Simulations Using the APEX model

Line No		EXP1	EXP2	EXP3	EXP5	EXP9	EXP10	EXP11	EXP12
331	[2] 2 (rrice,dom)	-0.0345	-0.6908	0.0345	0.0000	0.1954	0.2053	2.0345	0.4007
332	[3] 3 (corn,dom)	0.0818	1.6351	-0.0818	0.0000	0.0029	0.9679	1.9182	0.9708
333	[4] 4 (cnut,dom)	0.0000	-0.0001	0.0000	0.0000	0.0000	0.9999	2.0000	0.9999
334	[5] 5 (sugar,dom)	0.0082	0.1631	-0.0082	0.0000	-0.0190	1.1283	0.9918	1.1092
335	[6] 6 (fruits,dom)	0.1862	3.7241	-0.1862	0.0000	0.0000	0.9997	1.8138	0.9997
336	[7] 7 (veg,dom)	0.1333	2.6648	-0.1333	0.0000	0.1598	0.4339	1.8667	0.5938
337	[8] 8 (roots,dom)	-0.0402	-0.8048	0.0402	0.0000	0.2121	0.1144	2.0402	0.3264
338	[9] 9 (ccrops,dom)	0.1344	2.6885	-0.1344	0.0000	-0.0002	0.9985	1.8656	0.9983
339	[10] 10 (hogs,dom)	0.0216	0.4316	-0.0216	0.0000	0.2173	0.2907	1.9784	0.5080
340	[11] 11 (poultry,dom)	0.1261	2.5219	-0.1261	0.0000	0.2310	0.0007	1.8739	0.2317
341	[12] 12 (lives,dom)	0.0769	1.5366	-0.0769	0.0000	0.2722	0.2149	1.9231	0.4871
342	[13] 13 (agservices..)	-0.0201	-0.4010	0.0201	0.0000	0.0655	0.5873	2.0201	0.6528
343	[14] 14 (marine,dom)	0.1026	2.0514	-0.1026	0.0000	-0.0001	0.9990	1.8974	0.9989
344	[15] 15 (inland,dom)	0.1260	2.5199	-0.1260	0.0000	0.0051	0.9760	1.8740	0.9811
345	[16] 16 (forestry,d..)	0.0378	0.7560	-0.0378	0.0000	0.0511	0.4587	1.9622	0.5097
346	[17] 17 (crude,dom)	0.0663	1.3276	-0.0663	0.0000	0.1350	0.7708	1.9337	0.9058
347	[18] 18 (omining,dom)	0.0886	1.7728	-0.0886	0.0000	0.0000	1.0000	1.9114	1.0000
348	[19] 19 (rcmilling...	-0.0208	-0.4153	0.0208	0.0000	0.1219	0.4379	2.0208	0.5598
349	[20] 20 (smilling,d..)	0.1862	3.7242	-0.1862	0.0000	0.0001	0.9996	1.8138	0.9997
350	[21] 21 (dairy,dom)	0.1140	2.2789	-0.1140	0.0000	0.0352	1.2647	1.8860	1.2999
351	[22] 22 (oils,dom)	0.1422	2.8431	-0.1422	0.0000	0.0001	0.9998	1.8578	0.9998
352	[23] 23 (meat,dom)	0.1132	2.2637	-0.1132	0.0000	0.1864	0.2590	1.8868	0.4454
353	[24] 24 (fmilling,d..)	0.1325	2.6494	-0.1325	0.0000	0.0107	1.0003	1.8675	1.0111
354	[25] 25 (afeeds,dom)	0.0966	1.9325	-0.0966	0.0000	0.0547	0.8479	1.9034	0.9026
355	[26] 26 (ofoods,dom)	0.1711	3.4218	-0.1711	0.0000	0.0006	1.0029	1.8289	1.0035
356	[27] 27 (bevtoabacco..)	0.1867	3.7331	-0.1867	0.0000	0.0730	1.0950	1.8133	1.1680
357	[28] 28 (textile,dom)	0.1621	3.2427	-0.1621	0.0000	0.0561	0.8695	1.8379	0.9256
358	[29] 29 (otextile,d..)	0.1708	3.4156	-0.1708	0.0000	0.0001	0.9996	1.8292	0.9997
359	[30] 30 (garments,d..)	0.1589	3.1774	-0.1589	0.0000	0.0001	0.9995	1.8411	0.9996
360	[31] 31 (woodp,dom)	0.1430	2.8597	-0.1430	0.0000	0.0001	1.0000	1.8570	1.0000
361	[32] 32 (paperp,dom)	0.1244	2.4896	-0.1244	0.0000	0.0730	0.8702	1.8756	0.9432
362	[33] 33 (fertilizer..)	0.0150	0.3003	-0.0150	0.0000	0.0582	0.7911	1.9850	0.8494
363	[34] 34 (orubber,dom)	0.1241	2.4826	-0.1241	0.0000	0.0600	1.1169	1.8759	1.1769
364	[35] 35 (coalp,dom)	0.0571	1.1421	-0.0571	0.0000	0.1117	0.6897	1.9429	0.8014
365	[36] 36 (basicmEtal..)	0.0770	1.5399	-0.0770	0.0000	0.0000	0.9998	1.9230	0.9998
366	[37] 37 (cement,dom)	0.1160	2.3215	-0.1160	0.0000	0.0442	1.0813	1.8840	1.1256
367	[38] 38 (semicon,dorr)	0.0960	1.9199	-0.0960	0.0000	0.0000	1.0000	1.9040	1.0000
368	[39] 39 (mEtalp,dom)	0.1960	3.9186	-0.0659	0.0000	0.0026	1.8815	1.8040	1.8841
369	[40] 40 (elecmmch,dorr)	0.1423	2.8451	-0.1509	0.0000	0.0271	1.1855	1.8577	1.2126
370	[41] 41 (transport,...)	0.1308	2.6166	-0.1503	0.0000	0.0340	1.2713	1.8692	1.3053
371	[42] 42 (miscmfg,dorr)	0.1185	2.3707	-0.1082	0.0000	0.0523	0.8856	1.8815	0.9379
372	[43] 43 (constructi..)	0.0001	0.0018	-0.1124	0.0000	0.0008	0.9997	1.9999	1.0005
373	[44] 44 (egw,dom)	-0.0197	-0.3938	0.0197	0.0000	0.0977	0.5707	2.0197	0.6684
374	[45] 45 (tcservices..)	-0.0251	-0.5024	0.0251	0.0000	0.1056	0.4837	2.0251	0.5892
375	[46] 46 (tsw,dom)	-0.0306	-0.6129	0.0306	0.0000	0.0933	0.4391	2.0306	0.5323
376	[47] 47 (banks,dom)	-0.0281	-0.5620	0.0281	0.0000	0.1172	0.4746	2.0281	0.5918
377	[48] 48 (insurance,...)	-0.0302	-0.6035	0.0302	0.0000	0.1927	0.2266	2.0302	0.4192
378	[49] 49 (gservices,...)	-0.0460	-0.9209	0.0460	0.0000	0.0898	0.2473	2.0460	0.3371
379	[50] 50 (oservices,...)	-0.0120	-0.2393	0.0120	0.0000	0.0885	0.6778	2.0120	0.7663

* Total of domestic and import change

- 3) aggregate consumption,
- 4) a few items in the balance of payments account,
- 5) household income of the five income groups,
- 6) sectoral supply of commodities (domestic and import), and
- 7) corresponding sectoral prices.

1. Foreign exchange rate variable

Before analyzing the results of the simulations, this report will discuss the balance-of-payments account of the model, i.e., how the foreign exchange rate variable affects the rest of the model.

The foreign exchange rate (forex) is treated as exogenous. It can, however, be reclassified as an endogenous variable in the model.¹³ The foreign exchange rate variable appears in the following equations of the model: zero-profit condition in exporting and import industries, nominal household non-factor income, import bill and export receipts in local currency, tariff revenue and excise tax collection.

The following equations describe how the forex relates to exports in the APEX model:

$$(6) \quad p^{(0)}_{is} = p^*_{is} + r$$

where $p^{(0)}_{is}$ is the price of commodities (in local currency), p^* is the world price of commodity (in foreign currency), and r the foreign exchange rate. This equation is the zero-profit condition for exporting. It converts foreign prices into local prices through the use of the forex. The implementation of this equation is supposed to capture the fact that if the country is regarded as a price-taker in world markets, the rest of the world absorbs all exports which the country supplies. Therefore, there is a necessary market clearing of exportable producer goods at their going world prices.

Export revenue in foreign currency is given by

$$(7) \quad e^* = SI_{(0)s}(p^*_{is} + x^{(4)}_{is})$$

where $I_{(0)s}$ is the export share of good i in total export; and $x^{(4)}_{is}$ is export demand which is given by

$$(8) \quad x^{(4)}_{is} = u^{(4)*}_{is}$$

where $u^{(4)*}_{is}$ is export demand shift variable (exogenous in the model).

13. GEMPACK, the computer software used to solve APEX, facilitates swapping endogenous and exogenous variables of the model.

Export revenue in local currency is given by

$$(9) \quad e = e^* + r.$$

The change in the current account deficit is given by

$$(10) \quad DD^* = (1/100)(M^*m^* - E^*e^*)$$

where M^* and E^* represent total absolute values of imports and exports in foreign currency, respectively, while m^* and e^* indicate changes in imports and exports in foreign currency.

Given the above formulations, it seems at first that changes in the forex cannot directly affect the volume of exports.¹⁴ This set of specifications is quite different from some CGE models where changes in the level of forex directly affect export and import volumes.¹⁵ For example, the specification of the export function is given by

$$(11) \quad E_i = q_i(P_i/PWE_i)h_i$$

where P_i is the average world price of good i , h_i export demand elasticity, q_i a constant term which gives the demand for export when $PWE_i = P_i$, and PWE_i the export price in foreign currency which is given by

$$(12) \quad PWE_i = PD_i / ([1 + t_{ei}]ER)$$

where PD_i is the domestic price of good i in local currency; and t_{ei} is export subsidy rate (negative if tax). It is clear that if (11) and (12) are combined, forex positively affects export volume or demand.

In the APEX model the balance-of-payments equation is specified as

$$(13) \quad DB^* = DD^* + DK^* + DV^*$$

where DB^* is the change in the overall balance of payments, DD^* is the change in current account deficit, DK^* is the change in capital outflow,¹⁶ DV^* is the change in the level of reserves. As noted earlier, a zero change in the balance of payments is imposed, i.e.,

$$(14) \quad DB^* = 0.$$

14. The equations in the import sector also have similar specifications.

15. See Dervis, de Melo, Robinson (1982), Habito (1989), and Cororaton (1989).

16. The model equates this to the change in the government borrowing requirements. This specification is common to other CGE models.

2. Simulation

A. Column EXP5 of Table 3 presents the results of the forex exchange rate experiment. The change in the forex is +1. The results show that, indeed, changes in the level of the forex do not affect the rest of the model. The numbers for the selected variables are either 1 or 0.¹⁷ Real GDP has 0 change. Supplies and prices of all the sector also showed no change.¹⁸

B. Column EXP1 shows the results of the change in tariff rate. The simulated change in tariff is +1. If the previous tariff rate was 10 percent, for example, this means that the new tariff level is 11 percent.

The results are puzzling. In terms of real GDP, the effect of a +1 increase in tariff rate is a +0.0107 percent increase in real GDP.

The real puzzle is found in the sectoral results. The change in all income levels is negative. Similarly, the change in the volume of supply is negative in almost all sectors. Only six sectors registered an increase: coconut (#4); sugar (#5); inland fishing (#15); textile and knitting mills; (#28) garments, footwear, leather and rubber footwear (#30); and banks and non-banks (#47). Clearly, there are inconsistencies in the results, unless the real contribution of the remaining 44 sectors is less than the contribution of these six sectors. This is probably due to how the change in real GDP is computed in the model.

The change in real GDP is computed in the model as the difference between the change in nominal GDP (which is negative for this experiment) and the change in GDP deflator (which is also negative for this simulation, but bigger in absolute value than the negative change in nominal GDP). Nominal GDP in turn is derived from the expenditure side of the national income accounts (i.e., its components are nominal values of consumption, investment, government, exports and imports).

GDP deflator is defined as the weighted average of changes in sectoral output prices (or producer prices), where the weights are the value-added shares. The problem here is that, for this particular experiment, the result for the GDP deflator does not seem to tally with its components. For example, the results show that almost all sectors registered an increase in producer prices. Only 11 sectors registered a decline: non-irrigated palay (#2); rootcrops (#8), agricultural services (#13); rice and corn milling (#19); electric, gas and water (#44); transportation and communication services (#45); trade, storage, and warehousing (#46); banks

17. The change in household incomes is 1 because of the non-factor income variable which appeared in the income equations. According to the authors of the APEX model, the 1 and 0 results of this experiment are a real test of homogeneity.

18. Three different levels of the forex were simulated: forex rate change of 10, -1, and -10. The results are the same; no change in the sectoral supply, price of commodities, or real GDP. Household incomes, however, changed by 10, -1, and -10, respectively.

and non-banks (#47); life and non-life insurance and real estate (#48); government services (#49); and other services (#50). Therefore, it is clear that the components will not tally with the composite price index, unless the weight of all the remaining 39 sectors combined is smaller than the weight of these 11 sectors which registered a decline in producer prices.

The increase in tariff rate results in a budget surplus. The surplus of the government increases by 0.0201 percent. As a result, the personal income tax shift variable decreases by -0.8398 percent. In other words, disposable income of the consumers increased by an amount equal to the decline in the personal income tax shift variable. Note that as specified in the model (essentially because of the zero-change restriction in the BOP), this shift variable absorbs any change in the fiscal deficit.

C. Column EXP2 shows the results of the experiment which also includes an increase in tariff rate, but this time the increase is +20. There is a linear increase in the results, i.e., the results are just 20 times the result of a EXP1 which is an increase of +1 in tariff rate. The APEX model therefore is linear in percentage changes of variables, although the real structure of the model is non-linear.

D. The linearity in the results is also seen in the solution of experiment EXP3. This experiment involves a decline in tariff rate by -1. The results are just (-1) times the results of EXP1.

E. Experiment EXP9 looks at the effects on the economy if export prices of commodities are increased by +1.¹⁹ The results show that the improvement in the terms of trade is favorable. As a whole the economy improves, but there are about 18 sectors which show some contraction in total output.

This effect would seem to conform with the effect on real GDP, i.e., the positive growth in real GDP is supported by a positive change in majority of the sectors (32 sectors). Also, the change in household incomes is positive.

Since the change introduced was an increase of +1 in export prices, one can observe from the results that producer prices of imported commodities did not register any change at all. However, local prices of commodities increased except for three sectors: sugar (#5), other commercial crops (#9), and marine fishing (#14).

F. Experiment EXP10 involves a +1 increase in imports prices.²⁰ The results show that the economy will be worse off if this reduction in the terms of trade happens. Real GDP will decline by a bigger percentage than the effect of a +1 increase in export prices (-0.2869 percent

19. As assumed in the model, 33 out of 50 sectors are directly affected by the +1 increase in export prices. These sectors are 1, 2, 5, 7, 8, 10-13, 16, 17, 21, 23-25), 27, 28, (32-35), 37, 39-42, and 44-50.

20. All 50 sectors are directly affected by this change in import prices as assumed in the model.

for the former and +0.1858 percent for the latter). There is also a clear worsening in terms of household income. Furthermore, there are 43 sectors out of 50 which will experience a decline in total supply, due probably to the big jump in prices of commodities. This seems to be a consistent set of results.

G. The results of experiment EXP11 are the combined effects of experiments EXP1 and EXP5. Similar to the previous runs, the results here are also inconsistent, i.e., the effects on the components do not seem to add up to the total.

H. The results of experiment EXP12 are the combined effects of experiments EXP9 and EXP10, i.e., the net effect of an equal increase in export prices and imports prices is a reduction in the level of economic activities.

I. The results of the experimental run which involved an increase in the government's borrowing requirements are shown in Table 4.

As specified in the model, an increase in this variable is equated to the increase in capital outflow. Thus, an increase can be taken as a scenario where there is capital flight.

Since the change in the balance of payments is restricted to zero, and since there is no change in the level of reserves, the increase in capital outflow has to be accompanied by a decline in the current account deficit. This is shown in the results. The current account deficit variable, cd, indeed showed a decline of -1.

