# THE INTERACTIONS OF NATURAL RESOURCE ENDOWMENTS AND MOBILITY WITH TRADE LIBERALIZATION POLICIES IN THE PHILIPPINES: A COMPUTABLE GENERAL EQUILIBRIUM MODELING APPROACH

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## PREFACE

Like many other developing countries, the Philippines government with the goal of industrialization followed an import-substitution strategy during the 1950s until the early 1980s. During these three decades, economic growth was essentially based on an "inward-oriented" strategy, characterized by growing government intervention and high levels of industrial protection, which was biased against the agricultural sector.

In 1981, the government abandoned the inward-oriented policy and began to pursue free market strategies including liberalization of foreign trade to stimulate economic growth. Even though this new strategy brought economic progress for some countries, it stagnated the Philippines economy. The difference seems to be in diversity of natural resource endowments and their mobility in various countries; physical and human capital endowments and their mobility among economic sectors differ widely among less developed countries (LDCs) which in turn affect the outcome of trade policies.

Higher economic growth is expected as the mobility of natural resources increases when economic and trade liberalization policies are implemented. This dissertation tests this hypothesis in the context of a computable general equilibrium (CGE) model for the Philippines economy. Using the CGE model, the interactions of the Philippines trade policies with its natural resource endowments and mobility

**are analyzed. In addition, the effects of different strategies/policies on the level of production, investment, consumption, structure of trade, welfare, and prices are investigated. These analyses are then used to derive some implications for the structure and performance of the Philippines agricultural sector.**

**The CGE model can also be used to analyze intersectoral linkages and factor markets in the Philippines economy. This study uses the Global Trade Analysis Project (GTAP) model which provides a standard model structure for comparative static analysis. The GTAP model is modified to examine the effects of various trade policies in conjunction with different degrees of natural resource mobility on the Philippines economic performance.**

**The results of the analysis indicate that there is a positive correlation between factor mobility and the outcome of trade policy. As the degree of mobility of endowment factors increases, trade liberalization policies have better results in terms of higher GDP (gross domestic product) growth rates, improvements in welfare (as measured by equivalent variation), higher levels of income, and increased volumes of exports and imports.**

**These results lead to some policy recommendations for the Philippines economy.**

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# CHAPTER ONE

# Introduction

## I. INTRODUCTION

In the 1960's the dominant strategy for economic development in major less developed countries (LDCs) in Asia, Africa and Latin America was based on industry-led growth with a primary focus on import-substitution industrialization. The basic idea of the import-substitution strategy was that less developed countries face a foreign exchange constraint to import consumer goods and other necessary products. So, it would be better for these countries to save foreign exchange by producing the imported commodities domestically. Based on this theory, the government should initially pursue policies that encourage the importation of capital goods and intermediate inputs only in order for the country to be self-sufficient in consumer goods. Then it is hoped that the country will be able to progressively ,produce intermediate and capital goods also.

In this context, adopting such policies which were biased against the agricultural sector was justified. Based on the classical theory of growth, liberalizing the importation of agricultural products and underpricing of food keep real wages low (in order to decrease the cost of living in the industrial sector), which in turn encourages capital importation for new investments and facilitates the transfer of workers from agriculture to the industrial sector (Lewis, 1954). Additionally, agricultural products were often subjected to export taxes to increase their relative prices in the world market, discouraging their exports as primary commodities and encouraging the domestic processing industries to use cheap agricultural inputs and produce manufactured products for export. Another trade policy which was biased

against the agricultural sector was overvaluation of the domestic currency to make imported machinery and intermediate inputs cheap for domestic industries whose products were protected from foreign competition through various trade barriers such as tariffs, quotas, etc.. However, these policies led to a decrease in agricultural exports.

After pursuing such policies for a decade or more, the economies of many of these countries did not achieve the expected growth rates. The strategy shaped an industrial structure that produced primarily consumer goods for the middle and upper classes of the society. The production was relatively capital intensive which did not suit the economies of these countries with high rates of unemployment. There were almost no links among different industrial sectors. Because of the structural dependence on foreign capital and imports, economic development based on an import substitution strategy was very limited and investment didn't expand to include the production of intermediate and capital goods. Instead, there was a growing reliance on imports in the industrial sector. Protectionism in many of these countries created an increasingly uncompetitive production structure in industry. To finance fast growing fiscal deficits, governments of these countries had to rely on foreign borrowing which resulted in the early 1980s "debt crisis" in several developing countries including the Philippines.

Facing so many problems in the implementation and the consequences of the economic development plans through pursuing the import-substitution strategy, many LDCs switched their development strategy to export-oriented industrialization

during the 1980s. In this process, gradually, they removed trade protection by lowering tariff rates, subsidies, and other trade barriers. To increase the efficiency of investment and production, the governments of these countries followed the neoclassical view that relying on free market price signals improves the economic performance significantly, which in turn leads to higher growth rates and more efficient resource allocation.

These changes in trade policy and domestic price management are expected to have a significant impact on the structure of the agricultural sector and natural resource allocation in these countries which in turn affect their trade system. For example, changes in agricultural trade policy will affect the use and value of natural resources -in particular, land- through changes in the composition of the structure of agricultural production. As more cropland comes into the production of agricultural commodities for export, demand for imported fertilizer and farm machinery will increase. In the meantime cash crop[1] exports will rise and contribute to a still more important share in the country's total exports. So, a change in agricultural trade policy results in changes in the structure of the farm sector, natural resource allocation and trade composition itself.

Even though the effects of trade policies on the economies of some LDCs have been studied, the interactions of natural resource endowments and mobility with

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1. The terms "cash crop" and "export crop" are alternatively used in the literature which needs to be explained. Export crops are agricultural products that are exported from the country. Cash crops are the agricultural commodities that are produced to be sold to the market. Either of these can be food or non-food products.

trade policies and their outcome on the overall economic development have been largely ignored.

The current study is devoted to the analysis of the interactions of the Philippines trade liberalization policies during the past decade with its natural resource endowments (mainly labor, arable land and capital) and mobility through the use of computable general equilibrium[2] (CGE) modeling techniques. The CGE model and database used here are provided by GTAP (Global Trade Analysis Project) [see Hertel (1995)].

## II. Organization of the Study

The dissertation is divided into four chapters as follows:

Chapter One, the current chapter, introduces the study and discusses some aspects of the Philippines economy. In particular, this chapter highlights the problems of the Philippines agricultural sector, evolution of trade policy, and exchange rate policy during the last decade. In addition, this chapter also presents a short review of literature relevant to the subject.

Chapter Two familiarizes the reader with the basic issues of the CGE modeling approach. In this chapter the intellectual roots of this approach are briefly reviewed. It also discusses some of the important structural issues of CGE models such as the problem of closure rule and calibration procedures. A few other CGE models that have previously been built for the Philippines economy will also be

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2. These models are alternatively called applied general equilibrium (AGE) models in the literature.

reviewed there.

Chapter Three presents a description of the computable general equilibrium model provided by the GTAP (Hertel, 1995) used for the Philippines' economy. The data base and the modifications of the model are explained. Then, based on this model, a number of alternative policy experiments are simulated and their impact on the Philippines economy is described.

Finally, Chapter Four summarizes the main conclusions of the study. Some implications of the results for policy making are discussed and some possible extensions of the model are suggested.

## III. Research Agenda and the Objectives of the Study

The effects of trade liberalization policies on the economies of LDCs in general, and on the agricultural sector and resource allocation in particular, have been studied by some agricultural economists. Each study has been concerned with a different aspect of the impacts of various trade policies.

E. T. Kennedy and B. Cogill (1987) assessed the impact of agricultural commercialization in Kenya on agricultural production, food consumption, and the income of farmers. They also evaluated the effects of export cropping on the health and nutritional status of women and children. Since the commercialization of agriculture in Kenya, more and more farmers shifted their production from maize, the food crop, to sugarcane for export. Their study showed that even though the incomes of the sugarcane growers were higher than those of nonsugar farmers, this increased income did not translate into improvements in preschooler's health and

nutritional status.

It is interesting to note that the increased incomes of sugarcane farmers were basically the result of the government's agricultural pricing policy. If the government had used the world market price of sugar, average net income of these farmers would have been negative.

Horacio Sobarzo (1992) built a CGE model to analyze the effects of Mexico's trade liberalization on its economy in general and on the agricultural sector specifically. He considered a case in which all trade barriers with North America are removed and there are scale economies and imperfect competition in the Mexican industry. The model is presented with three different closure rules, but in all three versions the assumption of perfect mobility of productive resources (capital and labor) between sectors is maintained.

The results of the analysis show that "depending on the assumptions adopted in regard to the behavior of factor market, the adjustment of the economy can be very different" (P. 97). For example, the economic growth rate -and agricultural growth rate as well- are the highest when the model is based on full employment of labor (the variable that clears the market is the wage rate) along with a fixed price of capital. A common result of all three versions is that because of trade liberalization a smaller number of firms serve a larger market and use factors of production more efficiently.

Ademola Oyejide (1986) evaluated the effects of Nigeria's trade and exchange rate policies on the allocation of resources among various sectors of the economy and

within the agricultural sector itself, particularly in the production of food crops (mainly rice, maize, cassava, and yams) and cash crops (chiefly cocoa, groundnut, palm kernel, and rubber). He also attempted to establish the degree of protection - based on trade and exchange rate policies- granted to the agricultural sector compared with other sectors.

The analysis indicated that trade and exchange rate policies have had a significant impact on the Nigerian agricultural sector through their effects on the volume and prices of agricultural imports and exports as well as agricultural intermediate inputs and capital equipment. The study analyzes the effects of the oil booms (in 1973-74 and 1977-80) on the allocation of resources, using various models of Dutch Disease. It found that the booms caused major intersectoral resource movements, particularly in the agricultural sector which were unfavorable. The study also showed that the trade and exchange rate regime actually taxed, rather than protected agricultural exports. The study concludes that "Policy makers must consider the effects on other sectors before implementing policies to support growth in one sector" (P. 10). In another study, Von Braun, et. al. (1989) analyzed the nutrition and income effects of agricultural commercialization (in particular rice) in Gambia.

None of the studies reviewed here nor other studies in this area have considered the effects of natural resource endowments and mobility in each individual country on the outcome of agricultural trade liberalization policies and the resulting economic development.

