財團法人中華經濟研究院

CHUNG-HUA INSTITUTION FOR ECONOMIC RESEARCH
75 Chang-Hsing St., Taipei, Taiwan, 106
Republic of China
TEL : 886-2-735-6006
FAX : 886-2-735-6035

CHUNG-HUA INSTITUTION FOR ECONOMIC RESEARCH

EFFECTS OF TRADE LIBERALIZATION ON TAIWAN — A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

JI CHOU
YUN-PENG CHU
SHIU-TUNG WANG

DISCUSSION PAPER SERIES No.9406
October 1994

Discussion papers are intended to provide prompt distribution of CIER's preliminary research work to interested scholars and to invite their discussions and critical comments.

The opinions expressed in these papers are those of the authors and do not necessarily reflect the views of the CIER.

Any comment or communication, please write to: Publications Department, Chung-Hua Institution for Economic Research, 75 Chang-Hsing Street, Taipei, Taiwan 106, ROC.

財團法人 中華經濟研究院

CHUNG-HUA INSTITUTION FOR ECONOMIC RESEARCH
75 Chang-Hsing St., Taipei, Taiwan, 106
Republic of China
TEL : 886-2-735-6006
FAX : 886-2-735-6035

CHUNG-HUA INSTITUTION FOR ECONOMIC RESEARCH

EFFECTS OF TRADE LIBERALIZATION ON TAIWAN — A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

JI CHOU
YUN-PENG CHU
SHIU-TUNG WANG

DISCUSSION PAPER SERIES No.9406
October 1994

Discussion papers are intended to provide prompt distribution of CIER's preliminary research work to interested scholars and to invite their discussions and critical comments.

The opinions expressed in these papers are those of the authors and do not necessarily reflect the views of the CIER.

Any comment or communication, please write to: Publications Department, Chung-Hua Institution for Economic Research, 75 Chang-Hsing Street, Taipei, Taiwan 106, ROC.

Discussion Paper Series No. 9406

Effects of Trade Liberalization on Taiwan — A Computable General Equilibrium Analysis

by
Ji Chou
Yun-Peng Chu & Shiu-Tung Wang

October 1994

Chung-Hua Institution for Economic Research

75 Chang-Hsing St., Taipei, Taiwan 106

Republic of China

JI CHOU*, YUN-PENG CHU** AND SHIU-TUNG WANG***

Effects of Trade Liberalization on Taiwan —— A Computable General Equilibrium Analysis

Abstract

Joining the GATT by the end of 1994 has been established as one of the most important economic and political targets of the Taiwan government. However, the impact of this act is quite complicated. The openness of Taiwan's domestic market can cause a serious change in the production structure and income distribution, especially in the relative status between the agricultural and nonagricultural sectors, protected and unprotected sectors, and also between producers and consumers. The possible high cost of this move on society has raised doubt on the necessity of the government participating the organization. In order to clear up the controversy surrounding this issue, in this paper, we use a CGE model to analyze the possible effects of this policy change. Following proposals from the Final Draft of the Uruguay Round, we use tariff and nontariff barriers, aggregate measurement of support (AMS), indirect tax and export quota in our model as policy tools. Due to the difficulty of quantifying

*Research Fellow and Director of Center for Economic Forecasting, Chung-Hua Institution for Economic Research.

**Research Fellow, Sun Yat-Sen Institute For Social Sciences and Philosophy, Academia Sinica.

***Associate Professor, Department of Shipping & Transportation Management, National Taiwan Ocean University.

liberalization in the service sector, we neglect that part. Our analysis includes the impacts on resource allocation, production structure, income distribution and consumers' welfare.

I. Introduction

Taiwan is naturally a resource-scarce country whose economic activities heavily rely on international trade. In 1993, the total value of its trade was over 80% of GDP and its trade volume ranked as the fourteenth largest trade country in the world. Therefore, trade is always an important issue in Taiwan. Trade policies have changed from the import substitution strategy to the export promotion strategy since the late 1950s. The expansion of exports increased national output and national income. More importantly, it raised economic efficiency through the trade liberalization. However, there is always room to further trade liberalization. Especially in the 1980s, the huge trade surplus caused trade friction with major trade partners. Also the rise of protectionism and regional integration seem to have against the free trade principle and seems to have hurt the trade activities of small open economies such as Taiwan.

Fortunately, the Uruguay Round of the GATT reached general agreement on December 15, 1993. There are some disputes among member countries, however the success of the Uruguay Round reestablishes the integrity and credibility of the multilateral trading system and the GATT mechanisms for dealing with trade disagreements. Although Taiwan has grown rapidly over the years without being a GATT member, global institutional arrangements continue to be seen as a key to strong global economic performance. Joining GATT and dealing with trade partners through the multilateral negotiation would be beneficial to Taiwan.

Joining GATT means a further step in trade liberalization in Taiwan. Although it will raise economic efficiency and increase benefits by increasing global trade and income, it also implies a change in the domestic industrial structure and income distribution. What the outcome will be depends on the trade policy instruments and economic environment. Moreover, the trade impacts often affect more than one industry and have strong interindustrial effects. Therefore, numerical general equilibrium trade policy analysis is needed.

There are many studies concerning the assessment of trade liberalization.[1] Recently, Francois, McDonald, and Nordstrom (1993), OECD (1993), Goldin, Knudsen and van der Mensbrugghe (1993), and Nguyen, Perroni and Wigle (1991 and 1993), used multicountry CGE models, which usually cover different countries and different sectors, to analyze the global effects of the Round. These approaches have the advantage of analyzing the effects of the multilateral trade liberalization emerging from the Uruguay Round. de Melo and Tarr (1992) used a single-country CGE model to analyze the effects of the removal of protection in the United States and argued that the multicountry model may overestimate the terms of trade effects induced by a unilateral reduction in protection. Furthermore, each country may have its own features, so the property of uniform treatment of protection for the grouped countries in a multicountry model is in question.

In this paper, we attempt to set up a single-country CGE model for Taiwan to analyze the outcome of joining GATT under different exchange rate regimes, the mobility of production factors among sectors, and unilateral vs. multilateral negotiation trade liberalization. In addition to the reduction of tariff and nontariff rates, as well as the relaxation of domestic support in agriculture, we also investigate the outcome of reduction of the indirect tax. It has been argued that there is discrimination against domestic producers when the import price falls due to the cutting of import duties without reduction of the indirect tax rate.

The paper is organized as follows. The following section discusses the evolution of trade liberalization in Taiwan. Section three introduces the model framework, data source, and the specific equations which are employed in this study. Section four discusses the design of the simulation and analyzes the simulation results. The conclusion is in Section five.

II. Trade Liberalization in Taiwan

Taiwan is a naturally resource-scarce economy. Trade has always been an

[1] Previous literature surveys could be referred to in Shoven and Whalley (1984), Srinivasan and Whalley (1984), and de Melo (1988).

important issue in Taiwan. In the early 1950s, high tariff rates, import controls and a complicated multiple exchange rate system were instituted to save foreign exchange and to protect industries which the government wanted to develop. The import-substitution policy did have the effect of promoting domestic production, but the misallocation of resources caused the home market to become saturated. The export promotion strategy was adopted in 1958 to remove quantity restrictions, to unify the exchange rate and devalue the NT dollar. Following this strategy, Taiwan has experienced a high economic growth rate for the past thirty years since the increase in exports not only raised the earnings of the export sector, but also stimulated production in other sectors. Therefore, it accelerated the growth of the whole economy and eased off the shortage of foreign exchange.