Since in this scenario imports have increased by 0.0015 percent (shown in the variable mdollarv),²¹ exports will have to increase by a much higher rate so as to satisfy (10). Indeed, exports increased by 0.4138 percent (shown by the variable edollarv).

As shown in the results, the factors behind the growth in exports are not increases in export prices (changes in prices are almost nil), but increases in export demand. However, what is surprising is that the increase in export is highly uneven across export sectors. The results show that the rice- and corn-milling industry (#19) will have to increase by 977.1504 percent, other-food sector (#26) by 5.0775 percent, and construction by 6.0967 percent, while the rest of the export sector will stay almost constant. One should note that these are not even major export sectors of the country.

21. This result is surprising. During shortages of foreign exchange, imports usually decline. In the BOP crisis of the mid-1980s, imports dropped significantly.

TABLE 4. Increase in Govt's Borrowing Requirements

Scenario:

- * $ckg = +1$
- * zero change in BOP restriction is retained
- * foreign exchange rate is fixed

Results:

cd	-1
ck	1
mdollarv	0.0015
mpesov	0.0015
edollarv	0.4138
e	0.4138
pexp(i)	either 0 or very small negative numbers
qcomk(i,u4)	
#18	977.1504
#26	5.0775
#43	6.0967
others	either 0 or very small negative numbers

where:

- cd : change in current account deficit
- ck : change in capital outflow
- mdollarv : value of imports in foreign currency
- mpesov : value of imports in local currency
- edollarv : value of exports in local currency
- e : value of exports in local currency
- pexp(i) : export prices in foreign currency
- qcomk(i,u4): export demand

J. Table 5 presents the results of the simulation where tariff rate is decreased by -1 in an economic environment where the zero change in the balance-of-payments restriction is deleted and where the foreign exchange rate variable is made endogenous.²²

The foreign exchange rate variable is supposed to clear the market for foreign exchange once it is declared as an endogenous variable.²³ The results of this simulation run, however, do not seem to confirm this.

In the specified economic environment, if tariff rate is decreased by -1, the results would show that imports in terms of foreign currency would increase by 0.0375 percent. Imports in local currency, however, would decline by -0.0733 percent. Exports in local currency, on the other hand, would decline by -0.5633 percent, while exports in local currency by -0.6740 percent.

What is surprising, though, is that a decline in tariff rate is accompanied by an appreciation of the local currency by -0.1108 percent.²⁴ As a result of these movements, both the current account (cd) and the balance of payments (cb) deficits increase by 1.4613 percent. Since the change in both capital outflow and level of reserves is assumed zero, the external account is not cleared.

Another surprising result pertains to the relationship between the personal income tax shift variable (npshft) and the budget deficit of the government (deficit). As discussed before, the shift variable allows the private sector to finance government deficit. This variable is a positive number if the government is in a deficit position (this is because this variable is treated like a lump sum tax in the model).

The results, however, are disturbing. The shift variable registers a decline of -6.7421 percent, which means that there is an effective reduction in lump sum personal income tax. This happens in the face of a growing budget deficit of the government; the government deficit increases by +1.9836 percent.

The decrease in the personal income tax leads to a general increase in household incomes. This is shown in the result, except for the first three household labor income types and all non-factor household income types.

22. To close the model, two more endogenous variables should be exogenized. The author decided to reclassify the following variables as exogenous: financial transfers of the government (gtransfers) and revenue of the government from other sources (revos).

23. Clarete and Warr (1992:30).

24. This result is not consistent with theory.

TABLE 5. Endogenous Foreign Exchange Rate

Scenario:

- * mtrate = -1 (i.e. across-the-board tariff declined by -1)
- * the restriction that there is zero change in BOP deficit is deleted
- * the following variables were made exogenous
 - gtransfers : financial transfers of government
 - revos: revenue of government from other sources

Results:

1.	mdollarv	0.0375
2.	mpesov	-0.0733
3.	edollarv	-0.5633
4.	e	-0.6740
5.	cb	1.4613
6.	cd	1.4613
7.	ck	0.0000
8.	exrt	-0.1108
9.	gdp	0.0325
10.	rgdp	0.0325
11.	pdef	0.0000
12.	npshtt	-6.7421
13.	deficit	1.9836

Other Results:

- All household incomes increased, except for
1. non-factor income of households which declined by -0.0209
 2. the first three household income derived from labor income

hh1	-0.0195
hh2	-0.0111
hh3	-0.0046
hh4	0.0022
hh5	0.0446

where:

- mdollarv : value of imports in foreign currency
- mpesov : value of imports in local currency
- edollarv : value of exports in foreign currency
- e : value of exports in local currency
- cb : change in BOP deficit
- cd : change in current account deficit
- ck : change in capital outflow
- exrt : foreign exchange rate
- gdp : nominal gross domestic product
- rgdp : real gross domestic product
- pdef : gdp deflator
- deficit : change in budget deficit of the government
- npshtt : personal income tax shifter

In sum, based on the results of the simulation runs using the APEX model, some of the equations of the model may have been inconsistently specified or defined, because for some simulations the results do not seem to follow widely believed directional changes and movements of crucial variables. More experimental runs using the APEX version used in the review may unveil more inconsistencies.

III. THE PHILCGE MODEL

A. *General Description*

The model reviewed in this section is the second version of the Philippine CGE (PhilCGE) model of Habito (1986). This version of the model has 14 production sectors.²⁵ There are 10 household groups in included model. Table 6 compares the sectoral breakdown of the new version with the old version of PhilCGE.

In terms of the new sectoral production classification particular emphasis is given to agriculture. In fact, in this latest version of the model, there are now seven specific agricultural sectors, instead of just two aggregative agricultural sectors in the old version. The reason for this is that the model was specifically designed to analyze and simulate impacts of agricultural policy changes.

However, household income groups have been reduced to 10 types, instead of 11 groups in the original version. But in the latest version, the groupings reflect a greater disaggregation of higher income groups than the original version.

The specification of PhilCGE is patterned after the model developed by Dervis, de Melo, and Robinson (1982). The major components of the model are the government and the foreign sector. The government derives its income from direct and indirect taxes, public enterprises, and direct government transfers from abroad, and spends it on the products of the producing sectors with fixed expenditure proportions. Foreign transactions are based on a fixed exchange rate, which best approximates the "managed float" exchange rate regime that has prevailed in the Philippines in the past decade.²⁶ Imports are treated as imperfect substitutes for domestic goods; products of each sector are therefore treated as composites of the two, defined by a trade aggregation function.

The model is savings-driven. The existing closure rule equates nominal investment to available savings. The model, however, has some degree of flexibility. One can specify, for example, an investment savings closure rule where

25. The discussion in this section is based on Habito (1986).

26. The model is flexible enough to allow the foreign exchange rate to be an external sector clearing variable.

TABLE 6. Goods and Household Definitions of PhilCGE

<i>Production Sectors of the 18-Sector Version</i>	<i>Production Sectors of the 14-Sector Version</i>
1 Agriculture and fisheries	1 Palay
2 Forestry and logging	2 Corn
3 Mining	3 Coconut
4 Processed food and tobacco	4 Sugarcane
5 Textiles and apparel	5 Fruits and other crops
6 Wood and rubber products	6 Livestock and poultry
7 Paper and printing/publishing	7 Fishery and forestry
8 Chemical products	8 Processed food
9 Petroleum refining	9 Mining
10 Cement and nonmetallic mineral products	10 Nonfood manufacturing
11 Metals, machinery and misc. manufactures	11 Transport
12 Transport equipment	12 Services
13 Electricity, gas and water	13 Energy
14 Construction and real estate	14 Fertilizer
15 Trade	
16 Banking, finance and insurance	
17 Transportation, storage and communication	
18 Services	
<i>Household Breakdown in the 18-Sector Model</i>	<i>Household Breakdown in the 14-Sector Model</i>
1 Under P1,000	1 Under P2,000
2 P1,000-1,999	2 P2,000-4,999
3 P2,000-2,999	3 P5,000-7,999
4 P3,000-3,999	4 P8,000-9,999
5 P4,000-4,999	5 P10,000-14,999
6 P5,000-5,999	6 P15,000-19,999
7 P6,000-7,999	7 P20,000-29,999
8 P8,000-9,999	8 P30,000-39,999
9 P10,000-14,999	9 P40,000-49,999
10 P15,000-19,999	10 P50,000 and above
11 over P20,000	

- 1) government savings rate will adjust endogenously to ensure that available savings is equated to total investment, or
- 2) institutional savings rate (excluding government) will adjust proportionally to ensure the equality of savings and investment, or
- 3) total investment is set exogenously with an automatic adjustment mechanism in institutional savings.

The model is "dynamic." The dynamic nature of the model is characterized by a two-stage operation. In the first stage, all markets are assumed to clear subject to restrictions on the ability of certain markets to adjust (e.g., the foreign exchange, capital, and labor markets). In the second stage, the dynamic adjustment of certain variables whose values were fixed in the first stage is modeled explicitly. In effect, the model is partitioned into a static within-period equilibrium model and a separate between-period model that provides the necessary intertemporal linkages and therefore shifts the sectoral supply and demand functions.

The production function, capital stock, labor supply, consumption shares, and export demand are updated using exogenously specified update variables and parameters.

The benchmark year for the equilibrium data set was 1978. The major sources of data used to construct the benchmark equilibrium data set were the following:

- 1) The 1979 Input-Output Tables;
- 2) *National Income Accounts for 1978*;
- 3) *Family and Income and Expenditures data for 1975*;
- 4) *Annual Survey of Establishment*;
- 5) *The Philippine Statistical Yearbook*.

B. *Simulations*

The author conducted a number of policy experiments using PhilCGE. Because of the huge volume of numbers generated per simulation run of the model, the paper will only report a few results per simulation run.²⁷ The results of the runs conducted and presented in the paper are

- 1) broadening of value-added tax,
- 2) reduction in tariff, and

27. The model is solved using the Powell (1970) algorithm, which is a combination of steepest descent and Newton-Raphson methods. The author encountered problems in running this model and in his own CGE model, which uses the same algorithm. This error message appeared a number of times: "error return because a nearby stationary point of the system is predicted," implying that the solution of the non-linear systems of equation is not found. As a result, the algorithm automatically terminates the computing operations. For a detailed discussion, see the reference cited.

- 3) devaluation of the foreign exchange rate.²⁸

The analysis of the results will focus on the income distribution effects, although macroeconomic effects will also be analyzed occasionally.

Two other runs were conducted to test how the model respond to changes in the estimates of elasticities used in the model. The following changes in elasticity estimates are analyzed:

- 1) elasticity of substitution in trade aggregation; and
- 2) export demand elasticity.²⁹

Broadening of value-added tax. The broadening of value-added tax (VAT) scenario is defined here as a tax policy which imposes a 10 percent increase in VAT in all sectors except transport and services sector (defined as scenario VAT1), and then a 10 percent increase in VAT in all sectors without exception (scenario VAT2).³⁰ That is, the tax base of VAT is broadened to include service and transport sectors in scenario VAT2. The results are compared with the baseline scenario with zero VAT.

The following equations describe how sectoral value-added taxes, tv_i , enter into the model

$$(15) \quad YK_i = (PN_iXD_i - W_A L_{Ai} - W_N L_{Ni})(1 - tv_i) \\ i = 1, \dots, N$$

where:

- YK_i : income of capital in sector i
- PN_i : net or value-added price of good i , pesos
- XD_i : aggregate demand for domestic good i

28. The model was solved for the years 1978, 1980, 1982, and 1984. The solutions in these years were derived using actual values of the exogenous variables. (Note that this set of solutions provides the baseline values for the comparison with other policy experiments using the model.)

29. There are a number of parameters which are still to be tested: 1) the elasticity of substitution between capital and labor; 2) the capital-mobility parameter; 3) the labor-mobility parameter; 4) the wage-differential response parameter; and 5) the household income elasticities. Item 5 is particularly important in the MIMAP project.

However, let it be emphasized here that there is no substitution effect between capital and labor within a given period. As is common to CGE models, capital input is assumed fixed at the start of the year. Therefore, changes in the capital stock due to changes in relative prices, for example, cannot occur within a given year. Changes will occur in the future (or in $t+1$) through the capital stock update equation in the dynamic set of linking and updating equations. Thus, item 1 does not pertain to the substitution parameter between labor and capital in a given year.

30. This value-added taxation is different from the actual implementation of the VAT. In actual practice, agricultural products and some service sectors do not carry a 10 percent VAT. Furthermore, actual value-added taxation implemented follows a credit method. There is a tax on output and a credit on inputs. For general equilibrium analysis see Clarete (1991).

- W_A : wage rate of agricultural labor
- L_{Ai} : agricultural labor in sector i
- W_N : wage rate of non-agricultural labor
- L_{Ni} : non-agricultural labor in sector i

Value-added taxes also appear in the government income equation as a source of revenue.

The income distribution effects are the following:

- 1) In both scenarios and in all of the periods considered in the simulation,³¹ the first income group may have to suffer a drop in income share (Figure 1). The drop is bigger during the first period under scenario VAT1. However, the effect changes through time. In fact, between the third and the fourth period income share begins to improve under scenario VAT2. In the fourth period, income share under scenario VAT2 is almost equal to the baseline value. This is not the case under scenario VAT1 where the big negative gap between the baseline and the computed income share prevails.

The same pattern of effects is found in the results for the second income group (chart not printed).

- 2) The third income group enjoys a big jump in income share, especially during the first period (Figure 2). The improvement, however, is bigger under scenario VAT2 than under scenario VAT1. In all of the periods considered, the effect on this income group is positive, although the positive gap between scenario VAT2 and the baseline value decreases between the third and the fourth period.

The same pattern can be observed from the results for the fourth income group up to the sixth income level (charts not printed).

- 3) There is a slight improvement in income share of the seventh income group in both scenarios during the first period (Figure 3). However, within the second and the third period, the share declines below the baseline value under VAT2. It continues to decline so that in the fourth period, income share of this group under this scenario is already way below the baseline value. Scenario VAT1, however, still gives an income share for this group higher than the baseline.

The same direction of effects is seen in the results for the eighth income group.