**The objective of this study is to analyze the interactions of resource endowments and mobility with trade liberalization policies in the Philippines during the last decade, and to derive some implications for the structure and performance of the Philippines agricultural sector.**

**In particular, the study tries to answer the following questions:**

**1) What are the effects of the Philippines trade liberalization on its agricultural sector?**

**2) What is the role of natural resource mobility in the outcome of trade liberalization policies and the economic development?**

**3) What implications and policy recommendations can be derived from this study for the Philippines agricultural sector?**

## IV. Brief History of the Philippines Economic Conditions

### 1. An Overview of the Economy

**The history of the Philippines is the history of colonial administrations. From 1521 to 1946, for 425 years, the economy of the Philippines was plundered by successive colonial governments designated by Spain, Japan and United States that brought economic success to only a small elite of landowners and foreign immigrants and impoverished the overwhelming majority of the population. R. Broad and J. Cavanagh (1993) describe the economic situation of this country: "... in Philippine agriculture, economic activity was reoriented to serve the world market; where industry existed, it was eliminated to make way for industrial goods from the West. U.S. and Philippines trade legislation in 1909 helped to solidify this outward**

**orientation of the Philippines economy: that is, industrial goods were to be imported [duty free] and, to earn foreign exchange to pay for those goods, agricultural products had to be exported" (PP. 92 & 93).**

**Even after the independence in 1946, the influence of the United States on the Philippines economy remained so deep and determinant that ironically "...the actual achievement of independence was in many ways a disillusioning anticlimax." (F. Bunge, P. 41). The economy of the Philippines remained so highly dependent on the American's that there was little incentive for the Filipinos to develop local industry to compete with American products that entered the country duty-free.**

**After the 1949 economy-wide financial chaos, the government set up a new industrialization strategy based on import restrictions and foreign exchange controls to support domestic manufactures producing importable consumer goods. Since then, for more than three decades, the Philippines governments followed an import-substitution strategy that tended to favor industry at the expense of agriculture. Industrial protection policies including tariff and quantitative trade restrictions not only have not succeeded in propelling the economy into sustained industrialization they have also severely impaired the comparative advantage of the agricultural sector.**

**After three decades of pursuing industrialization based on an import-substitution strategy, the government was faced with chronicle rural poverty and high unemployment rates, low productivity of agriculture and industry, a large amount of foreign debt (which resulted in the 1993 debt crisis), and a limited**

domestic market which was an indication of low purchasing power of the majority of the population.

Based on this general observation and pressures from the IMF and the World Bank, in 1981 the Philippine government embarked on a gradual trade liberalization program and began to undertake reforms aimed at minimizing trade restrictions. This trade liberalization program along with fiscal and monetary policy reforms were part of a set of structural adjustment policies embodied in the Medium Term Plan. The goal of trade liberalization policy was to reallocate the country's resources to increase domestic industries efficiency and competitiveness in the international market. The trade liberalization program consisted of two phases: 1) The Tariff Reform Program (TRP) which began in 1981 and was completed in 1985; 2) The Import Liberalization Program (ILP) that started in 1985 and continues to the present time. The first part of the program (TRP) resulted in the restructuring of tariff rates. Tariff rates changed from a range of zero to 100% to a range of 10 to 50%, and the average tariff rate was lowered from 43% to 28%. The second part of the trade liberalization program (ILP) is aimed at the removal of quantitative import restrictions. By 1989, a total of 2,263 import items had been liberalized (C. F. Habito, P. 2).

Even though the government has had some success in implementation of this program, as M. S. Gaspay shows, there has been "... no clear indication that the anticipated improvement in growth and income distribution has occurred." (Gaspay, P. 1). In fact, as P. Intal and J. Power report, real gross national product (GNP) per

capita has declined steadily from 1960 to 1985 (P. Intal, and J. Power, P. III) and this trend continued until 1993.

The American observers are cautious but optimistic about the economic policies undertaken by the new Philippines administration. It is expected that at last real GNP per capita will rise in 1994 and the economy will be stimulated by the recent Philippine government actions such as liberalizing the foreign exchange market, abolishing import bans and quotas, deregulating the telecommunications market, and now banking, shipping and retail sectors (Business America, 1994, PP. 6, and 11-13; Economist, 1994, PP. 39-40).

2. Trade and Exchange Rate Policies During the Past Decade

From 1945 to 1981, the Philippine governments made a number of major modifications in the foreign trade policies to protect selected industries. During the 1980s the Philippines foreign trade was mostly liberalized. With technical and financial support of the World Bank an economy-wide program for the country was initiated. It included some policies to significantly liberalize the foreign trade regime, including tariff reform and eliminating import licensing. The objective of the program was to reduce the average tariff rate and gradually liberalize the foreign trade.

Based on this agreement, the government reduced tariffs by about one-third and lifted import restrictions from about 3,000 items during a five-to six-year period (from 1981 to 1985). In turn, the bank agreed to provide some U.S. $200 million in loans for Philippines balance of payments relief while the tariff wall was reduced.

The program resulted in the "restructuring of tariff rates from a range of 0-100% to 10-50%, and the lowering of the average tariff from 43% to 28%" (Habito, P. 2).

Table 1.1

Average Tariff Rates in Major Industries, 1980-1986
(Percent)

| Year | Agriculture, Fisheries, & Forestry | Mining & Quarrying | Manufacturing |
|---|---|---|---|
| 1980 | 56.4 | 16.4 | 42.4 |
| 1981 | 42.1 | 14.4 | 34.6 |
| 1982 | 35.2 | 13.8 | 31.5 |
| 1983 | 34.4 | 13.6 | 29.6 |
| 1984 | 33.7 | 13.3 | 28.9 |
| 1985 | 32.3 | 15.6 | 27.9 |
| 1986 | 32.0 | 15.6 | 28.0 |

Source: Tariff Commission of the Philippines

The new tariff structure was obviously biased against the agricultural sector (relative to industry). Because the agricultural products tariff rates were cut more than non-agricultural goods (Table 1.1), agricultural imports increased, causing a decrease in their prices which discouraged the domestic production. As Table 1.1 shows, while the average agricultural tariff rate was cut by 36%, the industry tariff cut was 22% and that of quarrying and mining sectors were 17%.

The program was halted by the economic and political crisis beginning in August of 1983. The crisis followed the August 1983 assassination of former Senator

Bnigno Aquino. Other important factors in the 1983 foreign exchange crisis were the rapid growth of the Philippines external debt[3] and the persistent trade deficits. All these resulted in massive capital flight. It is estimated that U.S. $200 million left the country within a few weeks following the assassination (Bautista, 1987). The current account deficit in 1983 rose to U.S. $27 billion (about 8 percent of GNP) which was financed from the country's international reserves. The foreign exchange reserves were decreased to a level equivalent to less than one month's imports by October 1983 (ibid).

In November 1983 the government declared a moratorium on payment of debt principal. A new agreement was reached with the IMF in December 1984 which included "...adjustment measures that were harsh, and the economy reacted severely.... interest rates rose to as high as 40 percent, and real GNP declined 11 percent over 1984 and 1985". (E. Dolan P. 180). Because of shortages of foreign exchange, from 1983 to 1985, import control and foreign exchange rationing were used extensively.

Following the 1986 presidential election victory, the new government faced many economic problems. The most pressing one was the country's US $28 billion external debt which was unprecedented (Table 1.2) in the Philippine's history. Large debt-service payments were a drain on both the country's foreign exchange earnings from exports and its investible surplus.

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3. The Philippines total outstanding foreign debt was about U.S. $ 26 billion by mid-october 1983.

## Table 1.2

## Philippine's External Debt, 1982-1990

| Year | Outstanding Debt (Billion US $) | Debt Services (Billion US $) | Ratio of Debt to GNP (Percentage) | Ratio of Debt to Exports (Percentage) |
|---|---|---|---|---|
| 1982 | 24.54 | 3.50 | 62.5 | 42.5 |
| 1983 | 24.36 | 3.02 | 71.5 | 36.3 |
| 1984 | 24.38 | 2.30 | 77.2 | 33.4 |
| 1985 | 26.92 | 2.57 | 83.5 | 32.0 |
| 1986 | 28.37 | 3.04 | 94.1 | 34.5 |
| 1987 | 30.03 | 3.61 | 87.8 | 38.5 |
| 1988 | 29.16 | 3.48 | 74.8 | 31.5 |
| 1989 | 28.92 | 3.38 | 65.2 | 26.3 |
| 1990 | 26.97 | 2.35 | 57.9 | n.a. |

n.a.= not available

Source: Dolen, Philippines, a Country Study, 1991, P.313.

The government reached an agreement with the IMF on repayment terms. The government also agreed to liberalize import restrictions and to "eliminate quantitative barriers on 1,232 products by the end of 1986[4]. The target was accomplished for all but 303 products of which 180 were intermediate and capital goods" (ibid, P. 176).

A tariff revision plan was put forth again in June 1990 which was implemented the next year. Based on this reform, the tariff structure was simplified

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4. The deadline was later extended until May 1988 on these products.

Table 1.3

Philippines Trade Balance, 1985-1989 (in millions of US $)

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|
| Exports | 4,629 | 4,842 | 5,720 | 7,074 | 7,821 |
| Imports | -5,111 | -5,044 | -6,737 | -8,159 | -10,419 |
| Trade Balance | -482 | -202 | -1,017 | -1,08 | -2,598 |

source: International monetary fund, Balance of Payments Statistics, 1990.

by narrowing the number of tariff rates to four, ranging from 3 percent to 30 percent. None of these could improve the Philippine trade balance (See Table 1.3). As Table 1.3 indicates, the trade deficit was growing from US $482 million in 1985 to US $2,598 million in 1989. While the imports more than doubled (104% growth rate) during this period, exports had a growth rate of 69%.

3. Agricultural Sector and Government Pricing Policies

The Philippines agricultural sector is an important sector in the economy. Although its importance has been declining during the recent years, still itaccounted for more than 20 percent of GDP in 1990 (See Table 1.4) and employment of about 50 percent of Philippine's labor force by the late 1980's (See Table 1.5). It is also an important export sector, responsible for about one third of total exports and 8 percent of imports during the 1980s.

Government foreign trade policy as discussed earlier, has been biased against the agricultural sector since the implementation of the import-substitution policy. Trade liberalization programs (beginning in 1981) also favored non-agricultural sectors.

Table 1.4

Structure of GNP, 1960 - 1990
(percent)

| Sector | 1960 | 1971 | 1981 | 1990 |
|---|---|---|---|---|
| Agriculture | 31.9 | 29.5 | 22.5 | 23.0 |
| Industry | 23.0 | 29.5 | 37.3 | 33.0 |
| Services | 45.1 | 41.0 | 40.2 | 44.0 |
| GNP | 100.0 | 100.0 | 100.0 | 100.0 |

Source: Bunge, Philippines a Country Study, 1984, P. 291.