As foreign exchange was no longer the binding constraint on economic growth, the government drastically cut the number of controlled and prohibited imports in 1974. However, a licensing procedure was employed for the purpose of protecting national security and maintaining health and safety standards (Tu and Wang, 1988). More extensive import liberalization and deeper tariff cuts were undertaken in the 1980s due to the growing trade surplus, especially bilaterally with the United States. As shown in Table 1, import duties rate (which includes tariff, surcharges, temporary tax, and commodity tax) was reduced from 13.51% to 9.31% and the average tariff rate was reduced from 10.06% to 6.96% between 1976 and 1986. These rates were further cut to 6.74% and 4.87%, respectively, in 1992.

In the export promotion strategy, although the government has liberalized activities related to exporting, it has been reluctant to liberalize import-oriented markets, the nontraded goods and services sectors. However, the recent shifts by advanced industrial countries such as the United States toward the use of more aggressive bilateral actions to open foreign markets and protect domestic ones and toward the greater utilization of regional trading agreements (in contrast to multilateral arrangements) to achieve trade-policy goals imply that developing countries are now facing a significantly different international trading environment (Baldwin, 1993). Under such circumstances, Taiwan should do its part to try to join the multilateral trading system and to reduce its own trade barriers. Although Taiwanhas grown rapidly over the years without being a GATT Contracting Party, global institutional arrangements continue to be seen as key both to strong global economic performance and to the

interests of smaller countries such as Taiwan. Therefore, using GATT to deal with the large developed countries would be beneficial to Taiwan, and accession to the GATT has been established as one of the most important economic policies of Taiwan.

Table 1 Overall Tariff Rate in Taiwan

year	Average tariff rate	Import duty rate
1955	32.23	-
1960	14.99	-
1965	15.59	-
1971	12.25	19.47
1976	10.06	13.51
1981	7.42	10.49
1986	6.96	9.31
1989	6.45	8.06
1992	4.87	6.74

Note: Average tariff rate is the ratio of custom duty (in which surcharge and temporary tax is not included) to customed imports, data is from *Taiwan Statistical Data Book.*

Import duty rate is the ratio of import duty (which include surcharge, temporary tax and commodity tax) to total imports, data is from *1989 Input-Output Table, Taiwan Area, ROC.*

Taiwan is prepared to do its part to bring its tariff and nontariff trade policies into conformity with GATT principle, particularly the Uruguay Round Agreement. The Uruguay Round was the most ambitious round of GATT negotiations ever undertaken. In addition to a major trade liberalization package involving reduction in tariff and nontariff barriers, other initiatives include a multilateral framework of principles, rules and disciplines on trade in services and on trade-related aspects of intellectual

property rights; further provisions concerning trade-related investment measures; proposals to integrate agriculture, textiles and clothing more fully into GATT; measures to subject many potentially trade restrictive regulations to refined multilateral disciplines; and a review of the function of the GATT, including the creation of a World Trade Organization (WTO). An assessment of the efficiency gains from the round is that the market access provisions alone will contribute an estimated $230 billion annually to global GDP and will boost world merchandise trade by about 12 percent above where it would otherwise be by the year 2005 (Francois, et al., 1993).[2]

Between 1986 and 1992, the tariff schedule has been revised eight times in Taiwan. Tariff reductions were granted on 13,271 items. Among them 673 items were classified as duty-free (Liu and Liu, 1993). The average tariff rate was reduced from 7.13% in 1986 to 4.64% in 1992. As shown in Table 2, most import duties have been lower than 10% except food and motor vehicles since 1989. Under the Uruguay Round, 38% cut of the present tariff rate would be applied to industrial products and 36% to agricultural products in the next ten years. In the case of agriculture, many countries have used agricultural protection policies that would violate the free trade spirit. Nevertheless, the degree of protection measured by producer subsidy equivalent (PSE) for Taiwan was only 26.76 and 29.43 in 1986 and 1988, respectively (Tu, 1993). Recently, GATT members agreed on a calculation for a total Aggregate Measurement of Support (AMS), which is merely a summary measure of the subsidies received by agricultural producers. The AMS is going to be cut by 20% in developed countries and by 13.3% in developing countries. The nontariff border measures in agriculture should be tariffied, and subsequently cut tariffs by an average of 36% over six years for developed countries and 24% over ten years for developing countries. Furthermore, a relaxation of rice import restrictions has been applied to Japan beginning with 4% and ending with 8% over six years, and to South Korea beginning with 1% and ending with 4% over ten years. A relaxation of rice import restrictions somewhere between the levels of Japan and south Korea will be applied to Taiwan.

[2]This estimate is considered a lower bound since it excludes the important effects of scale economies, liberalization in the services sectors, and the benefits of a strengthened set of trade rules.

Trade in textiles and clothing is currently governed by the Multi-Fibre Arrangement (MFA), which is a system of restrictions and detailed bilateral import quotas. Under the Uruguay Round, trade in textiles and clothing will be gradually integrated under GATT disciplines. This will involve a movement toward nondiscriminatory tariff barriers. Taiwan is a textile-exporting country and exports to developed countries have been restricted by quotas. Since labor costs have rise, labor-intensive products of textile are no longer exported directly from Taiwan, and some of the quota is left

Table 2 Import Duty Rate by Sector

Sector	1976	1981	1986	1989	1992
1.agriculture	9 .73	5.23	6.38	4.67	4.08
2.food processings	23.38	22.03	17.18	13.74	12.00
3.mining	6.53	1.23	2.46	3.09	2.71
4.textile & garments	23.92	9.11	3.61	4.87	4.26
5.electrical & electronic products	5.77	10.82	4.79	7.47	6.53
6.electrical machinery	7.78	9.92	9.46	6.99	6.11
7.chemical product	13.80	11.97	13.22	4.62	4.04
8.steel	15.42	7.76	9.43	8.29	7.24
9.machinery	15.64	12.80	12.65	5.92	5.17
10.motor vehicles	55.27	58.27	52.25	60.74	53.08
11.low trade manufacture	16.83	9.37	8.66	5.53	4.85
12.other manufacture	14.09	11.08	9.00	3.50	3.06
13.traded service	2.03	0.16	0.14	0.00	0.00
14.nontraded service	0.00	0.00	0.00	0.00	0.00
Total	13.51	10.49	9.31	8.06	6.74

Sources:

DGBAS, *Input Output Table, Taiwan Area, ROC,* various series Department of Statistics, Ministry of Finance, *Yearbook of Tax Statistics, Monthly Statistics of Exports and Imports.*

Notes:

1. Mining is excluded from the total rate is due to the extracrdinary oil import in 1981 which will underestimate the in purt duty rate.
2. Motor vehicles' import duty rate in 1989-1992 are ligher than the rate in 1986. This might be caused by the classification of tariff for small vehicle in different periods.
3. The definition of import duty rate is shown at the footnote of previous table.

for Taiwan's DFI in neighboring countries. However, some technology intensive or capital-intensive textile products are still restricted by the quota. Therefore, the effects of the removal of MFA on Taiwan are mixed.

For nontariff barriers, Taiwan has lowered numerous barriers in recent years, including the lifting of bans on the import of some agricultural products, relaxing import procedure for steel products, eliminating local content requirements for VCRs and color TVs, and protecting intellectual property rights and the environment. However, the barriers still exist in some products, particularly motor vehicles which still have high tariff rates and restrictions in the areas of imports. Further removal of trade barriers on these products can be expected when Taiwan becomes a member of GATT.