- 4) Scenario VAT1 gives an improved income share relative to the baseline for the ninth income group in all of the periods considered (Figure 4). The opposite is true for

31. A period means two years.

FIGURE 1. Broadening of VAT: Effects on Income Distribution of Household Type 1

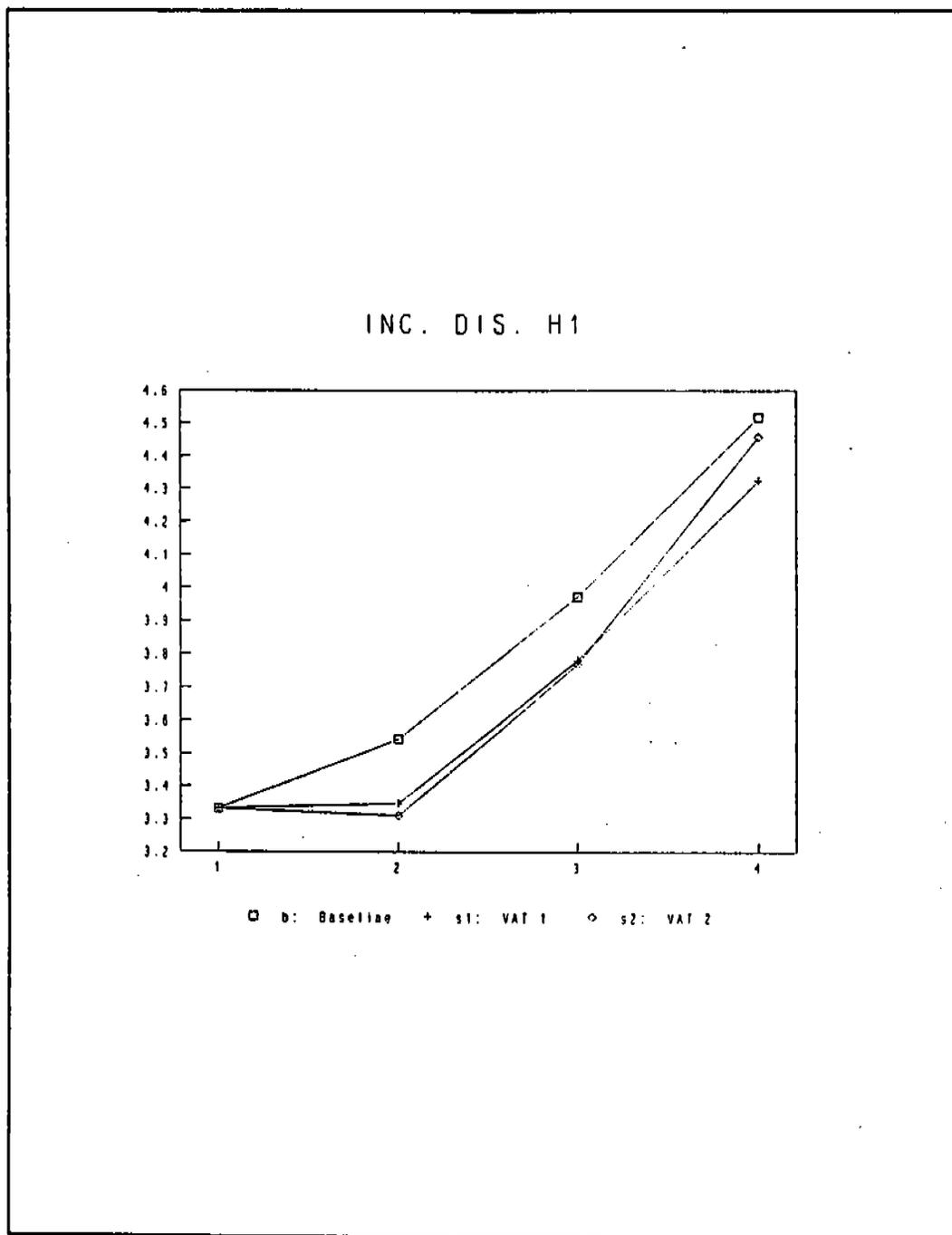


FIGURE 2. Broadening of VAT: Effects on Income Distribution of Household Type 3

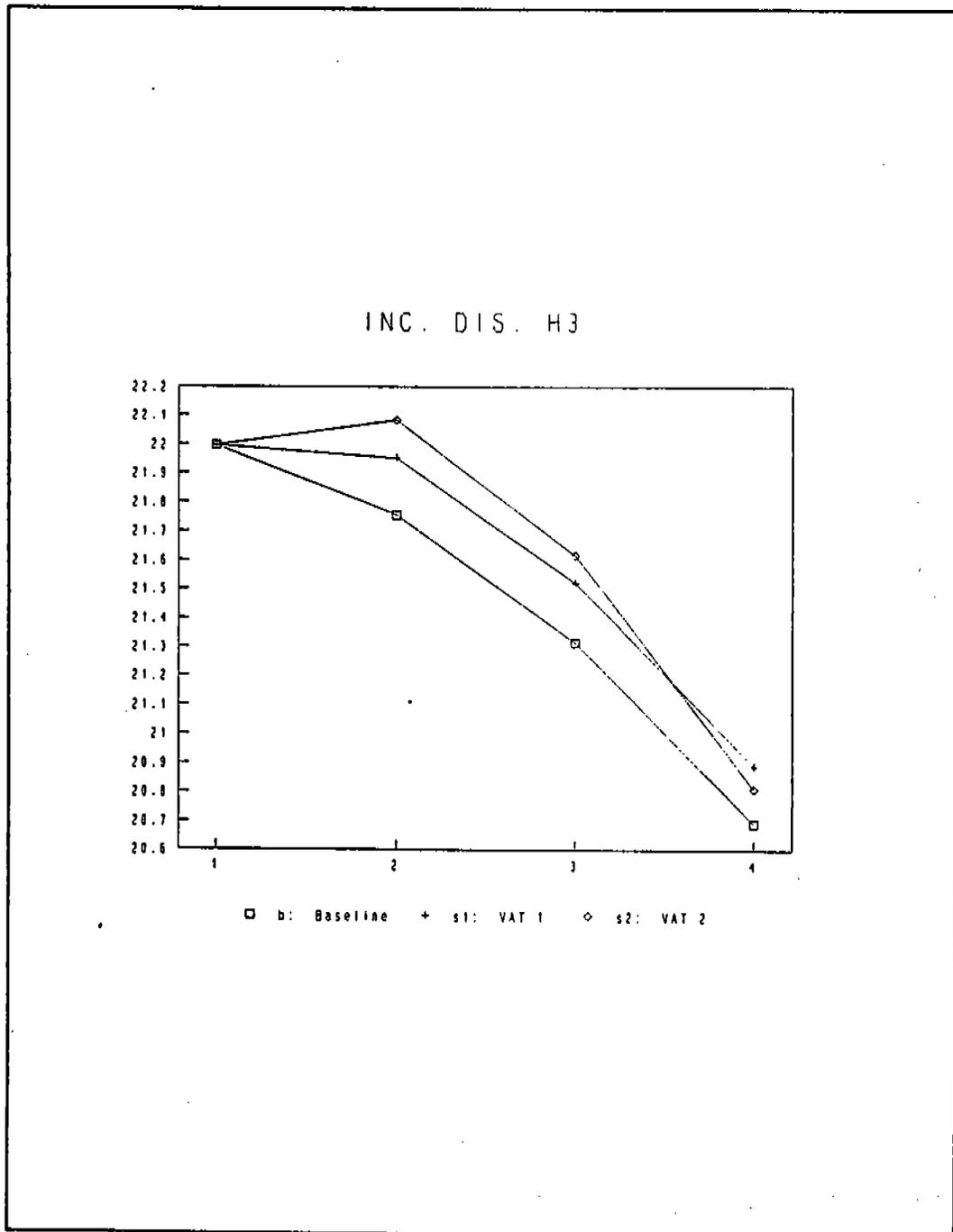


FIGURE 3. Broadening of VAT: Effects on Income Distribution of Household Type 7

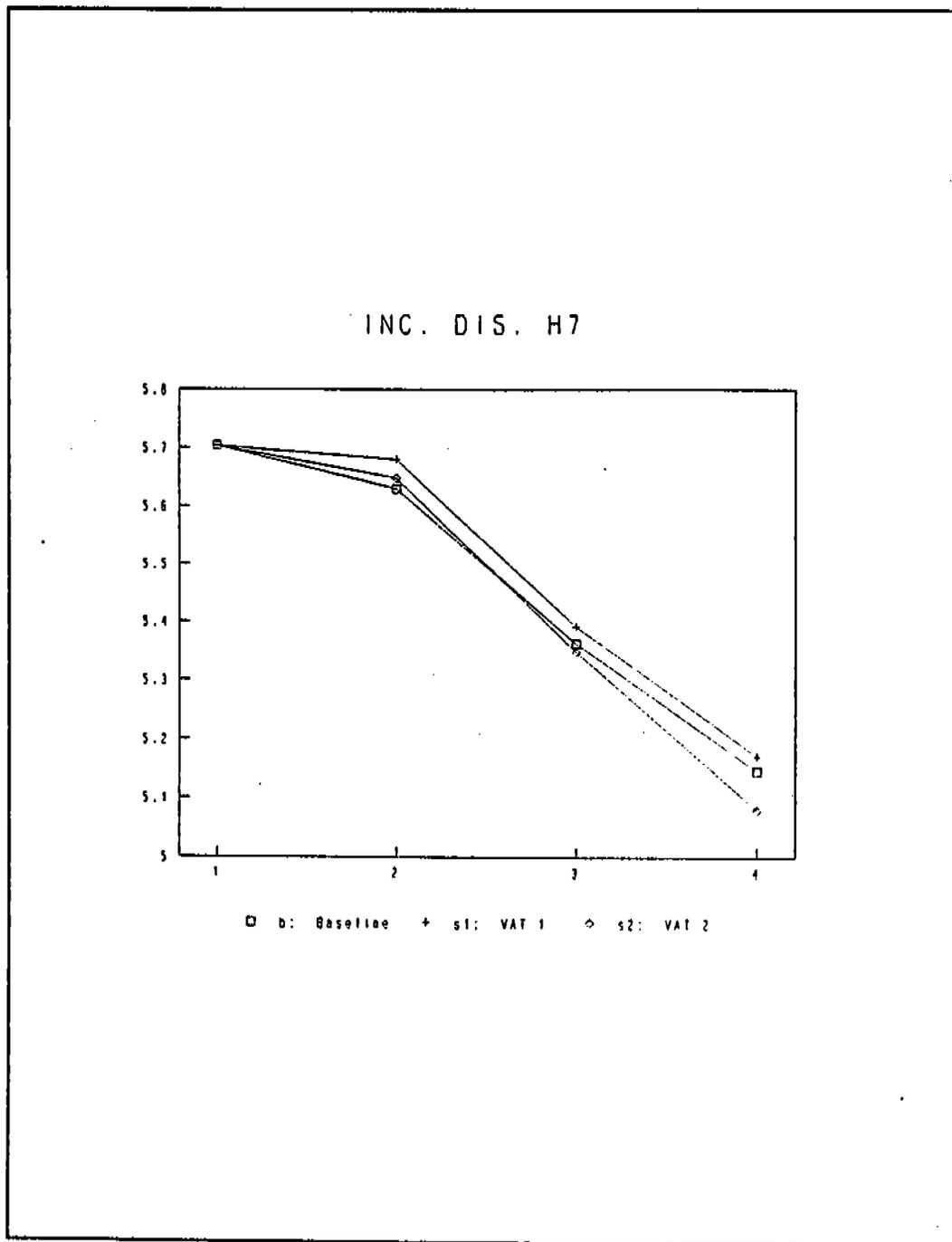
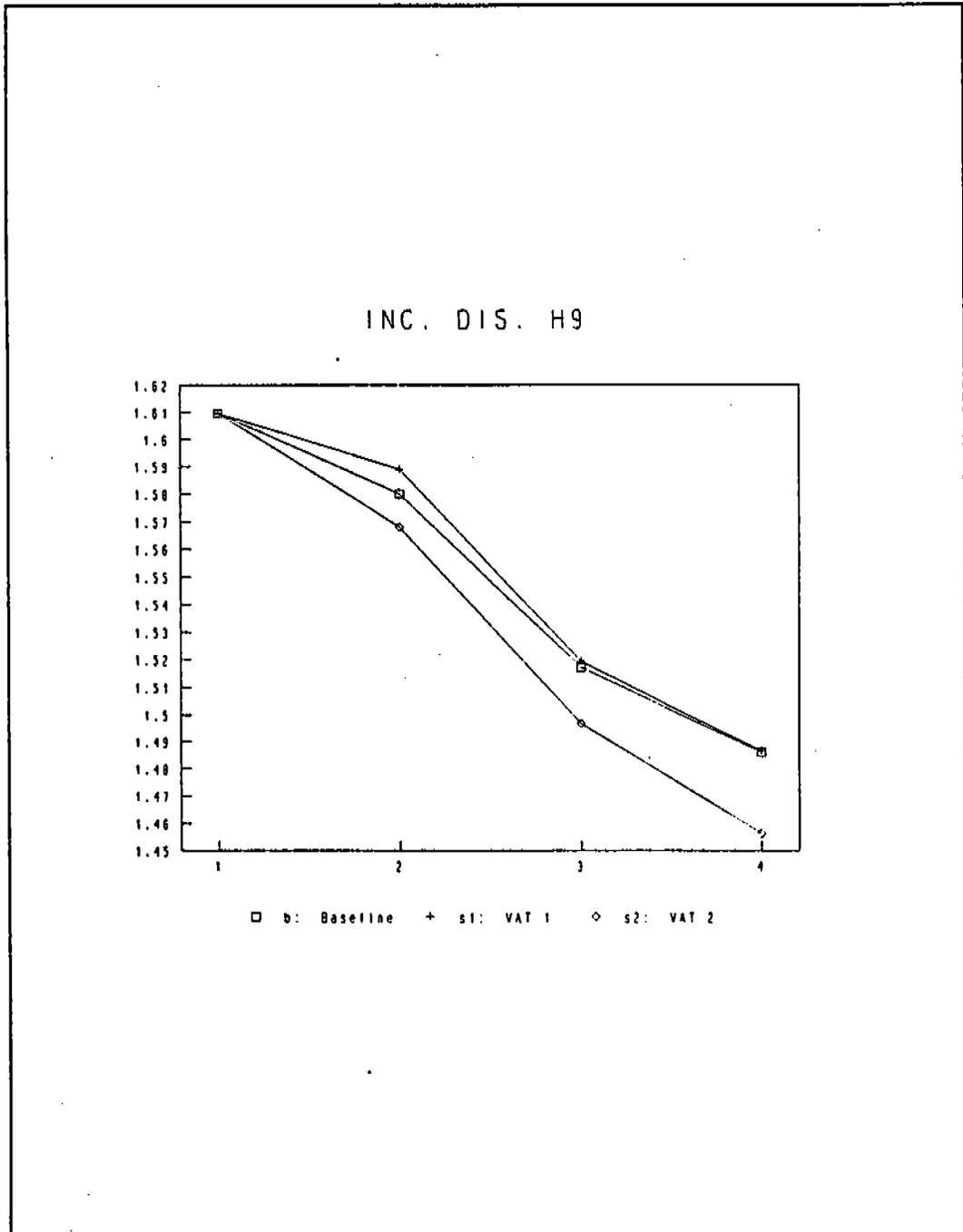


FIGURE 4. Broadening of VAT: Effects on Income Distribution of Household Type 9



scenario VAT2, with the gap increasing through time. Furthermore, in the fourth period, the share of this income group under in this scenario is already way below the baseline.

The same effects are observed from the results for the tenth income group.

In sum, based on the results, the effects of a broadening of value-added tax (as defined above) are favorable: that is, there is a redistribution of income from the rich segment of the population to the groups which belong to the lower income bracket. Specifically, this change in the VAT structure will likely result in a reduction of income share of the ninth and the tenth income groups and an improvement in the share of the second up to the sixth income groups.

However, in terms of overall output effect, defined as the average change in total real GDP (relative to the baseline), scenario VAT1 gives a relatively higher output effect than scenario VAT2 (1.59 percent for the former versus 1.19 percent for the latter, see Table 7, specifically line no. 65).

Reduction in tariff. Two scenarios were conducted to analyze the effect of a reduction in tariff. The first scenario (defined here as scenario TR1) involves an across-the-board 20 percentage points reduction in tariff rate. The foreign exchange rate in this scenario is flexible. The second scenario (defined as TR2) involves the same 20 percentage points reduction in tariff rate on all sector, but the exchange rate is held fixed.

Tariff rate affects the system through the following equation

$$(16) \quad PM_i = PW^*(1 + tm_i)ER \quad i = 1, \dots, N$$

where:

PM_i : import price of good i , pesos
 PW^* : world price of imports
 tm_i : tariff rate on good i
 ER : foreign exchange rate, P/\$

Tariff rate also enters into the government income equation as a source of revenue.

The foreign exchange rate variable, on the other hand, enters into the export equation through (12). It also enters into the import function through (16). Furthermore, the exchange rate variable affects factor incomes derived from net foreign remittances from labor income. Also, movements in the exchange rate affect total investment via foreign capital inflows. Income of the government is affected by the exchange rate through import taxes and export subsidy rate on good i .