Not only government's foreign trade policy, but also domestic agricultural pricing policy prohibited the growth of the agricultural sector and changed the structure of this sector. In 1981 the National Food Authority was established to

Table 1.5

Distribution of Employment by Sector, 1956 - 1990
(Percent)

| Sector | 1956 | 1961 | 1975 | 1980 | 1985 | 1990 |
|---|---|---|---|---|---|---|
| Agriculture | 59.0 | 60.6 | 53.8 | 51.4 | 49.0 | 45.3 |
| Industry | 15.8 | 14.4 | 15.2 | 15.5 | 14.3 | 14.7 |
| Services | 24.5 | 24.6 | 31.0 | 33.0 | 36.8 | 40.0 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

Source: National Economic and Development Authority (NEDA), Philippine Statistical Yearbook 1989.

regulate the marketing of the agricultural products. The goal was to maintain cheap food, stable prices, and food security by controlling the prices of food and by importing grain, soybeans and other agricultural commodities.

The dominant agricultural products in the Philippines have been rice and corn (the main food grains), coconut and sugar, (the major traditional exports), banana, tobacco, abaca and pineapple. Banana and pineapple are the main non-traditional export crops. Corn, wheat and soybeans are the Philippines major agricultural imports. Table 1.6 indicates the importance of agricultural sector in

Table 1.6

The Importance of Agriculture in Philippine's Trade 1962-1984

| Year | Exports Value (Million US $) | Share[1] (Percentage) | Imports Value (Million US $) | Share[2] (Percentage) |
|---|---|---|---|---|
| 1962 | 355.4 | 63.3 | 147.9 | 25.2 |
| 1965 | 479.4 | 60.4 | 188.7 | 22.6 |
| 1970 | 487.0 | 42.6 | 144.1 | 12.4 |
| 1975 | 1276.6 | 55.6 | 355.4 | 10.3 |
| 1980 | 1977.4 | 34.2 | 579.4 | 7.5 |
| 1984 | 1584.0 | 29.4 | 519.1 | 8.6 |

1. Share in total exports; 2. Share in total imports.

Source: NEDA, National Income Accounts; Fao, Trade Yearbook

Philippines trade during 1962-1984.

The related agricultural sectors including livestock, fishery and forestry are

also very important in the Philippines economy. In 1990, the livestock sector grew at a 8.5% growth rate. It accounted for almost 20 percent of agricultural value added during the 1985-1990 period.

The Philippine's fishing industry is dominated by a large number of subsistence fishermen who are among the poorest of the poor. In 1989, total fishing product was 2.3 million tons from which 46% was caught by about 574,000 low income fishermen.

Forests cover more than 21.5 percent of the Philippines territory. Because of the widespread deforestation mostly by foreign companies during the 60s and 70s, government imposed some restrictions on logging. For this reason, the volume of exports of forest products declined and its share in agriculture value added decreased from 13.9% in 1956 to 5.2% by the end of 1988.

## V. Review of Literature

There has been numerous studies of the Philippines economic policies during the past decade. Only a few of these studies that are pertinent to the subject are reviewed here.

R. Dohner and S. Haggard (1994) studied the political feasibility of adjustment policies in the Philippines in the mid 1980s, with specific attention to three periods: 1) The onset and background of the 1983 debt crisis; 2) The stabilization policies of 1984-85 under the Marcos administration; and 3) The developments of 1986-88, which took place under the Aquino regime. They used different disciplines to combine economic and political analysis. The first adjustment

program which took place under the pressure of the US government and international financial institutions followed the outbreak of the 1983 debt crisis. The resulting adjustment program which was based on a very tough monetarist stabilization policy and increased indirect taxes was successful in bringing inflation under control. The unusually harsh adjustment program had its political backlash against the government. The growing discontent caused the forced abdication of long-time president Marcos in 1986.

The authors described the Philippines characteristics under Marcos regime as "... highly inequitable distribution of income, a weak labor movement and the poverty of small peasant farmers and agricultural workers, associated with a high concentration of landownership, explaining the perennial troubles in rural areas. Moreover, President Marcos established a system of favoritism which ensured enormous incomes for a handful of people granted monopolies in the agricultural sector by the government" (P. 9).

During the second period, the Aquino government continued the adjustment program in a framework of reform with the support of public opinion. Because of relatively calm political situation, an improvement in the country's terms of trade and a substantial inflow of financial aid facilitated the adjustment program. A number of structural reforms were put into force by the government during this period including trade liberalization, tax reform, and agricultural marketing system reform.

The authors reached three policy conclusions from their analysis: First, policy

distortions by the government have negative consequences for income distribution. So, this study supports the idea that "... stabilization programs should be accompanied by targeted schemes to alleviate the distress of poor and vulnerable groups" (P. 83). The second policy conclusion is that the strategy and tactics of the foreign donors (the IMF, World Bank and bilateral donors, particularly the United States) "actually aided and abetted the policy failures of the late Marcos Period. ...By taking a relatively lax stance toward program derogations, the international community allowed structural problems to accumulate" (P. 12). The third policy conclusion is about the relationship between political and economical changes in developing countries. In the case of Philippines under Marcos regime where the government had completely lost its accountability, political reform is a pre-requisite for economic reform.

H. E. Bouis and L. J. Haddad (1990) studied how commercialization of agriculture affects household income and nutrition and addressed some other policy concerns for the Philippines agriculture. They did a survey of 500 corn and sugar producing households in one province of Mindanao Philippine during 1984-85. In this area, a sugar mill was established in 1977 that encouraged the farmers to switch from planting corn (staple food crop) to sugarcane (for export).

To study the positive and negative effects of agricultural commercialization, the authors undertook a strategy that consisted of cross-sectional comparisons of two groups of households: a group of households that continued corn production after the introduction of the new cash crop and the group that had switched to sugar

**production. A study of an initial random sample of households indicated that the introduction of the sugar mill has resulted in a serious deterioration of land tenancy patterns. The reason was that smallholder corn tenant farms which used primarily family labor were consolidated into larger sugar farms which used primarily hired labor. Thus, large, profitable sugar farms were established without a net increase in demand for labor which provides "a classic case of the rich getting richer and the poor getting poorer" (P. 134). Other important effects of the introduction of export cropping were "... an increase in incomes for households that grew sugarcane; a decline in women's participation in own-farm production; and very little improvement in nutritional status as a result of increased incomes from sugarcane production" (P. 7).**

**The analysis implies some policy recommendations. Since one major problem that caused low income of corn landowners was declining productivity of those lands, the first policy implication is that government should help to improve smallholder corn productivity. Improvement of soil fertility, introduction of hybrid varieties of corn, subsidization of fertilizer and other inputs are recommended by the authors to increase smallholder corn productivity.**

**The second policy implication is that the export cropping should be expanded on a smallholder basis. To achieve this goal, the authors recommend that the government should try to reduce the barriers to entry by "providing smallholders with credit and know-how through extension and by actively promoting their access to processing and marketing facilities where necessary" (P. 59).**

Rains, Stewart, and Angeles-Reys (1990) examined the interaction between the agricultural and nonagricultural sectors in the Philippines. They integrated micro and macro approaches with special emphasis on the spatial dimension of development to show how linkages of these two sectors affect not only the growth of each sector separately, but also the overall growth and development, the regional pattern of growth, and the participation of various socioeconomic groups in growth which in turn affects income distribution and level of employment. Based on this interconnection between agriculture and nonagriculture, they identified the conditions that lead to a rapid and balanced growth and the policies that encourage a more interactive and mutually reinforcing pattern of development.

There are linkages at different levels of geographic aggregation from which the authors are especially concerned with the rural linkages, involving the interactions between agriculture and nonagriculture within the rural economy.

In the case of the Philippines, the rural linkages are weak which is related to high spatial concentration of development and high industrial concentration. The authors also studied employment and income distribution in a number of Asian countries and found that in general "Spatial concentration of industry is typically associated with the adoption of large-scale, capital-intensive technologies and a high degree of inequality in income distribution" (P. 75).

Another finding of the study was that high concentration of nonagricultural production and of large-scale enterprises mainly resulted from three mutually reinforcing factors: 1) inequality of income and land distribution, 2) import-

substitution strategy along with related industrial policies, and 3) regional imbalances in the allocation of infrastructure.

A major finding of this study was that there is a reciprocal linkage between the growth of the quantity of agricultural output and nonagricultural employment. An increase in agricultural output will result in an increase in nonagricultural employment, while increasing nonagricultural activity -such as modernization of rural area- will increase productivity and hence output of the agricultural sector.

These results, have a number of important policy implications for the Philippines, as well as other developing countries. The basic theme in these policy recommendations is "... the need for balance -developing policies that treat geographical and economic sectors more equally, thus allowing a more interactive and mutually reinforcing pattern of development" (P. 3).

Gary Hawes (1987) examined the Philippines economy and agricultural sector from a perspective of political economy. Specifically, he investigated the effects of the authoritarianism -which was the outcome of the declaration of martial law on September 1972- on the three agricultural export crops: coconuts, sugar, and fruit products.

He was concerned with the rise of these three new export industries, the change in the distribution of costs and benefits in these industries and the impact of the continued and massive agricultural product exports on the growing problems of rural landlessness and malnutrition.

He believes that the best way to study the political economy of the Philippines

is to focus on the agricultural exports sector, since the export of agricultural products and the tremendous wealth generated in this sector have been the basis for the domination of colonial powers over the Philippines economy during the last two centuries. After independence, every president that was chosen came from these industries or had been forced to develop political coalitions based on support from them.

The author analyzed these agricultural export industries to investigate the Philippine's political economy during Marcos' regime. The analysis also illustrated how the country has incorporated into the world market and the role it played in the world economy.

Based on the data presented, Hawes showed the importance of these three agricultural products in the Philippines economy, the structure and the nature of their production, and how they have been manipulated for political ends. The analysis showed that "... the problems of the agricultural exports industries are not limited to those brought about by the political manipulation of Marcos. The agricultural industries generate extreme inequality as well as high levels of malnutrition and poverty, and so they contribute to growing class conflict in the countryside. These agricultural industries are, in turn, symptomatic of larger problems in the Philippine economy" (P. 162).

The pattern of class domination, land ownership, the strength of the agricultural elite, and the domination of the transnational pact have restored and resolidified or changed a little during the Aquino's government. And since the

country has remained dependent on agricultural exports for the bulk of its foreign exchange earnings, "... the coercive and administrative powers of the state will once again be used to defend the interests of agroexporters" (P. 163).

Intal Jr. and Power (1990) also have a political view point in analyzing the Philippines agricultural problems. They tried to examine the reasons underlying agricultural pricing policies and to understand the effects of such interventions on the agricultural sector during 1960 to 1985 period. In this study the political and economic forces behind price intervention are analyzed with special attention to rice and corn, the primary food grains, and sugar and coconut, the main export crops.

The authors also studied the effects of agricultural price intervention on such things as agricultural incentives and food prices, as well as their effects on food consumption, output, foreign exchange earnings, intersectoral transfers, and income distribution.