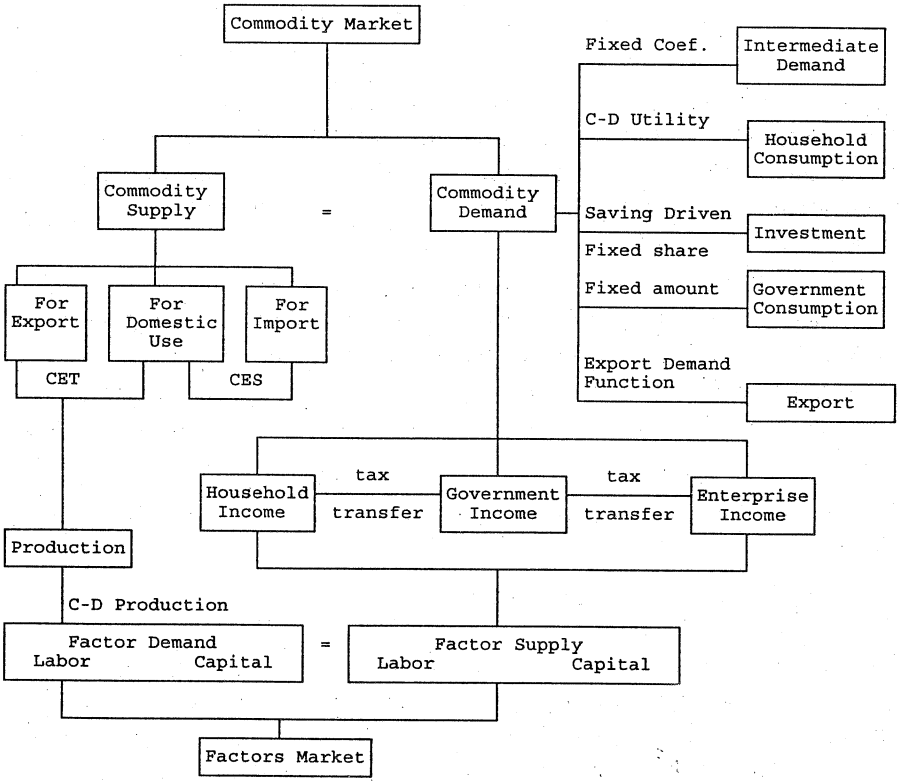
On the whole, if Taiwan accedes to GATT successfully, this further step of trade liberalization in Taiwan will raise economic efficiency and Taiwan will benefit from the increase of global income and trade. However, the openness of the domestic market may also cause a serious change in the production structure and income distribution in the relative status between the protected and unprotected sectors, and between producers and consumers. Therefore, a numerical assessment of the effects of acceding to GATT is needed.

III. The Model

In order to assess the impact of joining GATT, a single country CGE model for Taiwan is built. The framework of the model basically follows Devarajan, Lewis and Robinson (1991) in which the Armington assumption is applied to deal with the imperfect substitution between domestic products and foreign products (see Figure 1). However, some modifications are made to suit our specific purposes. The model includes 14 production sectors which include agriculture, food, mining, textiles, electrical, electronic products, electrical machinery, chemical products, steel and iron, machinery, motor vehicles, low traded manufacturing sector, other manufacturing, traded services and the nontraded service sector (see Appendix Table). Households, enterprises and government are also separately considered as three different types of institutions.

A social accounting matrix is composed to support the model. In this

Model Structure



social accounting matrix, the input-output structure is based on the 1989 input-output table which was built by the Directorate-General of Budget, Accounting and Statistics (DGBAS), Executive Yuan of the Republic of China. The 1992 national accounts data are reconciled with the input-output coefficients by RAS procedure to update the year 1992. Elasticities as shown in Table 3 are basically chosen from related literature both domestic and foreign. To solve the model, some parameters are directly calculated from the social accounting matrix, while others are determined in a calibration procedure. The model is solved by GAMS, a software developed by the World Bank for the purpose of multi-sectoral modeling.

The liberalization requirements of joining the GATT include reductions of tariff rate, nontariff barriers and also, in the agricultural sector, the aggregate measurement of producer support. In our model, conceptually,

barriers and the tariff rate[3], i.e.

$$(P_i^d - P_i^w)/P_i^d = RAMS_i + NTB_i + TM_i \quad (1)$$

Where P_i^d is the domestic price of i's sector. It represents a net price that is offered by domestic producers in the domestic market before tax. P_i^w is the world price of i's goods, $RAMS_i$ is the rate of aggregate measurement of support. The rate exists only in the agricultural sector. In other words, we set

RAMS to be zero in all nonagricultural sectors. NTB_i is the tariff equivalent of the nontariff barrier. TM_i is the tariff rate. In equation (1), the support measurement actually includes two border measures and one domestic support. For border measures, we put them into the import price equation. For domestic support, we put it in the value-added price equation. i.e.

$$P_i^m = PWM_i\ (1+NTB_i + TM_i).EXR \quad (2)$$

$$P_i^v = P_i^d\ (1- \Sigma a_{ij} - Idtax_i - Depk_i\ ) + RAMS_i \quad (3)$$

In equation (2), P_i^m represents the import goods price which is faced by domestic consumers. PWM_i is the world price of import goods in US dollars. EXR is the exchange rate in terms of NT$/US$. In this equation, tariff and nontariff barriers raise the import goods price that consumers face, and reduce the demand for import goods.

In equation (3), P_i^v is the value-added price that producers receive. If this price increases, the incentive for production will also increase. a_i^j is the input-output coefficient, and $Idtax_i$ is indirect tax imposed by the government on sector i. $Depk_i$ is the depreciation rate in sector i. RAMSi is the rate of aggregate measurement of support which raises the value-added price in the agricultural sector and hence the incentive for production for farmers.

[3]The idea for this equation benefitted from discussion with Chaw hsia Tu, Ron J. Woo, Nien feng Kuo, Yi-chuan Chen and Suh-hwa Sheu.

Table 3 Trade characteristics and Model Parameters

Elasticities	Trade Share		Elasticities		Export Demand	
	E/X	M/X	Import Substution	Export Transformation	Price	World Trade
Agriculture	4.34	17.60	1.10	2.60	1.00	0.23375
Food	10.68	11.89	0.80	1.60	0.80	0.23375
Mining	0.31	68.80	0.50	1.60	1.50	0.07
Textiles	47.81	7.74	3.00	1.60	0.80	0.2975
Elctrc & Elctrn Applns	49.32	24.23	1.20	1.60	1.00	0.2975
Electric Machinery	32.47	24.57	1.20	1.60	1.00	0.2975
Chemical Product	8.27	34.57	1.20	1.60	0.80	0.31625
Steel and Iron	5.87	22.72	2.00	1.60	0.90	0.31625
Machinery	28.32	41.45	2.00	1.60	0.40	0.31625
Motor Vehicle	9.16	22.25	2.40	1.60	0.80	0.31625
Low Traded Manf	8.62	14.18	0.80	1.60	0.60	0.09375
Other manufacturings	36.97	16.06	2.00	1.60	1.00	0.30625
Traded Services	7.58	6.93	2.00	0.80	0.30	0.09375
Nontraded Services	0.01	0.04	0.30	0.30	0.00	0.00

Sources: see Table 1

For nontariff barriers, we consider an induced pure rent that may be distributed to the enterprises or to the government.

$$PRENT = \Sigma\ NTB_i * M_i * PWM_i * EXR \qquad (4)$$

$$Inc_{ent} = Inc^k + GTENT + NFI^k + Prents * PRENT \qquad (5)$$

$$GR = Tariff + Indtax + HHTax + ENTTax + FTRG + (1\text{-}Prents) * PRENT \qquad (6)$$

Equation (4) shows that nontariff barriers create a pure rent where PRENT is the pure rent. M_i is the quantity imported of i's goods. Equation (5) says that enterprise income includes capital return (Inc^k), the government's transfer to enterprises (GTENT), net foreign capital income (NFI), and the pure rent that they receive due to the nontariff barriers. In this equation, we show that enterprises receive pure rent only according to their share where the parameter Prents is the pure rent share. In case the government does not sell any licenses (e.g., import licenses in the case of an import quota), this pure rent will totally go to the enterprises, and Prents is equal to one. In case the government sells import licenses or imposes

any administrative intervention that causes an increase in government revenue, the pure rent may go partly to the government. In equation (6), we show that government revenue is the sum of tariff revenue, indirect tax received, household direct tax received, enterprise direct tax received, foreign transfers and the pure rent received.