TABLE 7. Definition of Scenarios	
Scenario Number	Description
VAT 1	SC16 (BROADENING OF VAT ANALYSIS) NEX=1; TEFIX=0.10; EXCEPT TRANSPORT AND SERVICES (A 10 percent increase in VAT in all sectors, except transport and services)
VAT 2	SC17 (BROADENING OF VAT ANALYSIS) NEX=1; TEFIX=0.10; ACROSS-THE-BOARD (A 10 percent increase in VAT in all sectors)

TABLE 7 (cont'd). Broadening of VAT Simulations Using Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	VAT 1	VAT 2
1	<i>Disposable Income:</i>		
2	Household 1	-8.27	-10.87
3	Household 2	-5.67	-8.59
4	Household 3	-3.12	-6.57
5	Household 4	-2.58	-6.13
6	Household 5	-2.04	-5.67
7	Household 6	-1.39	-5.07
8	Household 7	-3.02	-7.02
9	Household 8	-3.03	-7.04
10	Household 9	-3.04	-7.05
11	Household 10	-3.04	-7.07
12	Total	-3.86	-7.24
13	<i>Real Income:</i>		
14	Household 1	-0.84	-1.48
15	Household 2	-0.74	-1.27
16	Household 3	-0.63	-1.01
17	Household 4	-0.52	-0.77
18	Household 5	-0.40	-0.50
19	Household 6	-0.34	-0.31
20	Household 7	-0.26	-0.15
21	Household 8	-0.31	-0.28
22	Household 9	0.09	0.64
23	Household 10	-0.02	0.47
24	<i>Income Distribution:</i>		
25	Household 1	-3.79	-3.25
26	Household 2	-1.45	-0.98
27	Household 3	0.70	0.87
28	Household 4	1.07	1.07
29	Household 5	1.42	1.24
30	Household 6	1.91	1.61
31	Household 7	0.48	-0.29
32	Household 8	0.52	-0.16
33	Household 9	0.19	-1.01
34	Household 10	0.27	-0.91
35	<i>Prices:</i>		
36	1. Palay	-2.62	-4.26
37	2. Corn	-1.39	-2.92
38	3. Coconut	-4.19	-6.24
39	4. Sugarcane	-2.65	-4.40
40	5. Fruits etc.	-1.75	-3.11
41	6. Livestock	-2.36	-4.43
42	7. Fish/Fores	-5.20	-9.08
43	8. Proc. Food	-1.63	-3.25
44	9. Mining	-0.27	-0.66
45	10. Nonfood Mf	1.55	0.97
46	11. Transport	-2.32	-1.83
47	12. Services	2.26	6.53

TABLE 7 (cont'd). Broadening of VAT Simulations Using Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	VAT 1	VAT 2
48	13. Energy	0.23	-1.09
49	14. Fertilizer	0.87	0.54
50	<i>Real GDP:</i>		
51	1. Palay	-1.36	-2.63
52	2. Corn	-0.75	-1.66
53	3. Coconut	-0.77	-1.24
54	4. Sugarcane	-1.49	-2.89
55	5. Fruits etc.	-0.26	-0.51
56	6. Livestock	-2.25	-4.26
57	7. Fish/Fores	-0.41	-0.98
58	8. Proc. Food	2.08	2.04
59	9. Mining	0.80	2.24
60	10. Nonfood Mf	2.92	2.73
61	11. Transport	-2.25	-4.81
62	12. Services	3.18	3.27
63	13. Energy	0.35	-3.19
64	14. Fertilizer	-0.55	-3.00
65	Total	1.59	1.19
66	<i>Employment:</i>		
67	1. Palay	-1.60	-2.48
68	2. Corn	-0.81	-1.36
69	3. Coconut	-1.75	-2.30
70	4. Sugarcane	-1.81	-2.67
71	5. Fruits etc.	-0.12	0.13
72	6. Livestock	-1.96	-3.18
73	7. Fish/Fores	-1.95	-2.97
74	8. Proc. Food	-4.25	-5.56
75	9. Mining	-2.33	-1.37
76	10. Nonfood Mf	-1.46	-1.85
77	11. Transport	-4.30	-10.75
78	12. Services	4.82	2.41
79	13. Energy	-5.80	-12.23
80	14. Fertilizer	-6.04	-8.38
81	Total	0.48	-0.94
82	<i>Export:</i>		
83	1. Palay	-0.37	-0.51
84	2. Corn	0.00	0.00
85	3. Coconut	2.01	4.39
86	4. Sugarcane		
87	5. Fruits etc.	1.39	3.37
88	6. Livestock	0.00	0.00
89	7. Fish/Fores	5.03	9.32
90	8. Proc. Food	0.70	3.00
91	9. Mining	1.56	3.70
92	10. Nonfood Mf	-0.98	0.23
93	11. Transport	0.33	-3.28
94	12. Services	1.86	-1.53

TABLE 7 (cont'd). Broadening of VAT Simulations Using Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	VAT 1	VAT 2
95	13. Energy	-0.19	-0.50
96	14. Fertilizer		
97	Total	0.61	1.02
98	<i>Import:</i>		
99	1. Palay	-5.48	-9.59
100	2. Corn	-3.16	-7.21
101	3. Coconut		
102	4. Sugarcane		
103	5. Fruits etc.	-3.31	-6.78
104	6. Livestock	-4.13	-8.61
105	7. Fish/Fores	-7.88	-14.45
106	8. Proc. Food	-2.51	-5.17
107	9. Mining	-0.61	-1.62
108	10. Nonfood Mf	3.12	3.17
109	11. Transport	-1.89	-4.44
110	12. Services	3.68	4.67
111	13. Energy	0.13	-1.71
112	14. Fertilizer	-0.06	-0.17
113	Total	1.60	1.07

*Average percent change of 1978, 1980, 1982, 1984 simulations

The observed income distribution effects are the following:

- 1) Figure 5 shows that the first income group may benefit in terms of increased income share during the first and the second periods under scenario TR1. This favorable effect, however, is not sustained beginning the third period. Income share of this income starts to go below the baseline values. For the other scenario (TR2), all throughout the simulated periods, the first income group suffers a decline in income share relative to the baseline values.

The direction of change in the second income group is similar to the first income group (not shown in the Figure).

- 2) The third income group may experience a big drop in income share relative to the baseline values during the first and the second periods in scenario TR1 (Figure 6). This drop is not seen under the other scenario, TR2. However, in the third period income shares in both scenarios start to improve slightly and to move towards the baseline values. In the fourth period, the income shares for both scenarios are already above the baseline.
- 3) A similar pattern is seen in the results for the fourth income group up to the tenth income group. However, in the higher income groups, the drop in income share in the first period under scenario TR1 is no longer felt. In fact, the richest segment of the population may not experience any drop in income share (Figure 7).

On the average, scenario TR2 gives a higher output effect (in terms of total real GDP) than scenario TR1. Line # 65 of Table 8 shows that GDP grows (average for the four periods considered) by 3.93 percent under scenario TR2, which is higher than the 1.46 percent growth in scenario TR1.³² The same results hold for total employment (line no. 81 in the table).

However, scenario TR2 may not be sustainable in the long run because it may be accompanied by a very slow improvement in exports and a very high growth in imports. Exports will only grow by an average of 2.3 percent (line no. 97), while imports will increase by an average of 14.44 percent (line no. 113). This scenario will therefore put a lot of pressure on the balance of trade deficit which will make this scenario unsustainable. In fact, the boom-bust growth experienced by the economy in the 1980s was triggered mainly by the trade deficit problems.

On the other hand, scenario TR1 may be sustainable. Exports will grow by an average of 6.34 percent. Imports will increase by 3.07 percent.

32. This conclusion is not consistent with the results of Clarete (1992) and Cororaton (1989).

FIGURE 5. Reduction in Tariff: Effects on Income Distribution of Household Type 1

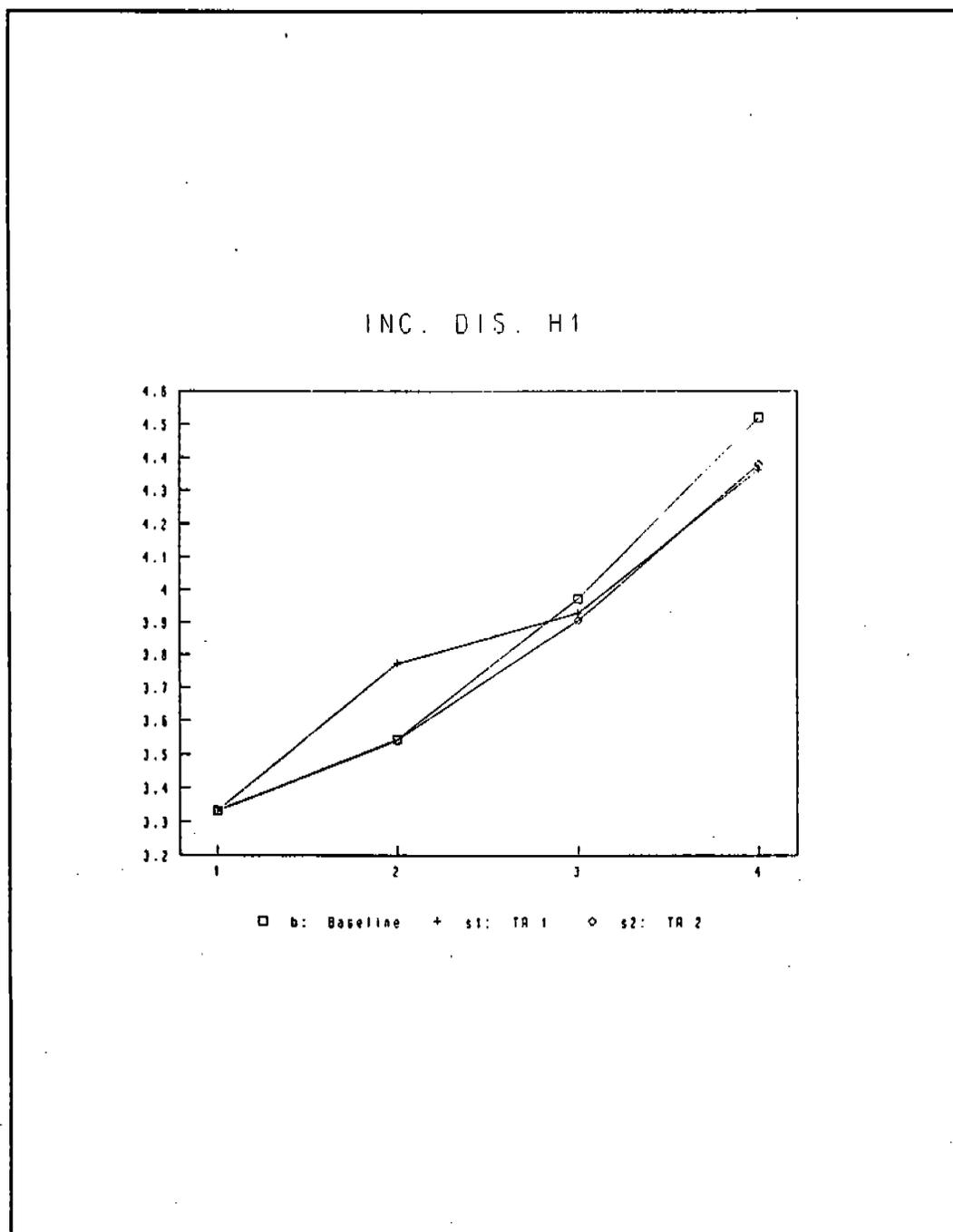


FIGURE 6. Reduction in Tariff: Effects on Income Distribution of Household Type 3

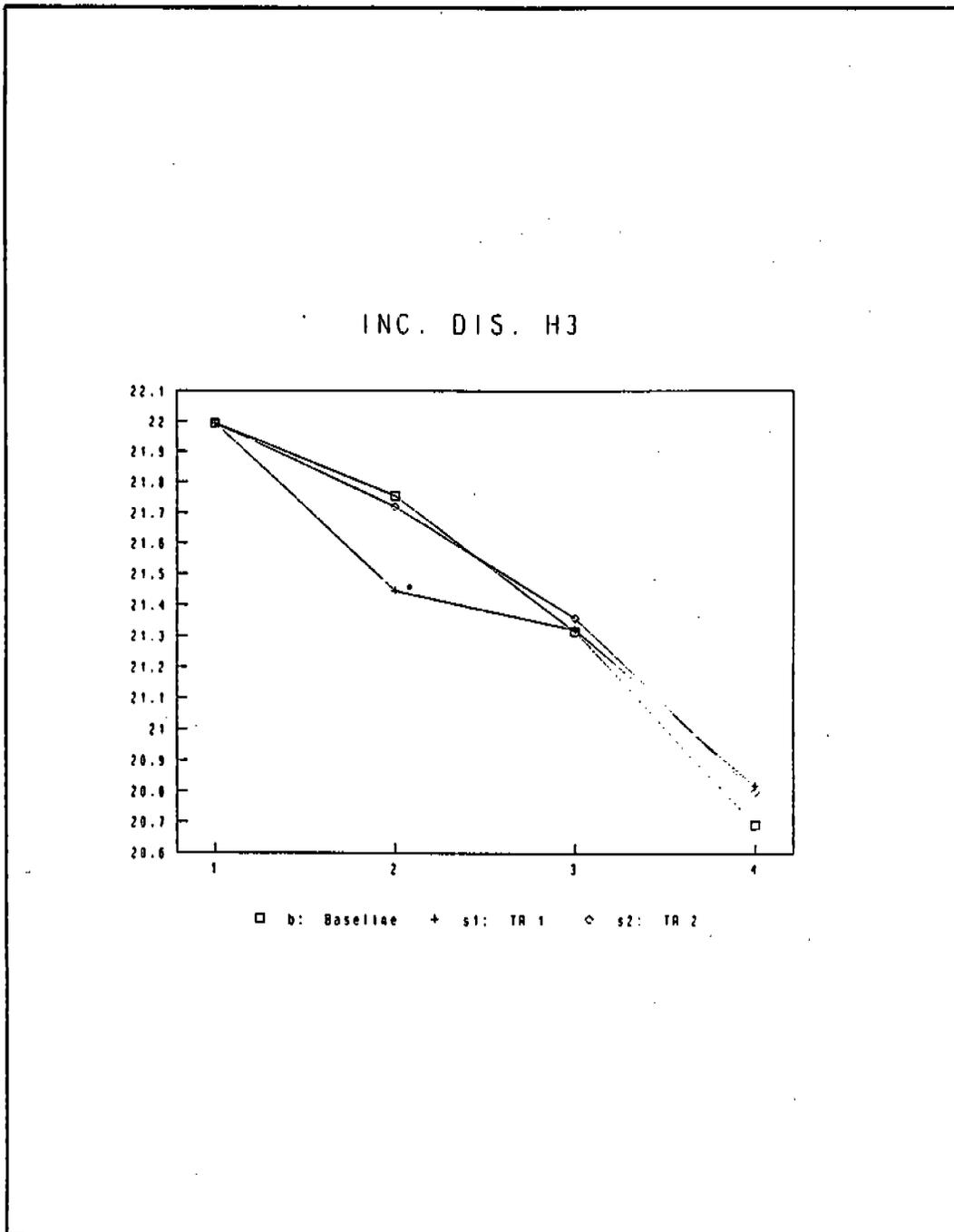


FIGURE 7. Reduction in Tariff: Effects on Income Distribution of Household Type 10

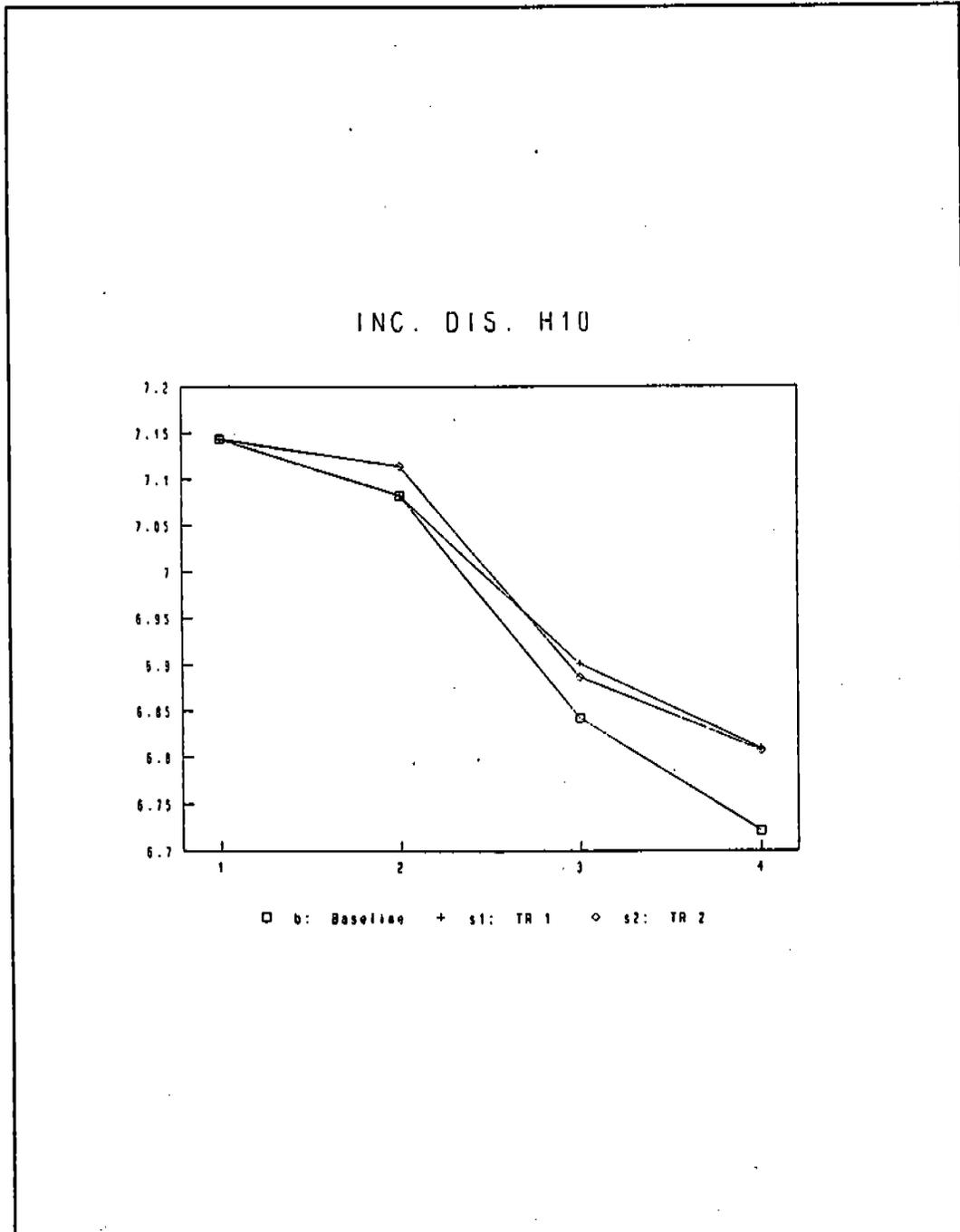


TABLE 8. Definition of Scenarios	
Scenario Number	Descriptions
TR 1	SC6A 20% reduction in tariff except transport and services with flexible forex (Jacob matrix is Jacob.flx)
TR 2	SC3A 20% reduction in tariff except transport and services with fixed forex (Jacob matrix is Jacob.dat)