According to the authors, two fundamental roots of the Philippines' disappointing economic performance (besides the effects of unfavorable international economic environment) were 1) "... the inability to diversify the economy and reduce dependence on sugar, coconuts and other primary exports" (P. 208), and 2) "... the continuing inefficient allocation of investment of what had long been high levels of saving in relation to GNP" (ibid). Both of these failures are the results of inappropriate economic development plans: "... the excessive protection of the domestic market and the concomitant bias against export diversification" (P. 208). Another failure of the Marcos regime was the increasing tendency to depend on

foreign borrowing used mostly to augment his political power. Instead of investing in profitable economic activities, "... much of the savings and investment of the 1970s was wasted on non-performing assets" (ibid).

The study had several findings. One of the principal findings the authors determined was that the various types of direct and indirect price intervention resulted in a substantial decrease in the production of sugar and coconuts, a slight reduction in the rice output, and a notable increase in corn production. Another important finding of the study was that "... direct intervention by the government in the producer price of sugar and coconuts had net negative effects that were exacerbated by indirect intervention (e.g., manipulation of exchange rates). This appears to account for the shift in political dissension from the rice-growing regions of Luzon to the Visayas, Bicol, and Mindanao, traditional sugar and coconut-producing regions" (P. III).

There are other studies of the Philippines economy that are important enough to be mentioned here:

R. Bautista (1987) examined the quantitative effects of the Philippines trade and exchange rate policies on the economy, with special attention to the agricultural sector during 1950 to 1980.

Floro and Yotopoulos (1991) investigated the implications of the Information Economics approach for the rural credit market with a sample of informal credit contracts in the Philippines.

Ernest H. Preeg (1991) assessed the effectiveness of United States economic

**assistance to the Philippines during the past decade in achieving its noneconomic objectives such as maintaining military base rights and containing the communist insurgency.**

**Sang-Woo Nam (1989) studied the most important factors in determining the Philippines and Korea's -the Asia's most heavily indebted countries- national savings.**

**Frederica Bunge (1984) edited a book that studied the Philippines economic, political, and social system, national security and institutions.**

# CHAPTER TWO

# Background and Structure of Computable General Equilibrium Modeling Technique

## I. INTRODUCTION

Economists have struggled with problems of reconciling analysis at different levels of aggregation for a long time. Macroeconomic models, based on national accounts focus on macroaggregate balances, while input-output analysis concentrates on intermediate flows and on the sectoral composition of production and demand. Computable general equilibrium models which have been developed more recently are able to reconcile the macroeconomic accounts with input-output sectoral intermediate flows.

Even though at the beginning (1960s) the high cost of implementing numerical solutions kept general equilibrium models from becoming popular, during the last decade there has been a proliferation of these models applied to both industrialized and developing countries. This new economic tool has helped economists to investigate a wide range of policy issues.

This chapter consists of four sections. Following the introduction, the next section reviews the theoretical and empirical background of these models and discusses some important issues of CGE modeling. These models have been classified from different perspectives. Some of those classifications will also be reviewed in that section. The third section is devoted to the application of CGE models to the issue of trade policy analysis. Finally the last section presents a tour of literature related to the Philippines CGE models.

## II. Theoretical and Empirical Basis of CGE Models

This type of model, that has been widely used as an economic tool during the past decade, has its roots in the Walrasian theory of general equilibrium. The first

empirical CGE model was applied to Norway by Leif Johansen in 1960. Since then a large number of models have been built to analyze a wide range of policy issues in many different countries under various economic conditions. These models are constructed based on input-output tables or SAM (social accounting matrix) frameworks. These tables bring together the accounts of each of the various economic agents whose behavior is to be modeled into a consistent framework and show their interactions. These agents include various production sectors -depending on their degree of disaggregation, the number of sectors may vary- different income groups of consumers, government and public sector, trade and foreign sector.

Issues investigated by CGE models, in a broad view, can be divided into four general categories: international trade, growth, economic structure and/or income distribution, issues in the theory of public finance, multicountry international trade, and energy issues.

Some important characteristics of these models are: they can be highly nonlinear; they are built based on reasonable assumptions and behave according to accepted economic theorems; they are suited for analyzing certain kinds of policies that may not have been implemented yet; various structures and characteristics can be included in these models such as perfectly or imperfectly competitive markets, quantity or price adjustment lags, and different government interventions. While they are not as suitable for forecasting as econometric models are, they may be built for one period or for several periods. One of the important features of these models is their ability to trace the consequences of a change in macroeconomic policy or a

large change in a particular sector throughout the entire economy.

These models were first built based on the assumptions of neoclassical theory of agents' optimization, price adjustment and full employment of resources. Later, economists incorporated a variety of institutional rigidities characterizing the economy of less developed countries into CGE models. Examples include wage rigidities, government price and exchange rate controls, etc..

Ahluwalia and Lysy (1979) classified CGE models as neoclassical (capital and labor fully employed), Keynsian (only capital fully employed), and Leontief (neither fully employed).

A branch of these models, structuralist CGE models, has become more popular in recent years. Their development goes back to the model first put together by Frank Lysy and Lance Taylor in mid-1970s for Brazil. This model emphasized forced saving and some output adjustment in an economy with several sectors and social classes (Taylor, 1990). In contrast to neoclassical type of models, this type of CGE model is based more on the analytical approach of Keynes.

Structuralist model builders are more concerned with institutions and political economy which includes issues such as distribution of income and wealth, control of the means of production by distinct types of actors (the private sector, the state, or transnational capital), and the extent of organization of the working class and other influential sectors.

While price determination in neoclassical models is based on the Walras' tatonnement process (auction type market), the structuralist CGE models are based

on the assumptions of fix-price/flex-price. This is because in structuralist models there are usually two distinctive type of markets. In one type of markets, prices are determined by producers based on the production costs of that commodity plus an exogenously determined mark-up rate. So, based on these prices, quantity demanded and produced will be determined endogenously (these are the markets with fixed prices). While in some other types of markets -such as foodstuff markets- the quantity of output is fixed and depending on the demand for that commodity, the price will be determined endogenously (these are the flex-price markets).

## III. CGE Modelling and Trade Policy Analysis

Classical economists like Ricardo explained that protecting one sector of the economy would cause resources to shift toward that sector. Ricardo's model, later was extended and modified by Hecksher (1919), Ohlin (1933), and Samuelson (1938). They presented Ricardo's general equilibrium approach to the analysis of trade policy as the neo-classical trade theory. The neo-classical trade model demonstrates that international prices are the correct signals for efficient allocation of domestic resources (especially for a small country that cannot affect world prices). Based on this theory, increasing the level of trade protection distorts the pattern of production in favor of less internationally competitive sectors causing an inefficient production structure to prevail. The neo-classical general equilibrium model's insights have been applied to evaluate actual trade policies enforced by governments of various countries in the CGE modeling framework.

The model developed by Bergsman (1974) is an early attempt to measure the

efficiency cost of protectionist trade policies in a general equilibrium framework. Since then CGE models have become a widely used instrument for analyzing trade policies because of the appeal of their theoretical consistency as well as their ability to capture the resulting resource allocation movements. In particular, trade liberalization has increasingly been analyzed in the context of CGE models to specify the gains from trade based on factor allocation efficiency.

## IV. A Survey of the Philippine's CGE Models

There are a few CGE models built for the Philippines economy. In this section some of them are reviewed.

Cielito Habito (1990), using a CGE approach, analyzed the effects of the Philippines trade liberalization program on the agricultural sector and concluded that "... traditional trade policy biases against agriculture have not been alleviated by the Tariff Reform Program, and may in fact have been worsened by it" (P. 1). Then he proposed and compared two alternative policies: an increase in the level of agricultural protection and a decrease in the level of manufacturing sector protection to improve the condition of the agricultural sector. Using a multisectoral CGE model of the Philippines economy, he found that "... in terms of the economy as a whole, a policy towards greater liberalization of industrial products [to reduce the cost of inputs for farmers] is superior to one that would impose greater protection of agricultural products". (P. 16)

Romeo Bautista (1986) recognized three sources of domestic price distortion in the Philippines: 1) underpricing of food, 2) overvaluation of the domestic currency

and 3) agricultural export taxation. He was interested to see how agricultural production and income would be affected by alternative liberalization policies that include the elimination of these three policy biases against the agricultural sector. He used a supply-oriented CGE model of the agricultural sector with the food-export crop trade-off in production as a key component (P. 35). The analytical and empirical examinations show that complete elimination of these three policy biases increases agricultural income significantly despite the partial offsetting effects on the production of food and exports of crops.

R. L. Clarete and J. A. Roumasset (1990) studied the welfare cost of agricultural and industrial protection policies. They used a CGE model of the Philippine economy to evaluate industrial/trade and agricultural policies during the 1970s. The results of the study were: " ... first, industrial/trade policies have larger economic waste relative to agricultural policies. Second, agricultural policy liberalization without accompanying liberalization of foreign trade regimes can result in relatively small gains in economic welfare. This is due to countervailing induced industrial protection via higher import premia and exchange rate appreciation". (P. 471)

Manuel S. Gaspay (1993) tested the neoclassical argument that "getting prices right" will significantly improve the country's economic performance. He examined this theory using static and dynamic CGE models of the Philippines economy. He included two versions of government fiscal behavior as important factors influencing the outcome of trade policy. The study led to the following conclusions: " First,

**simply "getting prices right" will not guarantee growth nor improve the equity in income distribution. Trade liberalization may be a necessary condition but not a sufficient condition for growth. Second, the link between tariffs and fiscal policy is too important to be taken for granted in liberalizing trade policy. Tariff policy must be consistent with trade liberalization program if the latter is to be successful" (P. v.).**

# CHAPTER THREE

# A Computable General Equilibrium Model for the Philippines

## I. INTRODUCTION

In order to investigate the economic impacts of the interactions of natural resource endowments and mobility with trade policies in the Philippines, GTAP model, a computable general equilibrium model for an open economy is used for the analysis. The Global Trade Analysis Project (GTAP), developed by Hertel was initiated with the goal of lowering the cost of conducting quantitative analysis of international economic problems in an economy-wide framework. It consists of a global data base and a standard modeling framework. The standard modeling structure permits users to examine the effects of changes in policy, technology, population and factor endowments on the regional economy. The full GTAP model consists of approximately 15,000 equations and 23,000 variables. The user can specify the split of variables between exogenous and endogenous variables (i.e. model closure) and/or make changes in the model and base data.

In this chapter the structure of the GTAP model and the experiments are explained. This chapter consists of four sections as follows. Following the introduction, in the second section a description of the basic theoretical structure of the GTAP model[5] is presented. The modifications to the GTAP basic model for the purpose of this study are discussed in the third section. More specifically, these modifications are incorporated to investigate the interactions of natural resource endowments and mobility with trade policies. The policy simulation schemes are also

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5. For detail description of the GTAP model see Thomas w. Hertel (ed.) "Global Trade Analysis Using the GTAP model", Purdue University, 1995.

explained in this section. The modified model used in this study examines three scenarios of hypothetical situations in the Philippines (dealing with various degrees of factor mobility) in conjunction with a number of alternative policy experiments (related to different trade policies).