In the textile sector, Taiwan faces an export quota. In our model, we treat this quota as an export tax equivalent that is included in the domestic export price equation.

$$PE_i = PWE_i * (1-Te_i) * EXR \tag{7}$$

Where PE_i is the price of export goods producers charge in the domestic market. PWE_i is the price of export goods producers present to the world market. Te_i is the export tax equivalent. This equation can be rearranged as follows.

$$PWE_i = \frac{PE_i}{(1-Te_i) * EXR}$$

The rearranged equation shows that the export tax equivalent raises the price of our exports in the world market (PWE_i). In case of termination of MFA, the export quota disappears and this should improve exporters' competitiveness in the world market and raise the quantity of exports.

Due to the single country model setup, there are some important connections, between Taiwan and other countries in the world, which are missing in our model. In order to make up this gap, we set export demand as a function of the world trade volume. i.e.,

$$E_i^d = \bar{A} \left(\frac{PWE_i}{PWSE_i}\right)^{\delta_i} (TV_i)^{\phi_i} \tag{8}$$

Where E_i^d is export demand. $\bar{A}$ is a fixed shift parameter. $PWSE_i$ is the world price of our export goods in the world market, PWE_i is the price of our exports in the world market. δ_i is the price elasticity of export

demand. TV_i is the world trade volume of goods i. ϕ_i is the elasticity of the world trade volume to export demand. Equation (8) shows that export demand is affected by relative price and world trade volume. In case the world trade volume expands due to world trade liberalization, the export demand should also be able to take advantage of this expansion.

IV. Simulations and Results

A. Simulations

Although trade liberalization can increase economic efficiency, Kilkenny & Robinson (1990) have shown that different assumptions on factor mobility and macro closures can cause differences in simulation results. Other researches also indicate that different assumptions on the economic and social environment may affect the modeling results significantly. In our study, certain assumptions on factor mobility and the economic environment are also made to test the possible outcomes of policy changes.

(1) Foreign Exchange Rate System

Under a fixed exchange rate system, external shocks may be absorbed by the domestic economy more completely. Hence, policy changes such as tariff reduction and market opening can cause more significant results. However, under a floating exchange rate system, these shocks may be transferred partly outside Taiwan through adjustment of the exchange rate. This will make policy results more moderate. In our study, we make two different assumptions on the economic environment, taking into account both the fixed exchange rate system and the floating exchange rate system. In practice, Taiwan's government may choose a policy in between these two extreme cases, that is, a managed exchange rate system. However, due to the multitude of possible exchange rate management mechanisms that the government can choose, it is hard for us to trace the government's intervention function, so we don't consider that case in our model. In the floating exchange rate system of our model, we allow a free adjustment of the exchange rate, and fix the foreign savings, i.e., we fix the net capital inflow (or outflow). In the case of the fixed exchange rate system, we fixed the exchange rate, however, foreign saving is allowed to move, i.e., we allow capital flows between Taiwan and the rest of the world.

(2) Factor Mobility

As we mentioned earlier, joining the GATT for Taiwan may cause a serious change in Taiwan's production structure. In the short run, the cost for some certain protected sectors may be huge. In the longer run, this cost may be alleviated by the adjustment of resource reallocation. Resource reallocation makes production more efficient. The dilemma between short-run cost and long-run efficiency is unavoidable under this kind of action. To see the difference of the effects of liberalization under different time periods, in our study we separate the simulations on the time horizon into three different terms. In the very-short-run scenario, we fix sectoral resources to a certain amount, i.e., we fix both labor and capital stock to a certain level in each sector; these factors are not allowed to move among sectors. In this setup, we are able to see the short-run shock to each individual sector more clearly. In the second scenario, i.e., the short-run simulation, we fix only the capital stock in each individual sector, and allow labor to move among sectors in response to changes in their rates of return in each sector[4]. In the third scenario, we allow both labor and capital to move among sectors, and refer it as the long-run scenario.

(3) Unilateral Liberalization vs. Multilateral Liberalization

In our study, the model used is a single country model. To model a multilateral event such as GATT negotiation, a single country model obviously has its limitations. Certain modifications have been made to overcome these weaknesses in our model. In this paper, we first analyze the effects of liberalization in which we neglect all the possible effects from other countries' liberalization activities. We deal only with our own actions such as reductions of tariff rates, nontariff barriers and aggregate measurement of supports. For the second case, we analyze the effects of multilateral liberalization in which we include some of the possible effects from other countries' liberalization actions. In this case, first of all, we allow the world trade volume to affect our export demand and make export demand a function of world trade volume (equation 8). When there is an expansion of world trade due to liberalization activities in the world economy, the effect will be passed through our export demand function to pull up export demand. Second, in the textile sector, we also allow the textile quota to be removed under the multilateral liberalization case. This

[4]More Detailed simulations could be made by selling factor mobility assumptions according to the specific industry.

is done through the removal of export tax equivalents in equation (7) in the previous section. Third, in the multilateral liberalization case, we also allow domestic industries to catch some of the externality caused by world liberalization activities. In this case, the economies of scale play a role, production become more efficient, and the shift parameters in the production function are allowed to adjust to more favorable values. To observers who are pessimistic about joining GATT, the comparison between the two cases may give a clearer insight.

(4) Indirect tax reduction as an alleviation of liberalization shock

In the short run, the cost of liberalization to some certain protected sectors may be high. There are some arguments that an indirect tax reduction on domestic products (henceforth indirect tax reduction) may reduce the cost of liberalization. However, an overall uniform reduction of indirect tax may be useful for alleviating import expansion in the aggregate, but may not be helpful to individual sectors. To help these sectors, selection of certain indirect tax reductions are unavoidable, and this involves the controversy of social justice. Nevertheless, in our study, we present the results of an overall uniform indirect tax reduction to give a sense of the effects of this policy choice.

In this paper, we made a total of 20 simulations. A summary of these simulations is shown in Table 4. There are four simulations in the multilateral case we did not carry out. We consider that two from the very short run would not happen in multilateral liberalization. Since these two simulations are not carried out for both the fixed exchange rate and floating exchange rate regimes, there are four simulations left out.