TABLE 8 (cont'd). Tariff and Forex Adjustments Using Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	TR 1	TR 2
1	<i>Disposable Income:</i>		
2	Household 1	2.64	3.90
3	Household 2	2.80	4.80
4	Household 3	3.10	5.98
5	Household 4	3.17	6.22
6	Household 5	3.22	6.41
7	Household 6	3.26	6.61
8	Household 7	3.51	6.76
9	Household 8	3.54	6.79
10	Household 9	3.55	6.79
11	Household 10	3.59	6.82
12	Total	3.09	5.76
13	<i>Real Income:</i>		
14	Household 1	0.31	-0.72
15	Household 2	0.29	-0.69
16	Household 3	0.25	-0.63
17	Household 4	0.14	-0.67
18	Household 5	0.06	-0.67
19	Household 6	0.05	-0.61
20	Household 7	-0.05	-0.64
21	Household 8	-0.05	-0.71
22	Household 9	-0.07	-0.26
23	Household 10	-0.07	-0.39
24	<i>Income Distribution:</i>		
25	Household 1	0.18	-1.36
26	Household 2	-0.08	-0.70
27	Household 3	-0.20	0.13
28	Household 4	-0.11	0.35
29	Household 5	-0.02	0.49
30	Household 6	-0.02	0.59
31	Household 7	0.36	0.75
32	Household 8	0.34	0.81
33	Household 9	0.48	0.44
34	Household 10	0.53	0.58
35	<i>Prices:</i>		
36	1. Palay	1.50	2.02
37	2. Corn	0.83	1.22
38	3. Coconut	3.76	3.67
39	4. Sugarcane	2.86	1.84
40	5. Fruits etc.	-2.82	-4.27
41	6. Livestock	1.88	0.72
42	7. Fish/Fores	8.46	2.72
43	8. Proc. Food	1.60	0.48
44	9. Mining	-8.30	-14.26
45	10. Nonfood Mf	-5.45	-7.84
46	11. Transport	2.81	1.54
47	12. Services	0.54	3.31

TABLE 8 (cont'd). Tariff and Forex Adjustments Using Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	TR 1	TR 2
48	13. Energy	-4.04	-4.52
49	14. Fertilizer	-4.69	-8.36
50	<i>Real GDP:</i>		
51	1. Palay	1.91	2.34
52	2. Corn	0.79	1.46
53	3. Coconut	1.22	1.20
54	4. Sugarcane	1.91	2.15
55	5. Fruits etc.	-0.56	-0.90
56	6. Livestock	3.16	4.06
57	7. Fish/Fores	1.08	1.40
58	8. Proc. Food	3.86	0.86
59	9. Mining	7.13	2.03
60	10. Nonfood Mf	1.51	2.42
61	11. Transport	6.05	8.26
62	12. Services	0.05	5.16
63	13. Energy	5.66	15.82
64	14. Fertilizer	2.71	-1.71
65	Total	1.46	3.93
66	<i>Employment:</i>		
67	1. Palay	1.37	1.85
68	2. Corn	0.19	0.79
69	3. Coconut	2.26	1.92
70	4. Sugarcane	1.78	1.51
71	5. Fruits etc.	-2.28	-3.11
72	6. Livestock	1.74	2.14
73	7. Fish/Fores	2.94	1.35
74	8. Proc. Food	6.16	1.78
75	9. Mining	5.11	-3.55
76	10. Nonfood Mf	-1.22	-0.74
77	11. Transport	6.97	11.18
78	12. Services	-1.23	7.66
79	13. Energy	8.98	23.76
80	14. Fertilizer	1.46	-5.59
81	Total	0.44	3.18
82	<i>Export:</i>		
83	1. Palay	0.83	0.75
84	2. Corn	0.00	0.00
85	3. Coconut	2.22	-1.53
86	4. Sugarcane		
87	5. Fruits etc.	3.85	0.34
88	6. Livestock	1.65	1.65
89	7. Fish/Fores	1.58	-2.08
90	8. Proc. Food	6.85	-0.66
91	9. Mining	6.63	3.96
92	10. Nonfood Mf	8.05	3.84
93	11. Transport	5.42	3.75
94	12. Services	4.58	2.06

**TABLE 8 (cont'd). Tariff and Forex Adjustments Using Habito's Models*
(percent change relative to baseline)**

Line No.	Scenario	TR 1	TR 2
95	13. Energy	5.07	5.72
96	14. Fertilizer		
97	Total	6.34	2.31
98	<i>Import:</i>		
99	1. Palay	23.29	41.10
100	2. Corn	21.17	38.78
101	3. Coconut		
102	4. Sugarcane		
103	5. Fruits etc.	14.19	27.35
104	6. Livestock	20.88	36.62
105	7. Fish/Fores	27.44	37.83
106	8. Proc. Food	15.24	27.88
107	9. Mining	3.41	7.46
108	10. Nonfood Mf	1.79	16.35
109	11. Transport	-1.62	13.11
110	12. Services	-4.74	4.57
111	13. Energy	4.79	0.92
112	14. Fertilizer	3.02	6.98
113	Total	3.07	14.44

**Average percent change of 1978, 1980, 1982, 1984 simulations*

In sum, based on the simulation runs conducted, the income distribution effects of a reduction in tariffs are generally not favorable.³³ Income share of the poor may decline further, while income share of the rich or the well-off may further increase. Also, the poor may be generally poorer under scenario TR1 (tariff reduction with flexible exchange rate) than under scenario TR2 (tariff reduction with fixed exchange rate). However, in comparing these scenarios, in terms of macroeconomic effects, scenario TR1 may be more sustainable than TR2. This is because of the tremendous negative effects of scenario TR2 on the balance-of-trade deficit. TR1 may have favorable effects on the trade account, while TR2 may give a trade picture similar to the boom-bust growth experienced in the 1980s.

Foreign exchange rate devaluation. There are two foreign exchange rate devaluation experiments conducted. These are defined in the table below. The 20 percent devaluation scenario is called DEV20, while the 50 percent devaluation is called DEV50. Under these two scenarios, the foreign exchange rate variable was devalued exogenously; thus the variable is still an exogenous variable in the model.³⁴

Year	Baseline		20% Devaluation		50% Devaluation	
	P/\$	percent change	P/\$	percent change	P/\$	percent change
1978	7.40		7.40		7.40	
1980	7.50	1.35	8.88	20.00	11.10	50.00
1982	8.50	13.33	10.06	13.33	12.58	13.33
1984	16.70	96.47	19.77	96.47	24.72	96.47

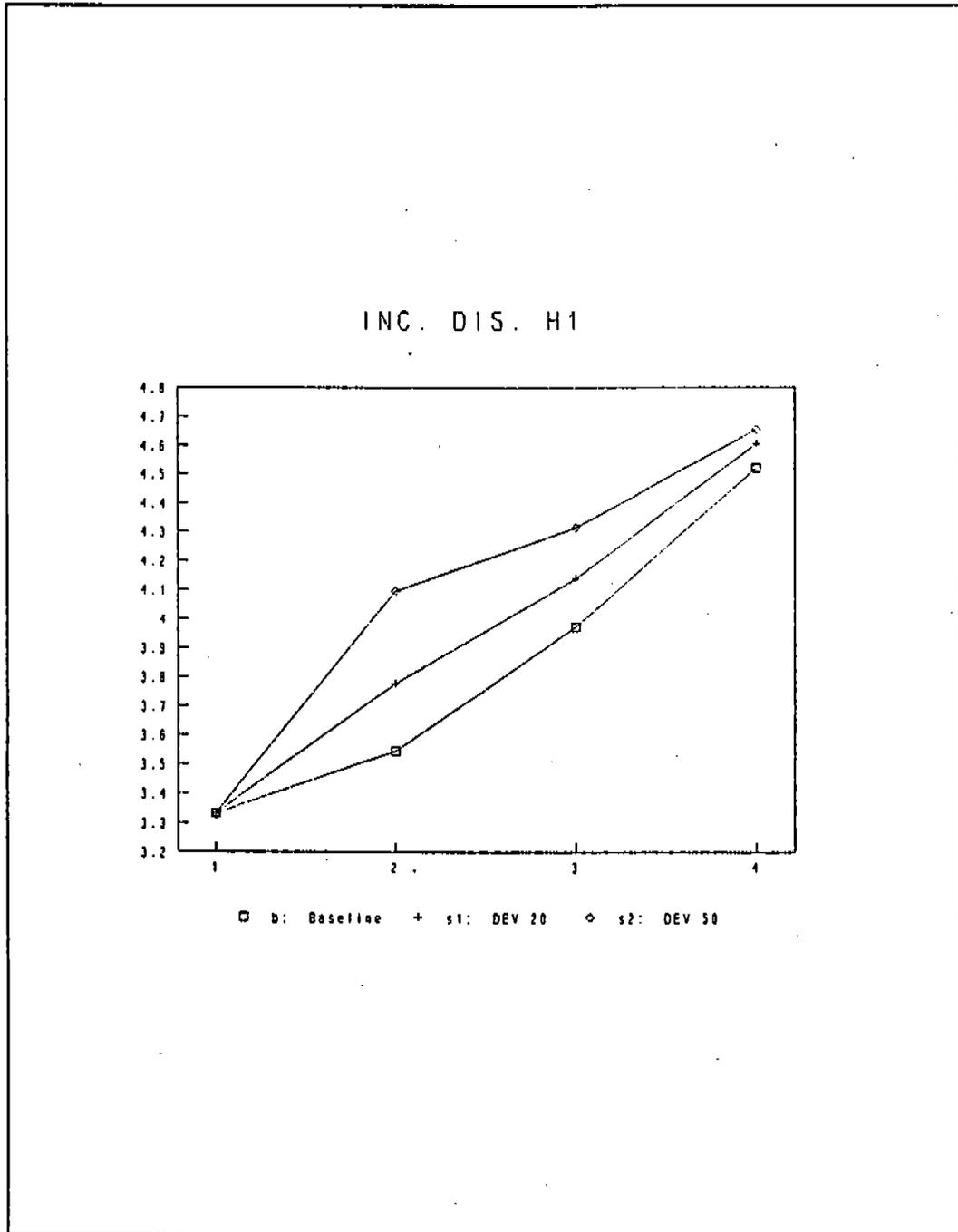
The income distribution effects are the following:

- 1) The first income group may experience a big jump in income share in the second period under scenario DEV50 (Figure 8). The effect on income share for this income group under scenario DEV20 is relatively smaller, but still above the baseline value. However, for both scenarios, income shares of the first income group are all above the baseline values for all of the periods considered in the simulations.

33. This is generally not consistent with the results of Clarete (1991).

34. The model can also be used to simulate experiments with flexible exchange rate and fixed exchange rate with import rationing. The latter case involves a premium rate. Premium rate is that which emerges in the parallel market for foreign exchange. For the analytics of these two sets of economic environment, see Dervis, de Melo, and Robinson (1982).

FIGURE 8. Forex Devaluation: Effects on Income Distribution of Household Type 1



The second income group may experience the same effects as the first income group (not shown).

- 2) The third income group may suffer a reduction in income share in all of the periods (Figure 9). The negative effects are particularly emphasized under scenario DEV50.

The fourth income group up to the eighth income group may experience the same negative effects on income share (not shown).

- 3) The ninth income group may also suffer a reduction in income share (Figure 10). The negative effects are larger under scenario DEV50 than under scenario DEV20. But the reduction may only happen up to the third period. In the fourth period, income share for this income group is already above the baseline value.

The tenth income group may experience the same effects on income share as the previous income group (not shown).

Exogenously adjusted foreign exchange rate (or a devaluation) contracts output. Under scenario DEV20, total real GDP (line no. 65 in Table 9) declines by -3.64 percent on the average.³⁵ Under scenario DEV50, output declines by -7.45 percent. Total employment also declines in both scenarios (line no. 81). The negative employment effects are emphasized in utilities and service sectors. However, the effects on the trade balance are favorable. Under scenario DEV20, exports increase by 5.43 percent on the average, while imports decrease by -12.32 percent. Under scenario DEV50, exports increase by 9.20 percent on the average, while imports decrease by -24.80 percent on the average.

Changes in elasticities

Export demand elasticity. The parameter h_i in (11) is the sectoral export demand elasticity. The elasticity estimates used in the model are shown in Table 10. An elasticity of 1 is assumed for all agricultural products, while the rest of the sectors have elasticities ranging between 2 and 4.

An effort was exerted to determine the effects on the solution results of changes in the values of the elasticities used in the model. An experiment was conducted to see the effects of a 30 percent increase in all of the export demand elasticities (scenario E1). An experiment was also conducted to analyze a 30 percent decrease in the same elasticity set (E2).