The final section includes the analysis of the results of these experiments and a comparison of the effects of various trade policies on sectoral output, investment, structure of trade, prices, and social welfare.

The model is based on the following assumptions:

1. The country (the Philippines) is a small open economy. It is assumed that the economy is too small to affect the world prices. Thus import supply and export demand are perfectly elastic.

2. There are three factors of production: agricultural land, labor, and capital. Labor and capital are perfectly mobile across production sectors. Land is assumed to be the "sluggish factor". It is imperfectly mobile and sluggish to adjust to changes in the rental rates of return.

3. Each production sector is assumed to produce a homogeneous output. Thus, there is no joint production in this model.

4. The model is static and does not include dynamic effects of technology changes, population growth and capital stock augmentation.

The model is based on the Global Trade Analysis Project data base[6]. The

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6. The data base was developed and updated by the cooperation of Australian Industry Commission, Purdue University, Economic Research Services of USDA, and the World Bank.

GTAP provides data for 24 regions[7] and 37 sectors for each of those regions. The 17 countries, European union, and 6 composite regions of the data base provide worldwide coverage. Detailed description of the GTAP data base, variables and parameters, aggregation method and updating procedure can be obtained from Chyc et al. (1994 a, b).

The productive activity for the Philippines model is an aggregation of these 37 sectors into ten sectors (Table 3.1). Even though some sectors such as sugar and coconut production are very important in the Philippines economy, they are not classified as individual products here, because there are no data available for these individual categories in the GTAP data base.

Since the original input-output matrices for these 24 regions range between 1980 (European Union) and 1992 (the composite regions) data, and the trade flows correspond to 1992 data, the original input-output data are updated to 1992 to provide a uniform basis for economic analysis. The original Philippines data is based on the 1988 report from the Philippines National Economic and Development Authority which corresponds to the 1983 data.

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7. These 24 regions are consisted of 17 countries -Australia, New Zealand, Canada, United States of America, Japan, Republic of Korea, Indonesia, Malaysia, Philippines, Singapore, Thailand, People's Republic of China, Hong Kong, Taiwan, Argentina, Brazil, Mexico-, European Union, and 6 composite regions -Rest of Latin America, Sub-Saharan Africa, Middle East and North Africa, Eastern Europe and Former Soviet Union, South Asia, Regions not elsewhere classified.

**Table 3.1**

**Aggregation of Production Sectors of the Model**

| GTAP Model Sectors↓ | Philippines Model Sectors↓ |
|---|---|
| Paddy Rice | Rice |
| Wheat | Other Agriculture |
| Grains (other than rice & wheat) | |
| Non-grain Crops | |
| Wool | Livestock |
| Other Livestock | |
| Forestry | Forestry |
| Fishing | Fishing |
| Coal | Other Resource-Based Industries |
| Oil | |
| Gas | |
| Other Minerals | |
| Petroleum and Coal Products | |

Table 3.1 Continued

| | |
|---|---|
| Processed Rice | Food Processing |
| Meat Product | |
| Milk Products | |
| Other Food Products | |
| Beverages and Tobacco | |
| Textiles | Light Manufacturing |
| Wearing Apparel | |
| Leather, etc. | |
| Lumber and Wood | |
| Pulp, Paper, etc. | |
| Chemicals, Rubber, Plastics | |
| Other Manufacturing | |
| Non-metallic Mineral Products | Heavy Manufacturing |
| Primary Ferrous Metal | |
| Non-ferrous Metals | |
| Fabricated Metal Products | |

Table 3.1 Continued

| | |
|---|---|
| Transport Industries | Heavy Manufacturing (cont.) |
| Machinery and Equipment | |
| Electricity, Water, & Gas | Services |
| Construction | |
| Trade and Transport | |
| Other Services (private) | |
| Other Services (government) | |
| Ownership of Dwellings | |

II. Description of the GTAP model

The equations of the GTAP model are grouped into ten blocks[8]. Each block will be described below, but before that some of the important features of the model are reviewed first:

1. The behavioral components of the model are in terms of percentage changes in prices and quantities. In this way the nonlinear CGE model is linearalized by totally differentiating the equations. In these equations lower case p and q denote percentage changes in price and quantity which are the weights in the equations.

2. There are two types of commodities: saving and non-saving commodities.

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8. Since the model is proprietary (it can be obtained from Purdue University), it is not included in the dissertation.

**The latter is divided into two groups: tradeable and non-tradeable commodities. Non-tradeable commodities are actually the services of primary factors which in this model are called endowment commodities. So, there is no trade in factor services (interest, profits, dividends, or wages) while the non-factor services (business, shipping, insurance, and financial services) are tradeable. The latter is broken into shipping and non-shipping services components.**

**3. The coefficient of the model are in value terms because in this approach it is not necessary to compute price and quantity level (P and Q) separately.**

**4. Another important feature of the model is the inclusion of slack variables in some of the equations. In so doing, one can fix certain variables exogenously and drop the related equilibrium condition to create a special closure. For example, in the tradeable commodity market, the equilibrium condition can be achieved by allowing the prices to be free to adjust in order to resolve any imbalances between market supply and demand. But, if the price of a tradeable commodity in selected markets needs to be fixed, the endogenous change in the related slack variable (tradeslack) captures the excess of supply over demand in the new equilibrium.**

**5. In this model, a "super-household" represents all the households and the government of each region. This specification simplifies analysis of the regional welfare in the case of policy interventions. It also implies that the regional income is exhausted on private consumption, government purchases and savings.**

**6. There are two global sectors in this model, the global transportation sector and the global banking sector. The former provides the services and accounts for the**

difference between trade flow value at the origin and destination for each tradeable commodity shipped along a particular route. The global banking sector intermediates between global savings and investment.

1. Accounting Relationships in the GTAP model

The accounting relationships are gathered in Table 1 of the GTAP model. The market equilibrium conditions for tradeable and non-tradeable (endowment) commodities are presented in equations 1 through 5.

The tradeable market clearing condition (equation 1) is the material balance equation, forcing total supply to be equal to total demand either domestic or foreign demand (export demand). The domestic demand for imported goods and domestically produced goods comes from firms, private households, or government (equations 2 and 3).

Endowment commodities supply are equal to total firms' demand for those primary factors either perfectly mobile across sectors (i.e. labor and capital, equation 4) or sluggish in their adjustment (i.e. land, equation 5).

Firms are assumed to maximize their profits. Zero pure economic profits (equation 6) means that total firms receipts must be exhausted over total expenditures which includes payments for endowment commodities services, and composite intermediate inputs. In the case of international transport sector, this condition means that total revenue must be equal to total value of services purchased by this sector (equation 7).

The representative household in this model receives various types of incomes

and pays taxes (equation 9). The income comes from various sources. Endowment factor services, taxes, sales of tradeable commodities to domestic and foreign markets are all generating incomes which are accounted for in the computation of regional income. Instead of tracking the individual uses of various types of incomes, the model mixes all regional revenues into a single "pot" from which government and private household expenditures and savings are financed. To assure the complete disposition of regional income, savings and government expenditure are deducted from disposable regional income first, leaving the remaining for private household expenditures (equation 8).

The last five equations in accounting relationships refer to global savings and investment. Since the GTAP model is a comparative static model, current investment does not augment the productive stock of capital for the next period. So, the investment has only a limited role in the simulations. The beginning of the period capital stock is exogenously determined and is used to calculate the targeted end-of-period capital stock (equation 10).

Regional gross investment is aggregated into global net investment (equation 11) which is equated to global savings -which is an aggregation of regional savings (equation 13)- based on Walras' law (equations 12 and 14).

2. Price Linkages

The price equations of GTAP model are presented in Table 2. There are various types of taxes/subsidies in this model; some include: tax (subsidy) on firms' supply of commodities, import taxes, primary factor taxes on firms, commodity taxes

on household's and firms' purchases of tradeable goods, export taxes, etc. The general rule in computing the tax rates is that they are always defined as the ratio of agent's prices to market prices, or market prices to world prices in the case of trade taxes. For example, in the case of output tax ("TO" which is referred to as the *power* of the *ad valorem* tax) is given by: TO(i,r) = VOA(i,r)/VOM(i,r) where VOA(i,r) is the value of commodity i in region r at agent's prices, and VOM(i,r) is the value of output commodity i in region r at market prices. Value of TO greater than one implies that firms (households) are actually receiving a subsidy on the commodity supplied. Therefore, dTO(i,r)/To(i,r) = to(i,r)>0 indicates that the subsidy is increased.

The price equations in Table 2, show these linkages between agent's prices and market prices (or market prices and world prices) taking into account the taxes levied on commodities in each market.

3. Behavioral Equations

The behavioral equations in GTAP model are provided in three tables (Tables 3, 4, and 5). This group of Equations reveals the motivation of the various economic actors in the economy. It is assumed that all economic agents will independently pursue optimization behavior in the economy. This implies that producers maximize their profits subject to technological constraints and consumers maximize their utility subject to their budget constraints.

A. Firm's Behavior

The behavior of firms, as mentioned above, is subject to a technological

constraint. Firms are assumed to combine primary factors of production (land, labor,and capital) with intermediate inputs (some of which are produced domestically and some of which are imported) to produce tradeable commodities subject to a separable, constant return to scale (CRS) technology.

The assumption of separability in production implies that firms choose their optimal mix of intermediate inputs and primary factors independently of the cross prices of those inputs. Since the production technology is assumed to be constant return to scale (i.e. the level of output does not play a role in determining the factor demand), the components of value-added are demanded based on the relative prices of land, labor, and capital, while the intermediate inputs are demanded based on the composite prices of imported and domestically produced inputs. According to this assumption, firms decide on the sources of their imports first and then based on the resulting composite import prices, they determine the optimal mix of imported and domestic inputs.

In this model it is assumed that there is constant elasticity of substitution (CES) among primary factors (i.e. all pair-wise elasticities of substitution are equal) and between composite imported and domestically produced intermediate inputs. As the technology of production indicates, the elasticity of substitution between any individual endowment factor on the one hand, and intermediate inputs on the other, is also equal.

The behavior of firms is described in the equations of Tables 3 and 4. The equations of these two tables are arranged based on the "nests" or branches of that

technology tree. Each nest is described by two types of equations. One presents the substitution among inputs within the nest and the second type of equation, the composite price equation, determines the unit cost of the composite commodity produced by that branch. This composite price will then become the argument in the next higher branch which determines the firms' conditional demand for this composite input.