B. Results

(1) Unilateral Liberalization

Table 5 indicates the effects of aggregate variables in the unilateral liberalization case. The second column in the table shows the actual data we set up for the base year (1992). Column 3 through column 8 show the simulation results. In the very-short-run case under a fixed exchange rate system, trade liberalization (which is indicated as a 38% tariff rate reduction in the nonagricultural sectors, 36% tariff rate reduction in agricultural sector, 30% removal of nontariff barriers in agricultural sector and a 20% cut on aggregate measurement of support in the agricultural sector) has caused an increase of real GDP of 0.451%. This implies that trade liberalization will be beneficial to the economy. Total consumption

Table 4 A Summary of Simulations

A. Unilateral Liberalization (without Indirect Tax Reduction)
  A.1 Fixed Exchange Rate System
    Sim.1. —— Very Short Run
    Sim.2. —— Short Run
    Sim.3. —— Long Run
  A.2 Floating Exchange Rate System
    Sim.4. —— Very short Run
    Sim.5. —— Short Run
    Sim.6. —— Long Run

B. Unilateral Liberalization (with Indirect Tax Reduction)
  B.1 Fixed Exchange Rate System
    Sim.7. —— Very Short Run
    Sim.8. —— Short Run
    Sim.9. —— Long Run
  B.2 Floating Exchange Rate System
    Sim.10. —— Very Short Run
    Sim.11. —— Short Run
    Sim.12. —— Long Run

C. Multilateral Liberalization (without Indirect Tax Reduction)
  C.1 Fixed Exchange Rate System
    Sim.13. —— Short Run
    Sim.14. —— Long Run
  C.2 Floating Exchange Rate System
    Sim.15. —— Short Run
    Sim.16. —— Long Run

D. Multilateral Liberalization (with Indirect Tax Reduction)
  D.1 Fixed Exchange Rate System
    Sim.17. —— Short Run
    Sim.18. —— Long Run
  D.2 Floating Exchange Rate System
    Sim.19. —— Short Run
    Sim.20. —— Long Run

Note: In all cases, there are 38% tariff cut on nonagricultural sectors, 36%tariff cut on agricultural sector. there are also nontariff barrier removements, 38% on nonagricultural sector, 36% agricultural sector. In agricultural sector, there is a 20% deduction of aggregate measure of support in all cases. For multilateral liberalization cases, there is an increase of world trade volume 20% (see Nguyen, Perroni and wigle, 1993) and a total removement of export tax equivalent in textile sector. For very-short-run cases, we fix both sectoral labor and capital levels. For short run cases, we fix only sectoral capital level. For long run cases, we allow both labor and capital to move among sectors.

also increases 1.576%, indicating that consumers are benefitted by this action. This is also shown by a positive sign of the equivalent variation[5]. Investment increases by 2.893%. Total exports increase 0.067%. And, inevitably, imports have a significant rise of 6.296%, showing that liberalization has caused expenditures to switch to imported goods. Households incomeand nominal enterprises income are also both increased. However, the degree of increase in household income is significantly larger than that enterprise income, indicating that labors may get more benefit than capitalists. This seems to be advantageous to income distribution.
The fourth column of Table 5 reveals the short-run effects of the trade liberalization. In this case, labor are allowed to move among sectors though capital is sectoral fixed. This simulation shows that resource allocation is more efficient than in the case of the very short run. Real GDP increases by 0.631% which is obviously larger than that in the case of the very short run. Total investment also increases much more significantly than in the very-short-run case. However, the significant increase of investment crowds out contemporary consumption and exports somewhat. Consumption has an increase of 1.511%, which is slightly lower than that in the case of the very-short-run. Exports show a decline of 0.1%. Imports have a rise of 7.384%, which is again much more than that of the very-short-run case. Nominal household income and nominal enterprise income have both increased at a more significant level, but the direction of change remains the same, indicating that labors get more benefit than capitalists. Due to the fact that the real consumption level is not as high as in the very-short-run case, the welfare indication shows thatthe degree of improvement in consumer welfare is slightly lower than that of very-short-run case.

Under the fixed exchange rate system, we also made a simulation for the long-run case where we assume both labor and capital are mobile among sectors. The results are presented in column 5 of Table 5. The results show a pattern similar to the short-run case. Compared with the very-short-run case, real GDP, total investment, imports, nominal household income, and nominal enterprise income are all increased to a larger degree. Compared with the short-run case, consumption and exports are crowded out slightly. Welfare improvement, in terms of equivalent

[5]Equivalent variation is the minimum income necessary to reach a new utility level given the initial price.

Table 5 Effects on Aggregate Variables
(Unilateral Liberalization without Indirect Tax Reduction)

		Fixed Exchange Rate System			Floating Exchange Rate System		
	1992 Level (Billion of NT$)	Very Short Run %	Short Run %	Long Run %	Very Short Run %	Short Run %	Long Run %
GDP	5198.505	0.451	0.631	0.643	0.319	0.237	0.215
Consumption	2899.758	1.576	1.511	1.461	0.406	0.337	0.295
Investment	1258.490	2.893	5.926	6.449	-1.541	-2.768	-2.922
Export	2313.411	0.067	-0.100	-0.148	0.672	1.231	1.320
Import	2125.276	6.295	7.384	7.542	3.058	3.039	3.039
Households Income	4057.655	1.059	1.199	1.206	0.803	0.754	0.735
Enterprises Income	1383.032	0.600	0.756	0.772	0.396	0.273	0.254
Welfare improve (Equivalent Variations)		0.879	0.843	0.815	0.226	0.188	0.164
Exchange rate	25.42	0.0	0.0	0.0	3.372	3.142	3.093

variation, declines somewhat. The pattern of increase and decrease is the same as in the case of the short-run, however, the range of movement is much wider.

As we mentioned earlier, under the fixed exchange rate system, the shock from liberalization may be absorbed by the domestic economy much more thoroughly and the effects will be more drastic. To see that, we refer to the results shown in columns 6, 7 and 8 of Table 5. Compared with the case under the fixed exchange rate system, the results of these three latter cases are much more moderate. Real GDP increases are 0.319%, 0.237% and 0.215% for the very-short-run case, the short-run case and the long-run case, respectively. It is quite interesting that, in the fixed exchange rate system, the longer in time horizon the simulation is, the better real GDP improves. However, in the floating exchange rate system, the results show the opposite. As we can see, in the longer run, real GDP improvement is significantly lower than that in shorter run cases. The pattern for other variables is also the same. Under the floating exchange rate system, the longer the time horizon for the simulation, the more moderate the effects are (investment and total exports are two exceptions). This phenomenon seems to indicate that adjustment of the exchange rate in the longer run passes more of the shock (or effect) to the outside world.

In Table 6, we show the unilateral liberalization effects on value-added of the individual sectors. In all cases, the agricultural sector and the motor vehicle sector face the strongest shock, and both have very significant declines in their value-added. The results also show that the longer the time horizon, the more moderate the shock. Under the fixed exchange rate system, the value-added in the agricultural sector declines 7.599% in the very-short-run case. However, this shock reduces to 1.497% and 0.967% in the short-run case and the long-run case, respectively. The value-added in the motor vehicle sector shows the same pattern, though the moderation degree is somewhat smaller. Under the fixed exchange rate system, the nontraded service sector is the most benefitted sector. However, under the floating exchange rate system, this sector becomes the most harmed sector, especially in the very-short-run case. This sector has a strong characteristic of not being involved in international trade. When the exchange rate is fixed, it strongly absorbs benefit from other sectors' liberalization activities. However, when the exchange rate is floating, then other sectors adjust their production and trade behavior to suit the change in the environment; the nontraded service sector is the only sector that is left out of this adjustment and shows the opposite sign from the difference of total imports. When

Table 6 Effects on Sectoral Value Added
(Unilateral Liberalization without Indirect Tax Reduction)