35. Bautista (1987, 1992) also found similar negative output effects of an exogenously devalued foreign exchange rate.

FIGURE 9. Forex Devaluation: Effects on Income Distribution of Household Type 3

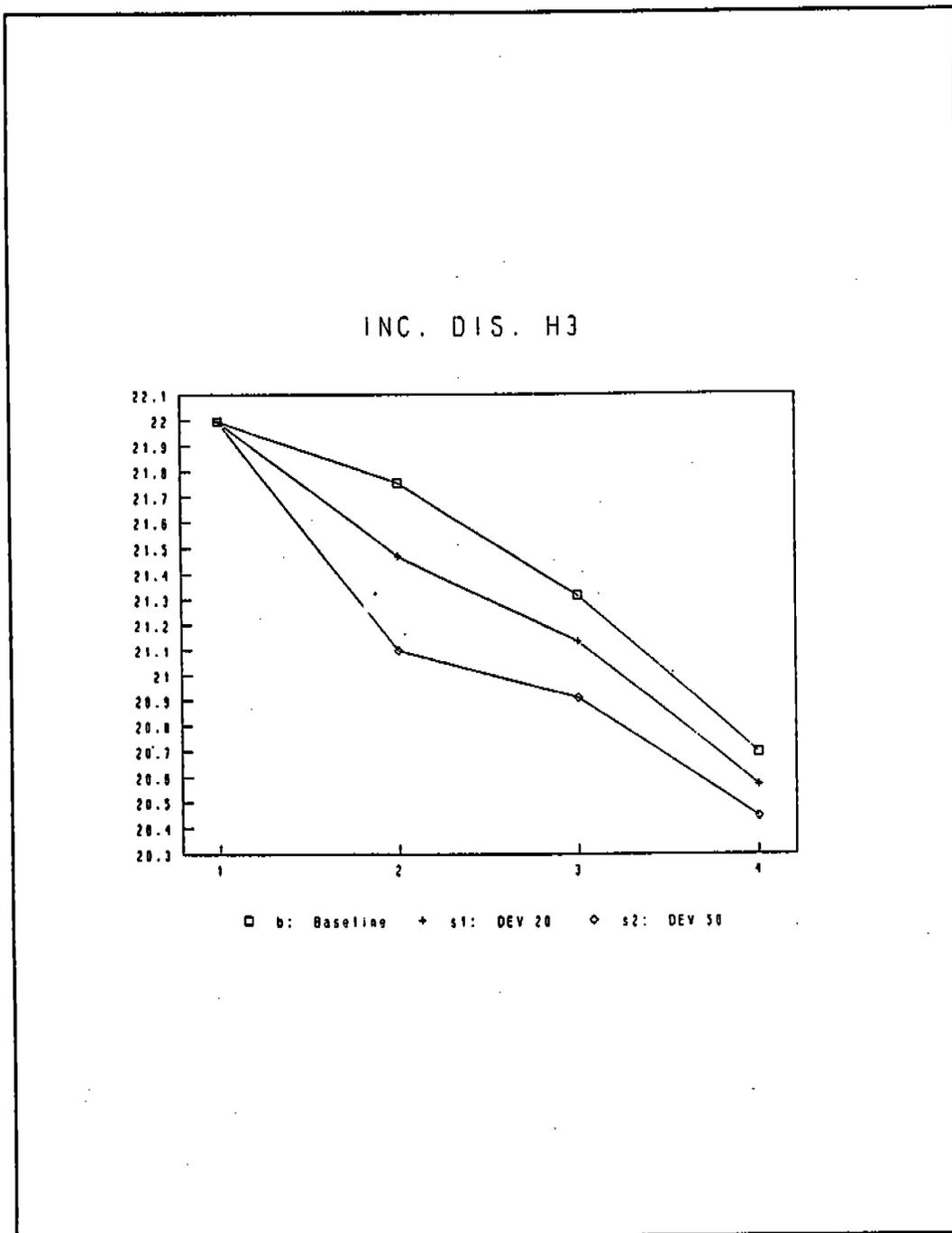


FIGURE 10. Forex Devaluation: Effects on Income Distribution of Household Type 10

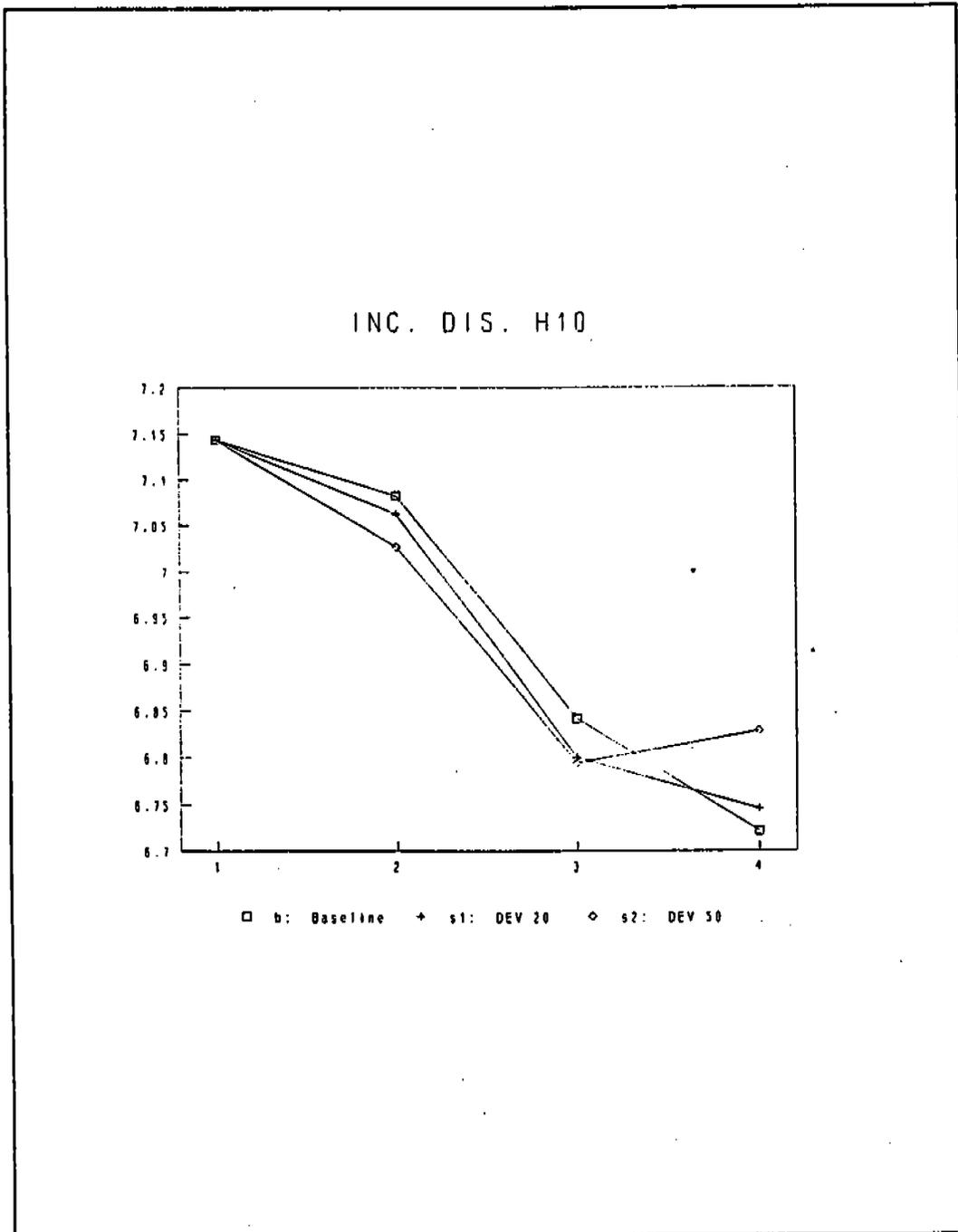


TABLE 9. Definition of Scenarios	
Scenario Number	Description
0	Baseline Forex (P/\$) 1978 7.40 1980 7.50 1982 8.50 1984 16.70
1	DEV20 Forex (P/\$) 1978 7.40 1980 8.88 1982 10.06 1984 19.77
2	DEV50 Forex (P/\$) 1978 7.40 1980 11.10 1982 12.58 1984 24.72

TABLE 9 (cont'd). Devaluation of Forex Simulations Using Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	DEV 20	DEV 50
1	<i>Disposable Income:</i>		
2	Household 1	-0.34	-0.09
3	Household 2	-2.24	-3.92
4	Household 3	-4.44	-8.36
5	Household 4	-4.90	-9.27
6	Household 5	-5.28	-10.04
7	Household 6	-5.69	-10.88
8	Household 7	-5.32	-10.11
9	Household 8	-5.31	-10.10
10	Household 9	-5.31	-10.10
11	Household 10	-5.30	-10.09
12	Total	-3.93	-7.32
13	<i>Real Income:</i>		
14	Household 1	1.83	4.47
15	Household 2	1.62	3.96
16	Household 3	1.34	3.27
17	Household 4	1.14	2.76
18	Household 5	0.85	2.07
19	Household 6	0.59	1.45
20	Household 7	0.52	1.25
21	Household 8	0.62	1.45
22	Household 9	-0.18	-0.34
23	Household 10	-0.25	-0.65
24	<i>Income Distribution:</i>		
25	Household 1	3.14	6.66
26	Household 2	1.31	2.73
27	Household 3	-0.69	-1.53
28	Household 4	-0.95	-2.07
29	Household 5	-1.08	-2.30
30	Household 6	-1.24	-2.65
31	Household 7	-0.84	-1.70
32	Household 8	-0.93	-1.89
33	Household 9	-0.21	-0.26
34	Household 10	-0.14	0.01
35	<i>Prices:</i>		
36	1. Palay	2.24	3.76
37	2. Corn	2.17	4.04
38	3. Coconut	3.25	6.22
39	4. Sugarcane	3.44	8.27
40	5. Fruits etc.	4.38	9.74
41	6. Livestock	3.18	7.12
42	7. Fish/Fores	7.31	24.37
43	8. Proc. Food	2.76	5.89
44	9. Mining	10.50	26.79
45	10. Nonfood Mf	3.35	6.90
46	11. Transport	-2.97	-7.22
47	12. Services	-6.82	-15.70

TABLE 9 (cont'd). Devaluation of Forex Simulations Using Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	DEV 20	DEV 50
48	13. Energy	5.36	14.18
49	14. Fertilizer	5.61	14.05
50	<i>Real GDP:</i>		
51	1. Palay	0.32	-0.34
52	2. Corn	-0.24	-1.25
53	3. Coconut	0.35	0.36
54	4. Sugarcane	0.21	-0.07
55	5. Fruits etc.	0.76	1.42
56	6. Livestock	-0.31	-0.94
57	7. Fish/Fores	-1.24	-2.32
58	8. Proc. Food	2.13	6.30
59	9. Mining	5.66	10.15
60	10. Nonfood Mf	-1.53	-2.75
61	11. Transport	-4.83	-8.39
62	12. Services	-7.50	-15.61
63	13. Energy	-9.01	-18.56
64	14. Fertilizer	5.01	12.77
65	Total	-3.64	-7.45
66	<i>Employment:</i>		
67	1. Palay	0.29	-0.71
68	2. Corn	-0.17	-1.21
69	3. Coconut	0.87	1.28
70	4. Sugarcane	0.50	0.96
71	5. Fruits etc.	1.37	2.80
72	6. Livestock	-0.26	-0.74
73	7. Fish/Fores	0.06	3.34
74	8. Proc. Food	4.53	11.64
75	9. Mining	12.53	29.86
76	10. Nonfood Mf	-0.91	-2.09
77	11. Transport	-8.36	-16.52
78	12. Services	-12.86	-26.59
79	13. Energy	-11.33	-22.75
80	14. Fertilizer	9.39	25.23
81	Total	-4.11	-8.26
82	<i>Export:</i>		
83	1. Palay	0.38	0.03
84	2. Corn	0.00	0.00
85	3. Coconut	3.80	9.00
86	4. Sugarcane		
87	5. Fruits etc.	3.97	8.88
88	6. Livestock	0.00	-0.83
89	7. Fish/Fores	3.71	3.39
90	8. Proc. Food	8.55	17.95
91	9. Mining	3.31	4.48
92	10. Nonfood Mf	7.54	13.87
93	11. Transport	1.49	0.02
94	12. Services	2.76	1.13

**TABLE 9 (cont'd). Devaluation of Forex Simulations Using Habito's Models*
(percent change relative to baseline)**

Line No.	Scenario	DEV 20	DEV 50
95	13. Energy	-0.34	-2.10
96	14. Fertilizer		
97	Total	5.43	9.20
98	<i>Import:</i>		
99	1. Palay	-12.33	-27.40
100	2. Corn	-13.11	-27.88
101	3. Coconut		
102	4. Sugarcane		
103	5. Fruits etc.	-10.56	-22.63
104	6. Livestock	-12.53	-25.83
105	7. Fish/Fores	-10.29	-15.14
106	8. Proc. Food	-11.19	-23.44
107	9. Mining	-4.53	-8.68
108	10. Nonfood Mf	-15.34	-30.81
109	11. Transport	-12.11	-24.35
110	12. Services	-12.89	-26.52
111	13. Energy	-8.34	-16.66
112	14. Fertilizer	-4.57	-9.50
113	Total	-12.32	-24.80

**Average percent change of 1978, 1980, 1982, 1984 simulations*

TABLE 10. Definition of Scenarios			
Scenario Number	Description		
E 1	RHOEP (EXPORT DEMAND ELASTICITY) PLUS 30% OF BASELINE VALUES		
E 2	RHOEM (EXPORT DEMAND ELASTICITY) MINUS 30% OF BASELINE VALUES		
Sectors	Baseline Elasticity	Plus 30%	Minus 30%
1. Palay	1.00	1.30	0.70
2. Corn	1.00	1.30	0.70
3. Coconut	1.00	1.30	0.70
4. Sugarcane	1.00	1.30	0.70
5. Fruits etc.	1.00	1.30	0.70
6. Livestock	1.00	1.30	0.70
7. Fish/Fores	3.00	3.90	2.10
8. Proc. Food	4.00	5.20	2.80
9. Mining	3.00	3.90	2.10
10. Nonfood Mfg	4.00	5.20	2.80
11. Transport	4.00	5.20	2.80
12. Services	4.00	5.20	2.80
13. Energy	2.00	2.60	1.40
14. Fertilizer	2.00	2.60	1.40

TABLE 10 (cont'd). Export Demand Elas. In Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	E 1	E 2
1	<i>Disposable Income:</i>		
2	Household 1	-0.44	-0.77
3	Household 2	0.08	-0.48
4	Household 3	0.67	-0.18
5	Household 4	0.80	-0.11
6	Household 5	0.91	-0.05
7	Household 6	1.03	0.02
8	Household 7	0.91	-0.09
9	Household 8	0.92	-0.09
10	Household 9	0.93	-0.09
11	Household 10	0.94	-0.09
12	Total	0.54	-0.25
13	<i>Real Income:</i>		
14	Household 1	-0.26	-0.16
15	Household 2	-0.21	-0.12
16	Household 3	-0.18	-0.09
17	Household 4	-0.13	-0.06
18	Household 5	-0.09	-0.02
19	Household 6	-0.04	0.02
20	Household 7	-0.03	0.02
21	Household 8	-0.05	0.02
22	Household 9	0.03	0.07
23	Household 10	0.07	0.10
24	<i>Income Distribution:</i>		
25	Household 1	-0.54	-0.20
26	Household 2	-0.24	-0.08
27	Household 3	0.10	0.05
28	Household 4	0.15	0.06
29	Household 5	0.19	0.07
30	Household 6	0.24	0.09
31	Household 7	0.16	0.03
32	Household 8	0.17	0.03
33	Household 9	0.12	0.01
34	Household 10	0.10	-0.01
35	<i>Prices:</i>		
36	1. Palay	-1.37	-0.93
37	2. Corn	-1.05	-0.80
38	3. Coconut	-1.45	-1.06
39	4. Sugarcane	-1.07	-0.71
40	5. Fruits etc.	-0.90	-0.66
41	6. Livestock	-0.85	-0.52
42	7. Fish/Fores	0.11	-0.48
43	8. Proc. Food	-0.76	-0.43
44	9. Mining	0.42	-0.31
45	10. Nonfood Mi	0.20	0.41
46	11. Transport	0.69	0.42
47	12. Services	0.79	0.61

TABLE 10 (cont'd). Export Demand Elas. In Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	E 1	E 2
48	13. Energy	0.84	-0.05
49	14. Fertilizer	0.19	0.14
50	<i>Real GDP:</i>		
51	1. Palay	-0.23	-0.01
52	2. Corn	-0.10	0.01
53	3. Coconut	-0.06	0.01
54	4. Sugarcane	-0.32	-0.02
55	5. Fruits etc.	0.02	0.02
56	6. Livestock	-0.34	-0.13
57	7. Fish/Fores	0.32	-0.19
58	8. Proc. Food	0.29	0.73
59	9. Mining	1.20	-2.31
60	10. Nonfood Ml	0.65	-0.86
61	11. Transport	0.66	-0.85
62	12. Services	0.65	0.14
63	13. Energy	0.80	-0.14
64	14. Fertilizer	-0.88	-0.65
65	Total	0.47	-0.14
66	<i>Employment:</i>		
67	1. Palay	-0.23	0.06
68	2. Corn	-0.04	0.10
69	3. Coconut	-0.10	0.05
70	4. Sugarcane	-0.25	0.09
71	5. Fruits etc.	0.12	0.08
72	6. Livestock	-0.14	0.05
73	7. Fish/Fores	0.51	-0.12
74	8. Proc. Food	0.27	0.86
75	9. Mining	2.30	-2.80
76	10. Nonfood Ml	0.91	-0.58
77	11. Transport	1.24	-0.45
78	12. Services	1.13	0.34
79	13. Energy	1.83	-0.36
80	14. Fertilizer	-0.71	-0.69
81	Total	0.51	0.09
82	<i>Export:</i>		
83	1. Palay	-0.06	0.05
84	2. Corn	0.00	0.00
85	3. Coconut	0.92	0.30
86	4. Sugarcane		
87	5. Fruits etc.	0.51	0.35
88	6. Livestock	0.00	0.00
89	7. Fish/Fores	0.39	-0.28
90	8. Proc. Food	-0.32	0.98
91	9. Mining	1.04	-2.05
92	10. Nonfood Ml	0.92	-1.45
93	11. Transport	0.92	-0.77
94	12. Services	0.65	0.17

TABLE 10 (cont'd). Export Demand Elas. In Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	E 1	E 2
95	13. Energy	0.62	-0.61
96	14. Fertilizer		
97	Total	0.61	-0.58
98	<i>Import:</i>		
99	1. Palay	0.00	1.37
100	2. Corn	-0.99	-0.52
101	3. Coconut		
102	4. Sugarcane		
103	5. Fruits etc.	-0.80	-0.55
104	6. Livestock	-0.78	-0.25
105	7. Fish/Fores	0.15	-0.40
106	8. Proc. Food	-0.29	0.06
107	9. Mining	1.19	-0.55
108	10. Nonfood Mi	0.24	0.07
109	11. Transport	0.66	-0.13
110	12. Services	0.68	0.25
111	13. Energy	0.66	-0.24
112	14. Fertilizer	-0.24	-0.32
113	Total	0.38	-0.09

**Average percent change of 1978, 1980, 1982, 1984 simulations*

One can observe that the +30 percent and the -30 percent changes in the sectoral export demand elasticities do not give symmetric results. This is essentially due to the non-linearity of the model. Note that under scenario E1 total real GDP increases by 0.47 percent, whereas under E2 it decreases by -0.14 percent. These unsymmetrical results are true for almost all sectors (although a few do register equal change). In terms of the income distribution effects, the change is generally bigger under E1 than under E2. Thus, the results of the model are generally sensitive to the direction of change in the parameter estimates of export demand elasticities.