B. Household Behavior

As previously noted, all final demand and savings in each region are originating from a single "super-household". This household allocates the total regional income among private household consumptions, government expenditures and savings according to a Cobb Douglas utility function (equation 37, Table 5).

Based on this specification of the utility function, each component of final demand has a constant share of total income (equations 38 and 39). The government spending is allocated among composite goods based on the assumption of constant budget shares. The conditional demands for composite tradeable goods are derived based on the aggregate price index for all government purchases (equations 40 and 41).

To specify the combination of imports and domestically produced goods in the composite demand, a price index is established first (equation 42), and then government's composite demand is allocated between those goods (equations 43 and 44). Household consumption is modeled based on a constant difference elasticity (CDE) functional form, first proposed by Honoch. Therefore, household demands are

non-homothetic, which has an appealing treatment of income changes, Since as the income changes, the share of goods in consumer basket won't stay the same.

Based on the CDE function, the relationship between minimum expenditure, utility and prices is derived (equation 45). Per capita private household demands for tradeable composite commodities are determined according to equation 46. The mix of composite consumption goods (the combination of imported and domestically produced goods) is laid out in equations 48 and 49 in Table 5. The formulae in Table 6 compute various elasticities of demand. These are: own-and- cross price partial elasticities of substitution for private household consumption (equations F2 and F3), income elasticities of demand (F4) and uncompensated, own-price elasticities of demand (F5).

4. Supply of Sluggish Endowments

As it is noted earlier, sluggish endowment commodities (e.g. land) are not perfectly mobile across sectors and slow to adjust to changes in the market prices. Thus, shocks to the model will result in differential price changes across sectors.

The responsiveness of these production factors to changes in their rental rates is described by the two equations of Table 7. A constant elasticity of transformation (CET) type of function is used to describe the mobility of these endowment factors (equation 51). Since the CET function is convex in prices, the elasticity of transformation ($\sigma_t$ in equation 51) is always negative. As the value of $\sigma_t$ approaches zero, the intersectoral factor mobility decreases. As the value of $\sigma_t$ takes on more and more negative values, the supply of that factor becomes more and more responsive

to relative rate of returns. On the limit, as $\sigma_t$ approaches $-\infty$, the factor approaches perfect mobility and its rental rates across alternative uses converges. A price index for this factor is established first (equation 50) which in turn provides the basis for deriving the transformation relationship (equation 51).

5. Investment

Regional investment in GTAP model (Table 4) is determined by the global banking sector. The allocation of investment to each region contains two problems: The first problem is determining the combination of inputs going into investment in each region. The second problem is deciding on the level of investment activity in that region.

The first problem is solved by assuming that a unit of capital for investment in each region, is, like all other producing sectors in this model, created by assembling composite inputs according to a Leontief production function (see equation 36, Table 4). The composite intermediate input itself, is created according to a CES combination of domestic and imported inputs (equations 31 and 32 in Table 4).

The second problem, determining investment levels in each region depends on finding an aggregate investment level. Since in this model global investment is determined by global savings, it is important to find the global savings demand. Here, it is assumed that savings in each region is a fixed share of regional income (equation 38 in Table 5). An imaginary banking sector mediates between the household demand for savings and firms demand for investment capital.

To determine the level of investment in each region, the model provides two alternative approaches. In one "theory", the level of investment in each region depends on the relative rates of return on capital across regions. In the second approach it is assumed that the regional investment level will remain unaltered during the time period of the model. In Table 8, These two systems are combined (equations 11' and 59) through the introduction of a binary parameter RORDELTA which takes on the values 0 and 1. When RORDELTA=1 the first approach (rate-of-return model) is obtained, and when RORDELTA=0, the second model results[9].

6. The Global Shipping Industry

This global sector provides transportation services among regions and accounts for the difference between the value of trade flow at the origin and destination for each commodity (Table 9).

The services are "produced" based on a Cobb Douglas production function. The only input in this production function is the services exported from each region. The composite price index for this international commodity in percentage change is given in equation 61 (which is the same as equation 7 in Table 1). The conditional demand for the input in this sector (equation 62) depends on the quantity of global shipping services (qt) and a substitution effect with the elasticity of substitution assumed to be unitary.

The next equation in Table 9 refers to the distribution of this composite international shipping services across regions and for various commodities.

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9. In the Philippines model the value of RORDELTA is set equal to 1.

7. Aggregate Indices

The aggregate indices which are computed in GTAP model are presented in Table 10. Even though they do not play a role in obtaining the equilibrium values, including them in the model can explain some aftermath facts. For example, regional terms of trade changes may be measured through equations 64 to 66. Changes in the value, price and quantity of regional GDP (equations 70-72) are also included in Table 10.

The world price and quantity of supply indices for commodity i are computed through the equations 73 to 75. The rest of the equations of Table 10 are indices to compute changes in the volume of global exports (equation 78), and imports (equation 81), regional exports and imports (equations 84 through 87), and volume of global trade (equation 90).

III. Modifications of the GTAP Model and Policy Simulation Schemes

To analyze the interactions of resource endowment mobility with trade policies, three scenarios are examined. In each scenario two cases are considered:

A. perfect immobility of endowment commodities (particularly land and capital).

B. perfect mobility of endowment commodities.

The three scenarios are as follows:

A. Scenario #1. trade restrictions: For this simulation the 1980 tariff system[10] is used. The year 1980 is chosen because it is pre-liberalization year. The first phase of the Philippines trade liberalization program (Tariff Reform Program) began in

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10. Tariff system refers to the tariff equivalent of all non-tariff barriers.

1981 and completed in 1985. The average tariff rates for agricultural sectors (including processed agricultural products), fisheries, and forestry in that year were 56.4%, for mining and quarrying 16.4%, and for manufacturing commodities 42.4% which are included in the tariff system.

B. Scenario #2. Partial trade liberalization: The first phase of trade liberalization program was completed in 1985 and resulted in the restructuring of the tariff system. The tariff rates lowered from 0-100% to 10-50% and the average tariff rate from 43% to 28%. So, the 1986 tariff system is chosen for partial trade liberalization scenario. The average tariff rates in that year were 32.0% on agricultural products, fisheries and forestry, 15.6% on mining and quarrying, and 28.0% on manufacturing.

C. Scenario #3. Complete trade liberalization scheme: In this scenario all the Philippines import tariffs, export subsidies, and output subsidies are completely removed in order to achieve free trade.

These three scenarios taking into account two cases of endowment factor immobility and mobility for each scenario, make a total of six experiments.

The model is modified to take account of factor mobility. The mobility and immobility of endowment factors are implemented through changes in the $\sigma_t$, the elasticity of transformation and some other minor changes[11] in the basic structure

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11. These minor changes (including redefinition of some of the variables - capital, labor, and land- as being fixed or variable endowment factors in the basic model and data base) were necessary in order to implement the mobility and immobility of production factors.

of the model. As it was explained earlier, the transformation elasticity can take on values between zero and -∞ with $\sigma_t$=0 implying perfect immobility (allocation of factors across uses is fixed) and $\sigma_t$=-∞ perfect mobility and in this case no differential return would be sustained in the economy.

The effects of each scenario on the economic growth, trade structure, investment, sectoral output, prices, income and welfare are analyzed and compared with the other cases. Based on the neo-classical theory of trade[12] -Hecksher(1919), Ohlin (1933), and Samuelson (1938)- it is expected that the economic growth would be higher in the final case where natural resources are perfectly mobile and government follows a complete trade liberalization policy. In this case the production factors are employed in each sector up to the point where the marginal value product of each factor is equalized to its marginal cost. In this case the classical equilibrium condition is met and production factors will be used more efficiently. The basic argument is that free trade stimulates more efficient industries through the reallocation of natural resources. This reallocation, in turn, will cause an increase in output of that sector. For example, if the Philippines has comparative advantage in agriculture, a free trade regime will redirect resources to this sector leading to an increase in agricultural production and output. Trade liberalization should also improve economic welfare of the Filipinos because through changes in income distribution. This is because in the Philippines most low income people are involved

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12. For a detail discussion of neo-classical trade model see Husted, Steven and Michael Melvin. International Economics, Second Edition, Harper Collins College Publishers, 1993.

in agricultural production. Thus, as agricultural sector develops, return to the endowment factors involved in this sector, including agricultural labor increases which in turn provides an improvement in their welfare.

It is also expected that a positive relationship between economic growth and factor mobility would be found. The logic of this argument is simple. As the endowment factors become more mobile, their allocations among sectors become more efficient which leads to a higher production level. So, in each scenario, the association of perfectly mobile factors (case B) with a better economic performance is expected.

## IV. Interpretation and Analysis of the Simulation Results

This section analyzes the effects of different scenarios of trade policy in connection with the degree of factor mobility. The numerical results of the simulations are presented in Tables 3.2 to 3.8. The entries of these tables are in terms of percent changes from the initial equilibrium values. The latter are based on the 1992 data. The following five sections describe, summarize and compare the results of the simulations on the various aspects of the Philippines economy.

### 1. Simulation Results for Macroeconomic Aggregates

The results of the simulations at a macro level (See Table 3.2) supports the neoclassical theory of trade that the imposition of trade restrictions distort production pattern towards less competitive sectors which leads to inefficient distribution of endowment factors and lower rate of growth.

As the simulation results indicate, the economic growth rate (measured in

terms of changes in the value of GDP) increases dramatically by moving from high levels of trade restriction toward free trade (from -3.75 percent growth rate associated with scenario #1 to 13.94 percent in scenario #3). With the exception of terms of trade and price level, the overall economic performance improves as trade barriers are removed. The value and quantity of exports and imports increase, the investment level increases too (although slightly). While total income growth has the highest rate in the free trade scenario, it has the lowest growth rate in the partial

Table 3.2

Simulation Results for Macroeconomic Aggregates
(Percent Change )

| Variables | Scenario # 1 (Trade Restriction) | | Scenario # 2 (Partial Liberalization) | | Scenario # 3 (Free Trade) | |
|---|---|---|---|---|---|---|
| | A[1] | B | A | B | A | B |
| Value of GDP | -3.75 | -3.47 | -3.61 | 3.25 | 7.59 | 13.94 |
| V. of Imports | 2.20 | 2.94 | 2.72 | 2.70 | 18.05 | 21.07 |
| V. of Exports | -35.64 | -34.49 | -34.84 | -26.66 | 32.04 | 44.39 |
| Q. of Imports | -24.81 | -23.09 | -20.64 | -20.24 | 16.58 | 19.46 |
| Q. of Exports | -39.63 | -38.32 | -32.62 | -31.45 | 40.98 | 56.91 |
| Terms of trade | 9.69 | 10.15 | 6.21 | 6.90 | -4.69 | -4.30 |
| Investment | -.1 | -.02 | -.01 | -.01 | 0.0 | 0.1 |
| Income level | -3.38 | -2.94 | -3.67 | - 2.26 | 5.28 | 5.92 |
| GDP Price Index | -1.73 | -3.94 | -1.56 | -3.24 | 7.42 | 8.71 |

1. Case A in each scenario represents endowment factor immobility, and case B factor mobility.

liberalization case (scenario #2). The reason is that the partial liberalization scenario is based on the 1985 tariff rates which were biased against agricultural sectors and worsened the economic condition in some respects.