	1992 Level (Billion of NT$)	Fixed Exchange Rate System			Floating Exchange Rate System		
		Very Short Run %	Short Run %	Long Run %	Very Short Run %	Short Run %	Long Run %
Agriculture	210.533	-7.599	-1.497	-0.967	-6.958	-1.686	-1.223
Processes Agri. Prod.	195.069	8.289	1.586	1.258	6.252	1.103	0.891
Mining	28.289	-1.589	1.575	1.761	3.674	0.846	0.730
Textile	205.862	0.196	0.555	0.672	4.425	2.677	2.393
Elect. App.	190.110	1.979	1.551	1.511	4.525	2.655	2.288
Elect. Mach.	46.319	1.349	1.978	1.879	2.291	1.468	1.320
Chemical Pro.	114.934	-1.321	-0.058	0.424	3.134	2.329	1.879
Steel & Iron	70.473	-5.083	-0.827	0.076	1.910	0.532	0.603
Machinery	77.400	3.474	2.489	2.280	-0.281	0.678	0.730
Motor Vechicle	97.154	-6.747	-4.790	-4.347	-7.878	-5.505	-4.998
Low Trade Manu.	227.833	0.117	1.948	1.805	1.532	0.621	0.730
Other Manu.	432.721	1.009	1.118	1.164	4.278	2.448	2.137
Trade Service	2408.371	1.078	1.306	1.341	1.410	1.160	1.103
Nontrade Service	292.381	9.774	6.063	5.151	-8.079	-2.007	-1.305

trade liberalization lowers the import price, there is an increase in total domestic demand (including import goods and domestic goods). Since nontraded services cannot be supplied by imports, the only source to provide these commodities is domestic production. Therefore, the increasing demand for production factors in the nontraded sector will raise the sector's value-added.

Some political and economic observers argue that a reduction on the indirect tax may be able to relieve some of the damage to the most harmed sector. Table 7 and Table 8 present the effects of 10% reduction of indirect tax rate on aggregate variables and on the sectors' value-added. Compared with Table 5, the results in Table 7 have shown an improvement in real GDP, consumption, income and welfare. Import expansion has been halted a bit under the fixed exchange rate system, but has not shown an improvement under floating exchange rate system. This indicates that the effect of an indirect tax cut is absorbed by adjustment of the exchange rate. Investment shrinks significantly in all cases. Exports improve only under the very-short-run case with a fixed exchange rate system.

To see the effects of an indirect tax cut on the individual sector, we can compare the results of Table 6 and Table 8. From the results, we see that the two most harmed sectors, the agricultural sector and the motor vehicles sector, show totally different responses. Agricultural value-added shows very significant improvement when the indirect tax is cut. However, in the motor vehicle sector, a uniform indirect tax cut does not give any help to its value-added. Of course, this does not mean that a specific indirect tax cut on the motor vehicle sector itself will not help this industry. This simply means that, if the government wants to cut the indirect tax to relieve the shock on certain industries, it has to make a careful decision on which indirect tax to cut and how to deal with it.

(2) Multilateral Liberalization

It does not seem very reasonable to model a multilateral eventwithout considering the reaction of the outside world. In Tables 9 through 12, we include some possible effects from the outside world in our model results. In these four tables, the results reported include only the short-run cases and the long-run cases. We don't consider the outside world effects for the very-short-run case because we believe that in order to catch these effects there should be a time lag for the domestic economy to adjust and respond. With no indirect tax cut, Table 9 shows the multilateral liberalization effects on aggregate variables. Under the fixed exchange rate system, real

GDP declines by 0.04% in the short-run case. This result may surprise us at first glance. However, making a careful examination of the results, it is not difficult to find that the decline of real GDP is mainly caused by a sharp increase of capital outflow. This effect is also shown in the sharp decline of domestic investment. The liberalization activities of the outside world cause a strong pull in export demand. In order to balance the foreign exchange market, either exchange rate appreciation or capital outflow have to be chosen. In our model when the foreign exchange rate is fixed, foreign saving is allowed to adjust freely. This mechanism is the main cause of capital outflow. Of course, this mechanism has its economic and policy implications. In the long-run case under a fixed exchange rate system, real GDP has a 0.076% increase. Compared with the unilateral liberalization case, this increase is much smaller. The main reason lies in the huge capital outflow. In both the short-run case and the long-run case, the inclusion of outside world effects has made the consumption and consumer welfare improvement more significant.

Table 9 also shows the effects under a floating exchange rate system. In the short-run scenario, real GDP increases 0.78% which is significantly larger than that in the case of unilateral liberalization, indicating that world liberalization activities have a significantly positive effect on the domestic economy. Consumption, investment, exports, imports, nominal household income, nominal enterprises income and welfare all have a very significant increase. In the long-run case, the results also show an increase of real GDP of 0.87% which is slightly improved from the short-run case, indicating that the long-run case has a better allocation of resources. However, due to export expansion, domestic consumption is lower compared with the short-run case. This is also reflected in a slight decline in the welfare indication compared with the short-run case.

Table 10 reveals the results of multilateral liberalization cases with reductions in indirect tax. In all cases, it shows that an indirect tax reduction improves the real GDP, consumption, incomes, and consumers' welfare. Import expansion is slightly alleviated in the fixed exchange rate cases, but does not show any improvement in the floating exchange rate cases. This indicates that the adjustment of the exchange rate has absorbed the effects of domestic efforts. In the floating exchange rate system, the real GDP, household income, enterprise income and equivalent variation increase 1.099%, 3.901%, 3.456% and 3.673%, respectively. These results are superior to the results from all other cases.

Table 7 Effects on Aggregate Variables
(Unilateral Liberalization with Indirect Tax Reduction)

	1992 Level (Billion of NT$)	Fixed Exchange Rate System			Floating Exchange Rate System		
		Very Short Run %	Short Run %	Long Run %	Very Short Run %	Short Run %	Long Run %
GDP	5198.505	0.439	0.795	0.831	0.323	0.435	0.441
Consumption	2899.758	2.722	3.871	4.049	1.674	2.795	2.967
Investment	1258.490	-0.301	0.952	1.193	-4.283	-6.942	-7.297
Export	2313.276	0.124	-0.281	-0.422	0.667	0.918	0.911
Import	2125.276	6.054	7.047	7.217	3.145	3.108	3.109
Households Income	4057.655	2.922	3.303	3.338	2.705	2.901	2.912
Enterprises Income	1383.032	2.731	2.922	2.962	2.563	2.483	2.493
Welfare (Equivalent Variations)		1.518	2.159	2.258	0.934	1.559	1.655
Exchange Rate	25.42	0.00	0.00	0.00	3.018	2.828	2.811

Table 8 Effects on Aggregate Variables
(Unilateral Liberalization with Indirect Tax Reduction)

		Fixed Exchange Rate System			Floating Exchange Rate System		
	1992 Level (Billion of NT$)	Very Short Run %	Short Run %	Long Run %	Very Short Run %	Short Run %	Long Run %
Agriculture	210.533	-6.695	2.975	3.403	-6.112	2.810	3.169
Processes Agri. Prod.	195.069	11.504	-4.354	-5.809	9.687	-4.842	-0.177
Mining	28.289	-1.043	1.306	1.508	3.676	0.623	0.563
Textile	205.862	0.692	1.442	1.666	4.484	3.378	3.256
Elect. App.	190.110	1.134	1.222	1.285	3.408	2.212	1.987
Elect. Mach.	46.319	-1.246	1.312	1.782	-0.434	0.841	1.276
Chemical Pro.	114.934	-0.667	0.129	0.685	3.323	2.274	2.003
Steel & Iron	70.473	-4.710	-1.605	-0.097	1.548	-0.411	0.380
Machinery	77.400	-1.754	1.380	1.713	-5.319	-0.278	0.295
Motor Vechicle	97.154	-6.878	-6.999	-7.147	-7.893	-7.720	-7.803
Low Trade Manu.	227.833	1.524	-0.122	-0.252	2.803	-1.346	-1.236
Other Manu.	432.721	0.085	1.339	1.611	2.994	2.544	2.512
Trade Service	2408.371	2.591	2.490	2.446	2.915	2.363	2.237
Nontrade Service	292.381	-3.572	2.404	2.715	-19.677	-4.897	-3.194