Trade aggregation. It is common to CGE modeling to define a good which is a composite of imports and domestic goods. This good is called the "Armington" good in CGE models. The idea behind this is that imports and domestic goods are considered imperfect substitutes.³⁶ The "Armington" good is defined as a CES composite good of domestic and import goods, i.e.,

$$(17) \quad Q_i = B^*(d_i M_i^{-r_i} + [1 - d_i] D_i^{-r_i})^{-1/r_i}$$

where B^* , d_i , r_i are parameters, M_i is import, and D_i domestic goods. The variables M_i and D_i are like inputs "producing" the aggregate output Q_i .

Using the familiar first-order conditions for cost minimization, one can derive an import demand function³⁷ with a "trade substitution" elasticity which is defined as

$$(18) \quad s_i = 1/(1 + r_i)$$

The sectoral trade substitution estimates used in the model are shown in Table 11. Note that the elasticity value for agricultural products is assumed to be 1.5, while all the rest are less than 1, except for processed food which is 1.2.

Experiments were conducted which involved a 30 percent increased in all sectoral estimates (defined as scenario TE1) and a -30 percent decrease in elasticities. The results are also shown in the same table.

Generally, the effects are also not symmetric (again, due to the non-linearity of the model). A 30 percent increase in the estimates will result in a total real GDP increase of 0.58 percent, whereas a -30 percent decrease in the estimates will result in a total real GDP decline of -1.05 percent. The non-symmetry in the effects are clear in term of sectoral results.

Therefore, based on the results of the elasticity analyses above, it is important to have a robust set of estimates of the parameters. Changes in the parameter estimates can have a significantly effect on the direction and magnitude of the simulation results.

36. Bautista (1992) developed a relatively small CGE model where the Armington assumption is avoided, i.e., there is zero substitution elasticity between foreign and domestic goods of the same type.

37. For more details see Dervis, de Melo, and Robinson (1982).

TABLE 11. Definition of Scenarios

Scenario Number	Description		
TE 1	RHOC (ELASTICITY OF SUB. IN TRADE AGGREGATION) PLUS 30% OF BASELINE VALUES		
TE 2	RHOC (ELASTICITY OF SUB. IN TRADE AGGREGATION) MINUS 30% OF BASELINE VALUES		

Sectors	Baseline Elasticity	Plus 30%	Minus 30%
1. Palay	1.500	1.95	1.05
2. Corn	1.500	1.95	1.05
3. Coconut	1.500	1.95	1.05
4. Sugarcane	1.500	1.95	1.05
5. Fruits etc.	1.500	1.95	1.05
6. Livestock	1.500	1.95	1.05
7. Fish/Fores	1.500	1.95	1.05
8. Proc. Food	1.200	1.56	0.84
9. Mining	1.500	1.95	1.05
10. Nonfood Mfg	1.200	1.56	0.84
11. Transport	0.330	0.43	0.23
12. Services	0.330	0.43	0.23
13. Energy	0.750	0.98	0.53
14. Fertilizer	0.750	0.98	0.53

TABLE 11 (cont'd). Elas. of Sub. in Trade Agg. In Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	TE 1	TE 2
1	<i>Disposable Income:</i>		
2	Household 1	-0.25	-0.44
3	Household 2	0.09	-0.64
4	Household 3	0.47	-0.86
5	Household 4	0.55	-0.91
6	Household 5	0.61	-0.95
7	Household 6	0.69	-0.99
8	Household 7	0.59	-0.91
9	Household 8	0.59	-0.91
10	Household 9	0.59	-0.90
11	Household 10	0.58	-0.90
12	Total	0.38	-0.80
13	<i>Real Income:</i>		
14	Household 1	-0.41	0.54
15	Household 2	-0.35	0.53
16	Household 3	-0.32	0.55
17	Household 4	-0.30	0.56
18	Household 5	-0.26	0.59
19	Household 6	-0.24	0.65
20	Household 7	-0.23	0.62
21	Household 8	-0.23	0.63
22	Household 9	-0.24	0.54
23	Household 10	-0.17	0.71
24	<i>Income Distribution:</i>		
25	Household 1	-0.53	0.61
26	Household 2	-0.23	0.29
27	Household 3	0.11	-0.07
28	Household 4	0.16	-0.14
29	Household 5	0.18	-0.22
30	Household 6	0.23	-0.32
31	Household 7	0.13	-0.21
32	Household 8	0.13	-0.23
33	Household 9	0.11	-0.11
34	Household 10	0.05	-0.27
35	<i>Prices:</i>		
36	1. Palay	-0.27	-0.48
37	2. Corn	-0.16	-0.55
38	3. Coconut	-0.00	-0.80
39	4. Sugarcane	-0.28	0.04
40	5. Fruits etc.	-2.49	2.15
41	6. Livestock	-0.21	-0.07
42	7. Fish/Fores	-0.13	0.45
43	8. Proc. Food	-0.40	0.22
44	9. Mining	0.38	-0.22
45	10. Nonfood Ml	0.30	-0.19
46	11. Transport	0.53	3.39
47	12. Services	-0.05	0.78

**TABLE 11 (cont'd). Elas. of Sub. in Trade Agg. In Habito's Models*
(percent change relative to baseline)**

Line No.	Scenario	TE 1	TE 2
48	13. Energy	0.98	-0.28
49	14. Fertilizer	0.07	0.23
50	<i>Real GDP:</i>		
51	1. Palay	0.21	-0.39
52	2. Corn	0.14	-0.44
53	3. Coconut	0.26	-0.31
54	4. Sugarcane	0.14	-0.57
55	5. Fruits etc.	-1.05	1.12
56	6. Livestock	0.02	-0.34
57	7. Fish/Fores	0.49	-0.91
58	8. Proc. Food	0.03	0.61
59	9. Mining	-0.01	-0.70
60	10. Nonfood Mi	1.86	-3.44
61	11. Transport	0.88	-0.90
62	12. Services	0.54	-1.07
63	13. Energy	2.12	-1.34
64	14. Fertilizer	0.05	-0.68
65	Total	0.58	-1.04
66	<i>Employment:</i>		
67	1. Palay	0.38	-0.40
68	2. Corn	0.33	-0.55
69	3. Coconut	0.55	-0.45
70	4. Sugarcane	0.33	-0.48
71	5. Fruits etc.	-1.78	2.14
72	6. Livestock	0.34	-0.36
73	7. Fish/Fores	0.63	-0.74
74	8. Proc. Food	-0.16	0.74
75	9. Mining	1.74	-1.91
76	10. Nonfood Mi	2.59	-4.52
77	11. Transport	1.77	-0.85
78	12. Services	1.09	-1.83
79	13. Energy	4.47	-2.58
80	14. Fertilizer	0.40	-0.94
81	Total	0.53	-0.82
82	<i>Export:</i>		
83	1. Palay	0.26	-0.31
84	2. Corn	0.00	0.00
85	3. Coconut	0.44	0.16
86	4. Sugarcane ::		
87	5. Fruits etc.	1.12	-0.57
88	6. Livestock	0.83	0.00
89	7. Fish/Fores	1.03	-1.42
90	8. Proc. Food	0.44	-0.66
91	9. Mining	-0.52	-0.09
92	10. Nonfood Mi	0.85	-1.32
93	11. Transport	0.71	-0.86
94	12. Services	0.21	-0.25

TABLE 11 (cont'd). Elas. of Sub. in Trade Agg. In Habito's Models*
(percent change relative to baseline)

Line No.	Scenario	TE 1	TE 2
95	13. Energy	0.47	-0.56
96	14. Fertilizer		
97	Total	0.44	-0.72
98	<i>Import:</i>		
99	1. Palay	0.00	-15.07
100	2. Corn	20.32	-17.28
101	3. Coconut		
102	4. Sugarcane		
103	5. Fruits etc.	9.77	-10.86
104	6. Livestock	9.78	-9.25
105	7. Fish/Fores	-0.33	-0.16
106	8. Proc. Food	3.81	-3.82
107	9. Mining	0.79	-0.24
108	10. Nonfood Ml	-0.28	-0.82
109	11. Transport	0.16	0.45
110	12. Services	0.12	-0.47
111	13. Energy	0.52	0.29
112	14. Fertilizer	-1.75	1.53
113	Total	0.67	-1.25

*Average percent change of 1978, 1980, 1982, 1984 simulations

IV. THE CGE MODEL OF CORORATON

A. *General Description*

Similar to the PhilCGE model of Habito, the basic structure of the CGE model of Cororaton (1989) is also patterned after the model of Dervis *et al.* (1982). The model was specifically designed to address questions on the short-run effects of tariff restructuring and foreign exchange rate devaluation in the Philippines.

The model has 12 production sectors (Table 12). There are three household classes: household 1, which derives income from rural labor; household 2, which derives income from non-rural income; and household 3, which derives income from capital "rent." There are two factors of production: labor and capital.

As in almost all CGE models, this model assumes an imperfect substitutability between domestically produced goods and imports. The substitution mechanism is captured by the Armington assumption.

A small-open-economy assumption is used in specifying both export and import functions. Therefore, the country cannot affect world prices of exports and imports. The volume of export demand by the rest of the world is given by a simple elasticity functional form as in (11). Using the Armington assumption and the condition that the marginal rate of substitution between imports and domestic demand is equal to their price ratio, the import demand function is derived.

The foreign exchange rate can be specified as fixed or flexible. If it is assumed flexible, then it clears the external sector. If it is assumed fixed, one has two options. One can either assume that

- 1) capital inflow from abroad finances external deficit, or
- 2) foreign exchange reserves are rationed.

The rationing mechanism results in a premium rate which is higher than the foreign exchange rate that clears the market for foreign exchange.

The model has a government sector. This sector derives its income from taxes (direct and indirect), and transfers from abroad. It uses the generated revenue to buy products of the production sector with fixed proportions.

The model assumes that households allocate a portion of their income to savings, and spend the rest of it on consumption. Thus, investment expenditure is savings-driven.

The price normalization applied in the model expresses all prices in terms of the general price level. Thus, this provides a "no inflation" benchmark.

TABLE 12. Definition and Composition of the 12 Sectors

Sectors:	Components (1974 I - O)
I. Primary Sectors	
1. Agriculture	Palay Corn Fruits & Nuts Root Crops Coffee & Cacao Sugar Cane Coconut Including Copra Tobacco Abaca Other Crops Livestock Poultry Other Agriculture Fisheries Forestry & Logging
2. Mining	Gold & Silver Mining Other Metallic Mining Non-Metallic Mining
II. Industrial Sectors	
3. Food	Meat Products Dairy Products Rice Milling Sugar Milling Other Food Manufactured Goods Beverages Tobacco Products
4. Textiles	Textile Manufactures Wearing Apparel & Made-up Textile Goods Leather & Leather Products
5. Wood	Lumber Plywood & Veneer Furniture & Fixtures Paper & Paper Products Printing, Publishing Miscellaneous Manufactures Scrap
6. Chemicals	Rubber Products Basic Industrial Chemicals Coconut Oil & Other Oil
7. Non-Metallic Products	Hydraulic Cement Other Non-Metallic Mineral Products
8. Basic Metals	Basic Metals Metal Products, Except Machinery & Transport Equipment
9. Machinery	Machinery Except Electrical Electrical Machinery Motor Vehicles Other Transport Equipment
III. Service Oriented	
10. Utilities	Electricity, Gas & Water Services
11. Construction	Construction
12. Services	Trade Banking & Other Financial Institutions Insurance Real Estate Transportation Services Storage & Warehousing Communication Private Services Government Services

The model was calibrated using the constructed social accounting matrix (SAM) which was in turn based on the 1974 input-output table, and other data sources like the National Census and Statistics Office, the Central Bank Statistical Bulletin, various National Income Accounts, and various Annual survey of manufactures.

B. *Simulations*

Two sets of policy simulations were conducted:

- 1) alternative foreign exchange policies given an exogenous decline in net foreign-capital inflow; and
- 2) tariff reduction and foreign exchange rate adjustment.

Three alternative foreign exchange rate adjustment policies were analyzed given a 100 percent decline in capital inflow:

- 1) adjustment by devaluation;
- 2) adjustment by premium rationing; and
- 3) adjustment by fix price.

In (1) the exchange rate is assumed flexible, in (2) the exchange rate is held fixed at a certain level, but with a parallel market for foreign exchange that is free of market rigidities and which is cleared by a premium rate, and in (3) the exchange rate is held fixed, but there is a quantitative constraint imposed on the demand for imports. The results are shown in Table 13. The results are percentage changes from the baseline solution.

If the exchange rate is allowed to float and seek its equilibrium value, a depreciation of about 21 percent will take place without triggering inflationary problems. This increase in the level of the foreign exchange rate will lead to an increase in the user price of imports by 21 percent, pushing down the volume of imports by 10 percent. The dollar price of exports will decline by 18 percent, boosting exports by about the same percent. The total effect on the economy is a GDP contraction of 0.44 percent.

If premium rationing is pursued, the result will be an increase in the user price of imports by about 15 percent, pulling down imports by about 18 percent. Since import prices are affected by the adjustment in the premium rate due to the decline in the foreign exchange, domestic price and the dollar price of exports are indirectly affected. The dollar price of exports will decline by 13 percent, increasing exports by 12.69 percent. The decline in imports under the premium adjustment policy is higher than that of the flexible exchange rate. This is because the adjustment falls solely on imports. The effect on the economy is a decline in GDP by 1.29 percent, higher than the first scenario which involves a flexible foreign exchange rate.

Under the fixprice rationing the exchange rate is held fixed along with the user price of imports. This inflexibility together with the quantitative constraint imposed on the demand for

TABLE 13. Short-run Macroeconomic Impact of Alternative Foreign Exchange Rate Policies

Economic Indicators	Devaluation	Premium Rationing	Fixprice Rationing
Exchange Rate	21.29	0.00	0.00
User Price of Imports (PM)	20.89	14.86	0.00
Dollar Price of Exports (PWE)	-17.83	-13.42	0.23
Imports (Volume)	-9.82	-17.50	-10.56
Exports (Volume)	17.73	12.69	-0.17
GDP*	-0.44	-1.29	-2.55

*Simple percentage change

imports results in a decline in the volume of imports. Both the dollar price of exports and the volume, however, are marginally affected. Thus the burden of adjustment falls on domestic prices. As a result, the negative effect on GDP is higher, it declines by 2.55 percent.

Thus, the comparative analysis above will show that the adjustment with the least negative effect on GDP given a decline on capital inflow from abroad is the flexible exchange rate.