Terms of trade is the best in the trade restriction scenario and the worst in free trade liberalization case. The reason is that with free trade, the mineral and agricultural exports increase and those of industry decrease (which is what the Hecksher-Ohlin model predicts if the Philippines comparative advantage is in these sectors). Because mineral and agricultural products produced in the Philippines usually have lower prices relative to industry in the world market, this change in the trade structure causes a decrease in the terms of trade in the final case (Table 3.2).

The results also support the idea that there is a positive correlation between endowment factor mobility and the outcome of trade policies. As the Table 3.2 shows, in each scenario, the outcome of the cases with mobility of production factors are superior over the ones with factor immobility. So, the proposed hypothesis that resource endowment mobility is important in the outcome of trade policies, is validated by this study.

2. The Impact On Sectoral Output

Changes in the structure of production as the result of trade policies in connection with factor mobility are reported in Table 3.3. The results indicate that all sectors (except the two sectors of manufacturing and services) have the highest growth rates in free trade scenario. Among the sectors, resource-based industries have the highest growth rate followed by agricultural sectors. This implies that free

trade allows the endowment factors move toward the most competitive sectors which are resource-based industries (including agriculture) in the Philippines. Among the agricultural sectors, "other crops" has the highest growth rate. The reason is that with free trade, the composition of agricultural output will shift toward the export sectors which in the case of the Philippines are sugar and coconuts (included in the "other crop" sector).

Table 3.3

Changes in the Structure of Sectoral Production
(Percent Change)

| Sectors | Scenario #1 (Trade Restriction) | | Scenario #2 (Partial Liberalization) | | Scenario #3 (Free Trade) | |
|---|---|---|---|---|---|---|
| | A | B | A | B | A | B |
| Rice | -2.56 | -2.08 | -3.11 | -3.02 | 4.08 | 5.08 |
| Other Crops | -4.81 | -4.73 | -4.97 | -4.46 | 6.55 | 9.21 |
| Livestock | -4.94 | -3.96 | -3.88 | -3.43 | 3.54 | 6.69 |
| Fishing | -.35 | -.33 | -.39 | -.36 | 2.05 | 2.81 |
| Forestry | -1.93 | -1.15 | -.51 | -.44 | 3.02 | 4.90 |
| Oth Res-Based Ind | -6.71 | -6.19 | -7.82 | -7.84 | 19.88 | 45.77 |
| Food Processing | -2.62 | -2.19 | -2.88 | -2.59 | 6.25 | 7.47 |
| Light Mfg | 6.43 | 7.84 | 4.97 | 6.32 | -9.42 | -9.84 |
| Heavy Mfg | 11.16 | 15.34 | 12.59 | 13.41 | -12.74 | -15.34 |
| Services | .06 | .40 | .25 | .63 | -2.09 | -4.11 |

**The services sector actually shrinks as the free trade is implemented. The reason is that by implementing free trade, government's revenue from tariffs declines. Consequently, government services which is the major component of this sector, are partly cut or decreased which causes a negative growth rate in the free trade version.**

**Comparing the first two scenarios (trade restriction vs. partial trade liberalization), the results indicate a lower growth rate for the agricultural sectors (including the food processing sector) associated with partial trade liberalization. The reason is that the Philippine's tariff program implemented in 1981 was biased against agricultural sectors. While average tariff rates have dropped from 56.4% to 32.2% for agricultural sectors, those for manufacturing have dropped from 42.4% to 28% which implies sharper cuts in agricultural products tariff rates than manufactured goods which harmed the agricultural sector and lowered its output.**

**3. Changes in the Structure of Trade**

**Tables 3.4 and 3.5 provide a comparison of the changes in the Philippines structure of trade as the result of changes in trade policy and factor mobility variations. A review of the Table 3.4 reveals that with the exception of the exports of the two sectors of manufacturing and services, the trade flow from the Philippines increases dramatically with free trade.**

**In the two cases of trade restrictions and partial liberalization, the aggregate sectoral exports have all negative growth rates except for the exports of the manufacturing sectors. The reason is that the results (as it was explained before) are**

based on percentage changes from the initial equilibrium which is according to the 1992 data and the economy is much less restricted than the year 1980. So, when the

Table 3.4

Changes in The Philippines Aggregate Exports
(Percent Change)

| Commodities | Scenario # 1 (Trade Restriction) | | Scenario # 2 (Partial Liberalization) | | Scenario # 3 (Free Trade) | |
|---|---|---|---|---|---|---|
| | A[1] | B | A | B | A | B |
| Rice | -17.11 | -6.00 | -11.22 | -6.39 | 3.92 | 5.89 |
| Other Crops | -19.57 | -20.37 | -12.56 | -13.32 | 8.68 | 14.79 |
| Livestock | -23.56 | -12.32 | -15.86 | -6.40 | 2.52 | 2.92 |
| Fishing | -6.07 | -5.29 | -5.04 | -4.52 | 2.11 | 2.73 |
| Forestry | -16.87 | -11.57 | -8.78 | -8.34 | 2.04 | 4.26 |
| Oth Res-Based Ind | -33.06 | -32.04 | -31.38 | -30.45 | 105.76 | 213.73 |
| Food Processing | -25.38 | -8.37 | -17.31 | -5.25 | 16.79 | 23.06 |
| Light Mfg | 7.15 | 8.63 | 5.07 | 6.47 | -10.10 | -9.44 |
| Heavy Mfg | 6.92 | 7.99 | 4.64 | 6.67 | -9.01 | -6.86 |
| Services | -1.33 | -.81 | -1.21 | -.40 | -3.93 | - 3.81 |

1. Case A in each scenario represents endowment factor immobility, and case B, factor mobility.

1980 and 1985 tariff rates are plugged into the base year's data, trade protection allows the manufacturing sectors to increase their production and exports.

The growth of the Philippines' sectoral exports in the free trade scenario is as expected. Resource-based sectors (including agriculture) in which the Philippines

has a comparative advantage, have the highest growth rates. This pattern is almost reversed in the next table (Table 3.5), where the trade flow to the Philippines shows that free trade results in the highest growth rate of importation of the manufacturing products. The logic, as discussed earlier, is in the lack of competitiveness of the Philippines' industrial products. The industrial sector has long been protected from international competition by output subsidies, import tariff systems, and export

Table 3.5

Changes in the Philippines Aggregate Imports
(Percent Change)

| Sectors | Scenario #1 (Trade Restriction) | | Scenario #2 (Partial Liberalization) | | Scenario #3 (Free Trade) | |
|---|---|---|---|---|---|---|
| | A | B | A | B | A | B |
| Rice | 2.03 | 4.15 | 3.76 | 4.02 | 1.85 | 1.02 |
| Other Crops | 5.88 | 7.48 | 6.39 | 8.91 | 2.76 | 1.89 |
| Livestock | 2.62 | 4.52 | 2.37 | 5.01 | 7.02 | 5.87 |
| Fishing | -8.74 | -7.97 | -5.14 | -4.47 | 4.13 | 3.90 |
| Forestry | -6.75 | -16.73 | -14.42 | -15.03 | 3.87 | 3.90 |
| Oth Res-Based Ind | -19.07 | -10.92 | -17.98 | -12.24 | 7.18 | 2.22 |
| Food Processing | -16.21 | - 6.00 | -19.74 | -13.26 | 2.52 | 5.25 |
| Light Mfg | -26.75 | -22.05 | -39.74 | -43.26 | 47.78 | 51.78 |
| Heavy Mfg | -19.93 | -25.89 | -19.98 | -20.49 | 33.72 | 40.43 |
| Services | -15.74 | -12.42 | -9.86 | -6.85 | 5.36 | 9.67 |

subsidies. With the removal of these protections, this sector's ability to compete in the world market declines, causing a decrease in its exports, and an increase in its imports. The latter is partly due to the fact that with free trade, the manufacturing sector shrinks (the output growth rates are -9.84 and -15.34 for light and heavy manufacturing respectively) and the imports increase to satisfy the domestic demands for industrial output. The imports of all sectors increases with free trade. It is partly because of the increase in total income that results in higher demand for imports. In this scenario when the endowment factors are mobile, they will be used in their best possible places, therefore, in general, there will be less need for the importation of commodities that country has comparative advantage in. For example, the imports of rice, other crops, and other resource-based industries decrease from 1.85 percent, 2.76 percent, and 7.18 percent to 1.02, 1.89, and 2.22 percent respectively when factors are allowed to moved across sectors (see Table 3.5). Factor mobility will cause a shift away from uncompetitive sectors which result in an increase in their imports. An example of this case is the manufacturing sectors.

The negative growth rates of manufacturing sectors imports in the first two scenarios are the result of high industrial protection in these two cases that discourages their imports.

4. The Effects on Factor Endowments

The effects of trade policies on the demand (supply) for and price of composite factors of production (land, labor, and capital) are demonstrated in Tables 3.6 and 3.7. Based on the neo-classical trade model, when there are distortions in the

foreign trade (such as high industrial protection), the endowment factors are encouraged to move away from competitive sectors towards the uncompetitive sectors. And this is proven to be true here. In the simulation results, the first two scenarios (Scenarios #1 and #2), show a decrease in the demand for the composite factor of production in agricultural sectors and an increase in demand by manufacturing sectors. With free trade (Scenario #3), the movement of production

Table 3.6

The Effects of Trade Policies on the Demand for Composite Endowment Factors (Percent Change)

| Sectors | Simulation #1 (Trade Restriction) | | Simulation #2 (Partial Liberalization) | | Simulation #3 (Free Trade) | |
|---|---|---|---|---|---|---|
| | A | B | A | B | A | B |
| Rice | -2.56 | -2.08 | -3.11 | -3.02 | 4.08 | 5.08 |
| Other Crops | -4.81 | -4.73 | -4.97 | -4.46 | 6.55 | 9.21 |
| Livestock | -4.94 | -3.96 | -3.88 | -3.43 | 3.45 | 6.69 |
| Fishing | -.35 | -.33 | -.39 | -.36 | 2.05 | 2.81 |
| Forestry | -1.93 | -1.15 | -.51 | -.44 | 3.02 | 4.90 |
| Oth Res-Based Ind | -6.71 | -6.19 | -7.82 | -7.84 | 19.88 | 45.77 |
| Food Processing | -2.62 | -2.19 | -2.88 | -2.59 | 6.25 | 7.47 |
| Light Mfg | 6.43 | 7.84 | 4.97 | 6.32 | -9.42 | -9.84 |
| Heavy Mfg | 11.16 | 15.34 | 12.59 | 13.41 | -12.74 | -15.34 |
| Services | .06 | .40 | .25 | .63 | -2.09 | -4.11 |

factors is reversed and with factor mobility (Case B) it is accelerated. Again the resource-based industries are the winners in absorbing the most endowment factors in the free trade scenario with a growth rate of 45.77 percent.