Table 9 Effects on Aggregate Variables
(multilateral Liberalization without Indirect Tax Reduction)

		Fixed Exchange Rate System		Floating Exchange Rate System	
	1992 Level (Billion of NT$)	Short Run %	Long Run %	Short Run %	Long Run %
GDP	5198.505	-0.040	0.076	0.780	0.870
Consumption	2899.758	1.645	1.658	4.009	3.858
Investment	1258.490	-13.965	-14.065	3.986	3.923
Export	2313.411	5.399	5.868	2.727	3.061
Import	2125.276	3.409	3.593	12.363	12.265
Households Income	4057.655	0.792	0.885	3.338	2.705
Enterprises Income	1383.032	0.138	0.284	1.690	2.563
Welfare (Equivalent Variations)		0.918	0.925	1.127	0.934
Exchange rate	25.42	0.0	0.0	-5.797	-5.414

Table 11 results the multilateral liberalization effects on individual sectors with no indirect tax reduction. As we can see, in all cases, the shocks to the agricultural sector are much more moderate. However, it does not show any improvement in the motor vehicles sector. In the fixed exchange rate system, trade liberalization in the outside world has caused very severe harm to the nontraded service sector. It is not difficult to understand that under a fixed exchange rate system, the more liberal world market pulls resources to all of the trade sectors. The nontraded characteristic of the nontraded service sector will naturally cause this sector to be the only loser in this phenomenon. However, under the floating exchange rate system, the results do not show any disadvantage to the nontraded sector. This is probably due to the fact the adjustment of the exchange rate has moderated the positive competitive position of Taiwan's products in the world market and alleviated the pull of resources to the trade sectors. The results also show that, in the textile sector, there is a very significant increase in value-added due to the termination of the export quota. With an indirect tax reduction, Table 12 shows an even better improvement in the agricultural sector. The motor vehicle sector still suffers.

Table 10 Effects on Aggregate Variables
(Multilateral Liberalization with Indirect Tax Reduction)

	1992 Level (Billion of NT$)	Fixed Exchange Rate System		Floating Exchange Rate system	
		Short Run %	Long Run %	Short Run %	Long Run %
GDP	5198.505	0.122	0.274	0.987	1.099
Consumption	2899.758	4.011	4.252	6.509	6.585
Investment	1258.490	-18.998	-19.214	-0.294	-0.587
Export	2313.411	5.210	5.573	2.435	2.661
Import	2125.276	3.067	3.292	12.426	12.334
Households Income	4057.655	2.877	3.012	3.817	3.901
Enterprises Income	1383.032	2.283	2.468	3.321	3.456
Welfare (Equivalent Variations)		2.237	2.372	3.630	3.673
Exchange rate	26	0.0	0.0	-6.017	-5.626

Table 11 Efffects on Sectoral Value Added
(Multilateral Liberalization without Indirect Tax Reduction)

	1992 Level (Billion of NT$)	Fixed Exchange Rate System		Floating Exchange Rate System	
		Short Run %	Long Run %	Short Run %	Long Run %
Agriculture	210.533	-0.336	0.107	0.021	0.541
Processes Agri. Prod.	195.069	2.026	1.693	3.000	2.365
Mining	28.289	-1.613	-1.647	0.055	0.383
Textile	205.862	15.972	13.428	11.230	9.871
Elect. App.	190.110	5.427	4.422	3.195	2.928
Elect. Mach.	46.319	0.260	0.561	1.407	1.639
Chemical Pro.	114.934	3.096	2.642	-1.496	-0.054
Steel & Iron	70.473	-2.352	-1.160	-4.721	-2.056
Machinery	77.400	-0.220	0.074	3.561	3.051
Motor Vechicle	97.154	-7.247	-6.589	-5.733	-5.328
Low Trade Manu.	227.833	-1.713	-0.736	1.071	1.317
Other Manu.	432.721	4.609	3.962	1.963	2.099
Trade Service	2408.371	0.639	0.705	0.918	1.110
Nontrade Service	292.381	-11.231	-8.146	5.281	4.262

Table 12 Efffects on Sectoral Value Added
(Multilateral Liberalization with Indirect Tax Reduction)

	1992 Level (Billion of NT$)	Fixed Exchange Rate System		Floating Exchange Rate System	
		Short Run %	Long Run %	Short Run %	Long Run %
Agriculture	210.533	4.150	4.500	4.512	4.953
Processes Agri. Prod.	195.069	-3.935	-5.405	-2.806	-4.635
Mining	28.289	-1.919	-1.890	-0.121	0.233
Textile	205.862	16.968	14.540	11.985	10.786
Elect. App.	190.110	5.116	4.213	2.805	2.666
Elect. Mach.	46.319	-0.418	0.472	0.803	1.590
Chemical Pro.	114.934	3.290	2.911	-1.467	-0.117
Steel & Iron	70.473	-3.140	-1.325	-5.533	-2.251
Machinery	77.400	-1.340	-0.463	2.658	2.655
Motor Vechicle	97.154	-9.427	-9.323	-7.691	-7.883
Low Trade Manu.	227.833	-3.744	-2.713	-0.787	-0.571
Other Manu.	432.721	4.840	4.435	2.076	2.467
Trade Service	2408.371	1.807	1.808	2.090	2.215
Nontrade Service	292.381	-14.926	-10.808	2.296	2.320

The results for the nontrade service sector still vacillate showing its instability in domestic adjustment.

V. Conclusion

Taiwan is a naturally resource-scarce economy. Trade is always an important issue to investigate. In this paper, we build a single country CGE model to demonstrate the possible outcomes of Taiwan's joining the GATT. In total, twenty simulations are conducted to analyze the liberalization effects under different assumptions of economic environment and policy mix. All of the simulations (except the short-run case under a fixed exchange rate system of multilateral assumption), show that liberalization benefits the domestic economy significantly. Real GDP increases, consumption increases and welfare improves. However, the degree of improvement varies under different time period assumptions, exchange rate system assumptions and outside world assumptions.

To the whole economy, the most optimistic case (the long-run case under the floating exchange rate system and multilateral liberalization with an indirect tax reduction), shows a real GDP increase of 1.099%. To consumers, the best case is the long-run, fixed exchange rate and unilateral liberalization with indirect tax cut assumption. In this case, total consumption increases 6.585%, and the equivalent variation has an increase

of 3.673%. An overall uniform direct tax reduction is proved to be beneficial to the economy as a whole, but for individual sectors, it may be harmful. If the government's target is to help certain industries, certainly a wise decision as to how to manipulate this policy tool has to be made. Of course, this policy instrument could cause resource distortion and waste, since the government is rarely able to select the "winners." To individual sectors, the liberalization may cause a boom or a slump. In our study, the agricultural sector and the motor vehicle sector are the two sectors harmed by liberalizations the most. However, it has also shown that the harm will be alleviated greatly as time passes.