By how much would the foreign exchange rate have to be devalued for every percentage change reduction in tariff rate without creating BOP and inflationary problems? Tables 14 and 15 provide some numbers. If the reduction in tariff rate is across-the-board, Table 14 shows that for every 10 percent reduction, the exchange rate has to be adjusted upwards by 1.66 percent. If sectors like utilities, construction and service sectors are assumed to carry zero tariff, a 10 percent reduction in tariff in the rest of the sectors will require a 1.01 percent adjustment in the foreign exchange rate.

V. THE BAUTISTA MODEL

A. *General Description*³⁸

Compared to existing CGE models of the Philippine economy, the model of Bautista (1987) is different on three counts:

- 1) it is the smallest model with only five major production sectors;
- 2) it is a non-Walrasian general equilibrium model, with some of the sectors cleared by quantity adjustments rather than by price adjustments; and
- 3) it explicitly incorporates money market, with explicit equations for demand and supply of money in the model.

The production sectors of the model are agriculture, manufacturing, construction, banking, and services. Households are classified according to location---Metro Manila, urban, or rural.

38. Based on Bautista (1987).

TABLE 14. Tariff and Equilibrium Exchange Rate Short-run
Schedule Without Inflation (across-the-board)

Tariff Schedule (%)	Equilibrium Exchange Rate
100	0.6857
90	0.7014
80	0.7106
75	0.7215
70	0.7404
60	0.7781
50	0.8201
40	0.8374
30	0.9092
25	0.9147
20	0.9221
10	0.9608
0	1.0000

Regression:

$$\ln (E) = 0.41091 - 0.1656 \cdot \ln (T)$$

(t = 11.046)
(t = 10.388)

$$R^2 = 0.91518$$

where: $\ln (E)$ = natural log. of equilibrium exchange rate
 $\ln (T)$ = natural log. of across-the board tariff

TABLE 15. Tariff and Equilibrium Exchange Rate Short-run Schedule Without Inflation (primary and industrial sectors only*)

Tariff Schedule (%)	Equilibrium Exchange Rate
80	0.7854
75	0.8049
60	0.8641
40	0.9275
25	0.9637
20	0.9221
10	0.9712
0	1.0000

Regression:

$$\ln(E) = 0.2463 - 0.1010 \cdot \ln(T)$$

(t = 5.067) (t = 3.708)

$$R^2 = 0.7747$$

where: $\ln(E)$ = natural log. of equilibrium exchange rate
 $\ln(T)$ = natural log. of across-the board tariff

* Zero tariff on utilities, construction, and service sector

The modeling of the production sectors is patterned by the model of Taylor (1983).³⁹ The agricultural sector is assumed to be a price-clearing sector. This sector produces food which is sold only to the domestic market and exportables which are solely for the world market. In particular, it is assumed that food is all consumed by local residents and nothing is exported, while all exportables are all bought in the foreign market. Furthermore, the agricultural export sector is a price-taker in the world market.

The derived excess demand for agricultural products is characterized by a fixed supply (constrained by the availability of capital and land) and a variable demand (which varies with income). This sector is cleared by a market-clearing price variable.

The manufacturing sector, which uses labor and intermediate imports as inputs to production, is assumed to operate with chronic excess capacity. Manufacturing price is not derived by the interaction between demand and supply forces, but by a markup over variable cost.⁴⁰ That is

$$(19) \quad P_m = (1 + t)(wb + P_n a_n)$$

where t is a fixed markup rate, b is a labor-output ratio, w is the wage rate which is assumed fixed, a_n is an import-output coefficient, and P_n the domestic price of imported intermediate input which is given by

$$(20) \quad P_n = eP_n^*$$

where e the foreign exchange rate, and P_n^* the world price of intermediate input.

39. The model is a "macrostructural CGE model." A major criticism of this is the constraints on the model which are essentially "ad hoc in that they are not related to any endogenous rational behavior of agents" (Robinson 1989). In many structural CGE models, theoretical literature on macro adjustment, political economy, uncertainty, incomplete markets, temporary equilibrium, implicit contracts, and the like are cited to justify the imposition of structural constraints on the model.

"Such deviations from the Walrasian paradigm lead to methodological problems that have concerned some writers" (Robinson 1989). Shoven and Whalley (1984) put the problem well:

"Unfortunately, the problem is, *the models that make major departures from the known theoretical structures can become difficult to interpret*. The conflict between modeler's desire to build realistic models which seek to capture real features of the policy issue at hand, and to stay within the realm of developed economic theory is something that seems to be increasingly apparent in some recent models."

40. The justification for mark-up pricing is the oligopolistic structure of firms.

The derived excess demand for the manufacturing sector has an output volume-clearing variable.⁴¹ This is mainly due to the assumption of excess capacity and price fixing by firms through mark-ups mechanism.

The rest of the sectors are also characterized by markup-price mechanism.

Other important features of the monetary sectors are the following.

- 1) The monetary sector of the model generally follows the portfolio approach to monetary analysis of Tobin (1969). There are three forms of assets assumed in the model: bank deposits, loans to firms, and foreign exchange. Only the public and the Central Bank hold foreign assets. Commercial banks' asset holdings include base money, loans to firms, and government debt. Commercial banks have deposits of firms and of the public as their liabilities.
- 2) The model is affected by monetary variables through the demand for working capital by firms. The assumption is that entrepreneurs must have money on hand to pay in advance for the services of current inputs into the production process.⁴² In the derived excess demand for loans, the market-clearing variable is loan interest rate. This variable directly affects the working capital of firms which is used to pay their wage bills.
- 3) Foreign assets are held not for transaction purposes, but are held by the public as one form of assets which yield an expected rate of return. The expected return on foreign assets is the expected inflation rate which is affected by the general demand conditions and the expected depreciation of the foreign exchange rate. Foreign exchange comes from various sources such as export receipts, remittances, and tourist receipts. The derived excess demand for foreign exchange has a market-clearing foreign exchange rate variable.
- 4) The closure rule imposed generally follows the closure rules adopted in macro models. Savings rate of each household type is fixed and the distribution of income that will satisfy the exogenously given aggregate investment is determined.
- 5) The model uses data for 1974. The model makes use of the 1974 Social Accounting Matrix.

41. The market excess demand functions derived are not homogenous of degree zero in prices and incomes. Structuralist CGE models usually do have this characteristic.

42. The idea is that in a poor, inflationary economy, suppliers of inputs are too financially constrained to allow their payments to wait. Working-capital costs hypothesis is strongly emphasized in the structuralist school (Taylor 1983).

B. *Simulation Results*⁴³

Bautista (1987) did a number of policy simulations using the model. Table 16 presents the results of a simulation which involves a 15 percent nominal devaluation of the foreign exchange rate. These results were derived using the model with a monetary sector.⁴⁴

The following effects can be observed from the following results.

- 1) A devaluation is stagflationary: prices increase by 3.24 percent while output declines by -0.35 percent. The manufacturing sector gets all the negative effects of this policy change: its output contracts by -1.2 percent.
- 2) Interest rate declines by -7.67 percent and triggers an increase in investment by 3.32 percent. This improvement helps pull up the construction sector, which improves by 3.21 percent.
- 3) The positive effect on aggregate investment demand is pulled down by the worsening of real incomes and consumption mainly due to significant increases in prices.
- 4) Real volume of credit available to the non-bank sectors increases. The increase in credit cannot catch up with the rise in the total cost of manufacturing production due to a devaluation-induced rise in intermediate input cost. Thus, output contracts.
- 5) "Inflation originates from both the demand side and the supply side. On the demand side, the inflationary pressure comes from a higher investment demand. On the supply side, a higher exchange rate negates the effect of a lower interest rate on manufacturing sector prices. Furthermore, a fall in output induced by a leftward shift in the aggregate supply schedule adds to the inflationary pressure" (Bautista 1987).

In sum, the model is probably too small to capture the effects of structural changes in the economy. Changes within the manufacturing and agricultural sectors are probably important, especially to the MIMAP project. Also, although structural models incorporate a number of realistic features of a developing country, its ad hoc imposition of structural constraints will make the results difficult to interpret and probably cast doubts on the meaningfulness of the results.

43. The computer program that solves the makes use of the Powell algorithm is briefly discussed in footnote 25. The author could not run it, however, because there was not enough documentation on the definition of the variable and parameter names.

44. Bautista also simulated a 15 percent devaluation using the same model, but without a monetary sector.

Table 16: Effects of a 15% Nominal Dev.
(in percent change from the base run values)

<i>Variables:</i>	<i>Effects</i>
OUTPUT:	
Agriculture	—
Manufacturing	-1.02%
Construction	3.21
Banking	0.04
Services	0.05
Total Output	-0.35
PRICES:	
Agriculture	-0.77
Manufacturing	5.66
Construction	3.05
Banking	1.38
Services	1.15
CPI	3.24
MARKUP RATES:	
Manufacturing	-0.51
Construction	1.59
Banking	-0.20
Services	0.03
REAL INCOME:	
Metro Manila	-1.73
Urban	-1.84
Rural	-1.78
Wage Income	-3.16
Non-wage Income	-1.94
Interest Rate	-7.67
Investment	3.32
Consumption	-1.74
Real Liquidity	5.05
Trade Deficit	-85.94
Government Revenue	2.80
Government Expenditure	1.84

Source: Bautista (1987)

VI. REMARKS

The paper surveyed four CGE models of the Philippine economy. The paper reviewed and assessed (i.e., simulated) the APEX model, the second version of the PhilCGE model of Habito, and the CGE model of Cororaton. The paper could have simulated the model of Bautista (the fourth model included in the survey), but there was no documentation on the definition of the variables and parameters used in the computer program to solve the model. The paper could also have included other big CGE models such as the 25-sector model of Clarete (1991) and the recent dynamic model of Gaspay (1993), but there was no time to become familiar with the analytics and the mechanics of the model, especially with the computer program used to solve those models.

Based on the review and assessment of these models, the following can be said.

- 1) The level of sectoral disaggregation in the APEX model is probably appropriate for the MIMAP project. The comprehensive treatment of the agricultural sector in the APEX model can probably shed some light on a number of important issues pertaining to agriculture, which in turn can be relevant to the MIMAP project which focuses on the issue of poverty.
- 2) However, based on the simulation runs conducted, there are a number of inconsistencies in the results of the APEX model. The results are counterintuitive and sometimes do not follow "commonly believed and understood" directional changes in some important economic variables. This has to be ironed out if the APEX model is to be adopted for the MIMAP project.
- 3) The MIMAP project is particularly interested in issues related to income distribution because of their implications on the problem of poverty. Therefore, the project will need a model that can adequately handle issues of income distribution. The PhilCGE model has 10 household types. The model that the MIMAP project adopts will probably have similar or more disaggregated income classes.
- 4) Based on the evaluation of the elasticity estimates used in PhilCGE, changes in the parameter estimates can have a significant effect on the results. It was observed in the results that, due to the non-linearity of the model, the results of a positive change (say +30 percent increase) in the parameters are different in absolute value from the results of a negative change (-30 percent decrease) in the parameter values. This implies that if a CGE model is implemented to determine the effects of changes in macro variables on sectoral variables, the parameters must be robust. That is, we will have to estimate econometrically the parameters of the model similar to the APEX model.
- 5) In applied general equilibrium modeling, there is usually a trade-off between making the model realistic to be able to capture the intricacies of a developing country and retaining the theoretical purity of the model. While making the model realistic is an important

consideration for the MIMAP project, too much deviation from the Walrasian general equilibrium theory would probably not help either. This is because, as mentioned in footnote 38, it is difficult to interpret the results of a CGE model that is not rooted on the well-defined and well-argued theory on general equilibrium. Too radical a departure from the known theory will probably cast doubts on the results.

- 6) Incorporating monetary variables into a general equilibrium model is a tricky (perhaps risky) business because no well-defined general equilibrium theory includes money. This is indeed a dilemma because one of the objectives of the MIMAP project is to be able to understand the effects of changes in monetary aggregates. The CGE modeler for the MIMAP project, therefore, has to think of an appropriate approach that can link macro variables with CGE model. Perhaps the suggestion of Dervis, de Melo, and Robinson (1982) can be considered.⁴⁵ The suggested approach involves adding "a macromonetary superstructure that interacts with the multisectoral general equilibrium model. One can, for example, attach a monetary behavior equations to the model and attempt to capture the demand for and supply of financial assets and the interaction between money and the real sphere of the economy. Such an approach, in which the price level is determined endogenously, has the great advantage of extending the field of CGE models from the analysis of problems of industrial strategy, protection, and trade policy to problems of inflation, 'Keynesian' imbalances between aggregate supply and demand, and short-run stabilization policy."

Bourguignon, Branson, and de Melo (1992) developed a model which combines a macro model and a CGE model in one analytical structure. The model essentially serves as a macro model. However, as in CGE, it has fairly disaggregated production sectors and household groups. Firms are assumed to maximize profits, while households are assumed to maximize utility. Clarete (1992), however, came out with an unfavorable comment and review of the model. Briefly, he said that

- a) the model seems to be an ad hoc creation that does not demonstrate the existence of an equilibrium, especially if the model is applied to a particular country; and
- b) the model seems to be deficient analytically in its attempt to incorporate money (and therefore responses of changes in monetary variables) in a general equilibrium model where only relative prices matter. Because of these problems, Clarete (and Mckinnon 1984) "believes in the conventional wisdom of separating

45. Clarete (1992) suggested a similar approach, i.e., interphasing a CGE model and a macroeconomic model focusing on the computation of the following variables: 1) real exchange rate; 2) real interest rate; and 3) aggregate real economic output. The macroeconomic model calculates the changes in the nominal values of macroeconomic variables such as the general price level, the nominal exchange rate, the nominal interest rate, and the nominal GDP of the economy as a result of a given macroeconomic policy shock. The underlying real values of these impact magnitudes, including the real exchange rate, real interest rate, and real aggregate output, are calculated. These real magnitudes are then introduced as shocks into the CGE model to get the microeconomic and distributional consequences of the policy shock.

micro from macroeconomic theory. Too much baggage is potentially involved if one combines both in one single analytical framework. The Bourguignon *et al.* model can be criticized in this light, as a macroeconomic model which borrowed microeconomic features of CGE models."

- 7) CGE modeling is usually SAM-based (social accounting matrix). The latest SAM that was constructed was for the year 1974. The I-O table used was also for 1974. Recent CGE models were based on SAM constructed by the respective authors. Indeed, there is no official SAM. Therefore, there is a need to
 - a) review and compare the individual SAMs used by these authors and
 - b) create a new SAM, probably based on the recent 1988 IO table.

The SAM has to be well documented and should be open to those who are interested. This is one way of making the database of the CGE model that will be used for the MIMAP project credible and reliable.

- 8) One of the major concerns of the MIMAP project is to be able to capture the transitional effects of structural adjustment policies, especially on the vulnerable groups. The author at present does not have an idea on how to capture this adequately in a CGE framework.
- 9) Other important issues on CGE modeling which are important to the MIMAP project are the following:
 - a) Perhaps another issue that the MIMAP CGE modeler should consider is the one that pertains to the possibility of incorporating economies of scale analysis into the CGE framework. The pioneering work in this area is the paper of Harris (1984). However, in doing this, the modeler should keep in mind the remark made in item #5 above.
 - b) One sectoral issue that the MIMAP project is interested in is the environment. An approach has to be thought of in trying to incorporate the issue on environment into the CGE framework.⁴⁶
 - c) It was difficult to learn the computer programs used to solve the models surveyed in the paper. For example, to modify the APEX model and then solve it requires running five very long computer programs in GEMPACK.⁴⁷ To add an equation in the PhilCGE model, it is necessary to go through a maze of Fortran codes. Some user-friendly software like the GAMS (General Algebraic Modelling

46. The author is aware that the analytics of incorporating environment into the CGE model are already available. Perhaps they can be adopted in the CGE modeling work of the MIMAP project.

47. The installation alone of a GEMPACK program takes about three hours.

System), or any other much more user-friendly software or general equilibrium solvers are suggested.

- 10) A number of policy simulations have already been conducted using the existing CGE models of the Philippine economy. Perhaps it would be worthwhile for the MIMAP project to conduct another survey, not focusing on the analytics of the models but on their documented simulated policy results. This is particularly important for the MIMAP project because its main objective is to understand the effects of changes in macro structural policies.

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