Changes in the composite prices of endowment factors as shown in Table 3.7, match the demand (supply) of these commodities (Table 3.6). For example, in free trade, the competition among the productive factors bids up the prices of the

Table 3.7

Changes in the Composite Price of Land, Labor and Capital
(Percent Change)

| Sectors | Scenario #1 (Trade Restriction) | | Scenario #2 (Partial Liberalization) | | Scenario #3 (Free Trade) | |
|---|---|---|---|---|---|---|
| | A | B | A | B | A | B |
| Rice | -1.07 | -2.48 | -.46 | -1.02 | 10.57 | 13.21 |
| Other Crops | -4.35 | -2.48 | -2.47 | -1.02 | 12.93 | 13.21 |
| Livestock | -1.64 | -2.48 | -.90 | -1.02 | 10.06 | 13.21 |
| Fishing | -1.61 | -5.10 | -1.05 | -4.39 | 8.88 | 14.83 |
| Forestry | -3.15 | -5.34 | .93 | -4.57 | 4.56 | 5.31 |
| Oth Res-Based Ind | -15.55 | -5.26 | -13.0 | -4.51 | 19.93 | 25.13 |
| Food Processing | -2.09 | -5.18 | 1.21 | -4.44 | 8.95 | 24.97 |
| Light Mfg | 9.07 | 14.99 | -17.18 | -4.30 | 9.76 | 2.58 |
| Heavy Mfg | 31.58 | 15.11 | -24.94 | -4.39 | 6.02 | 2.83 |
| Services | 2.59 | 5.04 | 1.96 | 4.34 | 3.31 | .69 |

composite price of those factors for most competitive sectors of the economy (i.e, resource-based industries and agricultural sectors).

5. The Impact on Government and Private Household

The effects of various experiments on the government and private household sector are portrayed in the Table 3.8. These results again support the importance of factor mobility in the outcome of trade policies. As the results of simulations indicate the government and private household are better off in the cases with factor

Table 3.8

Simulation Results for The Government and Private Household
(Percent Change)

| Variables | Scenario # 1 (Trade Restriction) | | Scenario # 2 (Partial Liberalization) | | Scenario # 3 (Free Trade) | |
|---|---|---|---|---|---|---|
| | A | B | A | B | A | B |
| Demand for Saving | 2.89 | 3.33 | 2.98 | 3.23 | 4.29 | 5.92 |
| Private Hhld Exp[1] | -3.38 | -2.94 | -3.67 | -2.26 | 5.28 | 5.92 |
| PCU from Pr. Exp[2] | -1.46 | -.95 | -.75 | -.42 | -.16 | .13 |
| PCU from Gov Exp | 2.93 | 2.94 | 2.27 | 2.86 | 3.78 | 4.66 |
| PCU from AHExp[3] | -.73 | -.62 | -.69 | -.28 | .54 | 1.26 |
| W Measurement[4] (in million of US $) | -114.22 | -97.01 | -107.96 | -43.81 | 84.49 | 197.15 |

1.Private Household Expenditure; 2. Per Capita Utility from Private Household Expenditure; 3.Per Capita Utility from Aggregate Household Expenditure; 4. Welfare is measured through Equivalent Variation which refers to the Cobb-Douglas, super-utility function.

mobility than the cases with factor immobility. For example, partial liberalization of trade results in a decrease in the private household expenditure by -3.38% (from the initial equilibrium) in the case of factor immobility and by -2.94% in the case of factor mobility. This is also true in any other scenario (Table 3.8).

A glance at the Table 3.8 also reveals the fact that complete liberalization of trade will produce better results. Welfare measurement[13] has the highest value in free trade. This is also true for other utility measurements and saving values. Partial liberalization of trade (scenario #2), however, seems to result in an inferior situation. The reason is, as it was explained earlier, the partial liberalization scenario is based on 1985 tariff system. Even though tariff rates were much lower than those of 1980's, because the tariff system was biased against agricultural sector the outcome is contradictory (the welfare measure is lower in Scenario #2 compared to Scenario #1).

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13. Welfare is measured through EV(r) = U(r) * INC(r)/100 in which EV(r) is the Hicksian equivalent variation for region r in $ US million, U(r) is the per capita utility from aggregate household expenditures in region r, INC(r) is the initial equilibrium value of total income in region r.

# CHAPTER FOUR

# Summary And Policy Conclusions

## I. INTRODUCTION

This study has used a CGE model to investigate the effects of factor endowment mobility on the outcome of trade policies in the Philippines. The basic model and data base were provided by the global trade analysis project (GTAP) which was modified in this study to include factor mobility and immobility in different experiments. Alternative versions of trade policies were used in conjunction with various degrees of factor mobility. A total of six experiments were conducted: Three trade strategies, each with two extreme degrees of factor mobility. The three trade policies were: The implementation of the 1980 tariff system which was the last year of pre-liberalization period in the Philippines. The tariff system was accorded with an import substitution strategy which was started prior to 1980. In 1981, following an agreement with the IMF, a five year plan (from 1981 to 1985) to lower the trade barriers was initiated. So, the year 1985 tariff system was chosen for the second scenario to present as the partial liberalization trade policy. The final scenario demonstrated the free trade policy, in which all the import tariffs, export subsidies, and output subsidies were assumed to be removed. For each of the three scenarios two cases were considered: A) Complete factor immobility, and B) perfect mobility of production factors across sectors. The objective was to analyze the effects of factor mobility on the outcome of trade policies in the Philippines .

It was expected that the Case B of the third scenario would produce the best results in terms of the highest economic growth rate (measured in terms of changes in GDP) and welfare (measured as equivalent variation). The logic is that as the

degree of mobility of production factors increases, their allocation among sectors would be more efficient, causing a better economic performance. In addition, the neo-classical trade model, predicts the association of free trade with the most efficient use of endowment factors. The results of this study were consistent with what was expected from economic theory.

The results of the simulations indicate that factor mobility does matter in the outcome of trade policy. For a given trade policy, a higher degree of factor mobility results in a higher economic growth rate and an improvement in overall economic welfare. In other words, the same trade policy with fixed endowment factors among production sectors resulted in lower level of income, economic growth rate and welfare. For example, the GDP growth rate was 7.59 percent under a free trade policy with fixed allocations of production factors. The GDP growth rate increased to 13.94 percent when the factors were free to move across sectors.

The conclusion is that factor mobility results in a more efficient use of endowments in the economy. The results also give support to the neo-classical trade theory. Lowering trade barriers shifts the pattern of production toward the most competitive sectors, which in the case of Philippines are natural resource-based sectors (including agricultural sectors). The results also support the theory that lowering trade barriers leads to a more efficient distribution of endowment factors among sectors of production, which in turn results in a higher level of real output. The simulation results from this study shows that while the output growth was -3.75 percent under trade restriction policy (first scenario), its growth rate was 13.94

**percent in free trade regime. The results also indicated that even though free trade resulted in a better performance of the economy, partial liberalization with tariff system biased against agricultural sectors, was the worst case with the GDP growth rates of -3.61 and -3.25 percent under cases A and B respectively.**

**In the following sections of this chapter some policy implications will be discussed first, and then a few extensions to the model will be proposed.**

**II. Policy Implications**

**What recommendations can be drawn from the results of this study for the Philippine economy? There are two sets of policy implications: One is related to the procedure of trade liberalization policies. The results of the study shows that even though removal of trade barriers (specifically tariff) leads to economic growth and improvement of welfare, partial trade liberalization policy, under some circumstances, may harm more than it can benefit. In the case of the Philippines, when tariff cuts were biased against agricultural sector, the overall results were negative despite some of its positive effects. For example, with trade restriction (Scenario #1) the economic welfare measure decreased to US $-97.01 million in case B while partial trade liberalization (Scenario #2) caused welfare measure (in terms of equivalent variation) to decrease to US $-43.81 million (case B) and to US $-107.96 million (case A).**

**This is in accord with the result of the study by Clarete (1989) which showed that the distortions in the Philippines economy are actually worsened by liberalizing the agricultural sector faster than the industrial sector. So in the process of**

liberalization of the foreign trade, the government should try to narrow the differences in tariff cuts across sectors while moving toward complete trade liberalization strategy.

The second set of policy recommendations is related to the mobility of endowment factors. As the study shows, a high level of factor mobility results in a better performance of the economy as discussed earlier. There are several studies about the positive effects of capital mobility on economic development. Shaw (1973), McKinnon (1991) and Fry (1988) emphasized the importance of the financial intermediation in economic growth through increasing the efficiency of investment in less developed countries. Government should try to increase the availability of agricultural credit with such terms that are affordable by small farmers. Rains et al. (1990) recommend in order to have higher economic growth rates, one policy that the government should adopted is to encourage "the creation of credit institutions to finance small-scale activities, agricultural and nonagricultural, in the smaller towns and rural areas" (P. 79).

Development in agricultural extension services helps farmers to learn about new technologies, and may lead to a more efficient use of their lands in response to changes in relative rates of return. Finally, government's investment in the expansion of infrastructure is viable in mobilizing factors of production (labor and capital). Another policy implicated by the results of the study is about the importance of investment in the sectors with comparative advantages. The Philippine is rich in natural resources. Fertile land, plentiful forest reserves, large aquatic resource base

and vast mineral deposits (such as copper, chromium and gold) cover the country. With the potential high growth rate of these sectors, the government should encourage the investors to use the opportunity of investing in the resource based industries to increase the overall economic growth rate.

## III. Extensions to the Model

In this study, the static effects of endowment factor mobility within a single country (the Philippines) on the outcome of trade policies were considered. It is interesting to investigate the dynamic effects of factor mobility on the trade policy. It is also interesting to study those effects in the context of regional economy which yields additional insights of the outcome of regional integrations (such as NAFTA) on the variables such as wage determination and rental rate of capital and land. The basic structure of GTAP model allows the computation of multi-region general equilibrium.

Other types of policy that can be studied in the context of GTAP model is the effects of sanctioning (or embargoing) a country (for example) by a coalition of some countries on the economy of various countries engaging in that action.

The problem associated with using the GTAP model is that it is a restrictive model in the sense that a user can mostly change only the model parameters rather than basic behavioral specifications. A more flexible GTAP system that permits the modeler to include his/her preferences in determining fundamental behavioral equations is desirable.

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# VITA

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