From our analysis, the economic gains from trade liberalization are positive. However, our estimates of the joining GATT are still at a lower bound. Although we include the effect of scale economies in terms of externality in the multilateral case, we exclude the important effects of liberalization in the service sectors[6], and the benefits of a strengthened set of trade rules. In addition, the GATT is likely to provide a boost in long-term growth rates. Such long-term dynamic income effects will magnify the efficiency gains from the GATT. Although the simulation results at an aggregate level are robust, the differences among sectors are sensitive to the parameters are assumed in each sector. This shortcoming is difficult to overcome, since no reliable estimates of elasticities are made.

[6]It has been argued that the service sectors are rather weak in the international market and that liberalization might hurt these sectors. We take the position that liberalization will force the service sector to face international competition and adjust themselves to meet international standards. The service sector my be hurt in the short run, but will benefit in the long run.

Appendix Table Sector Aggregation

Sector	Industries (major)	I/O 29 & 99 Sectors
1. Agriculture	Agricultural products & livestock forestry, fisheries	1, 2, 3
2. Food	Processed food, beverages and tobacco	5, 6
3. Mining	Minerals	4
4. Textiles	Fabrics, garments and accessories	7, 8
5. Elctrc & Elctrn Appln	Household electric appliances and electronic products	19, 20
6. Electric Machinery	Electric machinery and apparatus	21
7. Chemical Product	Chemical material and misc. chemical products	11, 13
8. Steel and Iron	Steel and iron	16
9. Machinery	Machinery	18
10. Motor Vehicle	Motor vehicles	73 (99 sectors)
11. Low Traded Manf.	Papers products, printing & publication, petroleum	10, 14, 15
12. Other manufacturings	Wood, wooden products, artificial fibres, plastics and products, misc. metals and metallic products, other transportation equipment and miscallaneous products	9, 12, 17, 23 22(except motor vehicles)
13. Traded Services	Transportation, communication and warehousing, wholesale and retail trade, miscellaneous services	27, 28, 29
14. Nontraded Services	construction, electricity, gas and city water	24, 25, 26

Source: Directorate-General of Budget, Accounting and Statistics (DGBAS), *1989 Input-Output Table, Taiwan Area, ROC.*

References

Baldwin, Robert E., "Trade Policies in a Maturing Taiwan Economy," CEPD and *CIER Conference on the Evolution of Taiwan within A New World Economic Order,* May 28-29, 1993.

Chen, Tain-Jy and Chi-ming Hou, "The Political Economy of Trade Protection in the Republic of China on Taiwan," NBER, *Second Annual East Asian Seminar on Economics: Trade and Protectionism,* June 19-21, 1991.

Devarajon, Shantanyanan, Jeffrey D. Lewis and Robinson, Sherman, "From Stylized To Applied Models: Building Multisector CGE Models for Policy Analysis," Department of Agricultural and Resource Economics, University of California at Berkeley, *Working Paper,* No.616, 1991.

John B. Shoven and John Whalley, "Applied General-Equilibrium Models of Taxation and International Trade: An Introduction and Survey," *Journal of Economic Literature,* Vol. XXII (September 1984), pp.1007-1051.

Kilkenny, Maureen and Sherman Robinson, "Computable General Equilibrium Analysis of Agricultural Liberalization: Factor Mobility and Macro Closure," *Journal of Policy Modeling,* 12(3):1990, pp.527- 556.

Liu, Da-Nien and Meng-Chun Lin, "Joining the GATT and Industrial Adjustment in Taiwan," in Chung-Hua Institution for Economic Research, *Imports and Adjustment of Taiwan of Joining the GATT,* 1993, (in Chinese).

Melo de Jaime, "Computable General Equilibrium Models for Trade Policy Analysis in Developing Countries: A Survey," *Journal of Policy Modeling,* 10(4):469-503 (1988).

Melo de James, and David Tare, *A General Equilibrium Analysis of US Foreign Trade Policy, The MIT Press,* Cambridge, 1992.

Francois, Joseph; Bradley McDonald, and Nordstrom, Hukan, "Economy-wide Effects of the Uruguay Round," *GATT Background Paper,* December, 1993.

Riedel, James, "International Trade in Taiwan's Transition from

Developing to Mature Economy," edited by Ranis, Gustav, *Taiwan, From Developing to Mature Economy, Westview Press,* Boulder, 1992.

Riedel, James C. and Maria Luisa Cicognani, "Economic Relations between Taiwan and the United States," in CEPD and CIER *Conference on the Evolution of Taiwan within A New World Economic Order,* May 28-29, 1993.

Shoven, John B and John Whalley, "Applied General Equilibrium Models of Taxation and International Trade: An Introduction and Survey," *Journal of Economic Literature,* Vol.XX11 September 1984, pp1007-1051.

Srinivasan T.N. and John Whalley, "General Equilibrium Trade Policy Modeling." *The MIT Press,* Cambridge, 1986.

Tu, Chaw-hsia and Wen-Chuen Wang, "Trade Liberalization in The Republic of China and The Economic Effects of Tariff Reductions," in *Joint KDI/CIER Conference Industrial Policies of Korea and the Republic of China,* 1988.

Tu, Chaw-hsia, "Joining the GATT and Agricultural Adjustment in Taiwan," in Chang-Hua Institution for Economic Research, *Impacts and Adjustment of Taiwan After Joining the GATT,* 1993 (in Chinese).

Whalley, John, "The Uruguay Round, The GATT, and Taiwan," in CEPD and CIER, *Conference on the Evolution of Taiwan Within A New World Economic Order,* May 28-29, 1993.

Discussion Paper Series

1. Kang Chao and Ellen S. S. Chien. "The Relative Real GDP and Price Structure of Mainland China," 1981. ***(No.8101)***
2. Kang Chao. "Economic Readjustment in Mainland China," 1981. ***(No.8102)***
3. Mingshu Hua. "The Inflationary Effect on the Structure of Trade," 1981. ***(No.8103)***
4. Kang Chao and P. C. Chang. "A Study of Regional Factor Productivities in Chinese Agriculture," 1982. ***(No.8201)***
5. Chun-yuan Wang. "The Spillover Monetary Effect of Devaluation: A Disequilibrium Interpretation of the Cooper Paradox and the 'Reversed'," 1982. ***(No.8202)***
6. Chihwa Kao. "Second-Order Efficiency in the Estimation of Heteroscedastic Regression Models," 1984. ***(No.8401)***
7. Chihwa Kao. "An Em Algorithm for the Heteroscedastic Regression Models with Censored Data," 1984. ***(No.8402)***
8. Hak Choi. "Methods of Generating Demand Functions - A Tabular Review," 1984. ***(No.8403)***
9. Chihwa Kao. "Robust Regression with Censored Data," 1984. ***(No.8404)***
10. Chihwa Kao. "The Bootstrap and the Censored Regression," 1984. ***(No.8405)***
11. San, Gee. "The Early Labor Force Experience of College Students and Their Post-College Success," 1984. ***(No.8406)***
12. Chihwa Kao. "Small Sample Studies of Estimating, the Regression Models with Multiplicative Heteroscedasticity: The Results of Some Monte Carlo Experiments," 1984. ***(No.8407)***
13. San, Gee. "Student Financial Aid, In-School Employment, and Educational and Labor Market Outcomes," 1984. ***(No.8408)***
14. An-loh Lin and Scott A. Monroe. "The Structure of Gasoline Demand Across the United States," 1985. ***(No.8501)***
15. Hak Choi. "Why the EEC-ROC Trade Remains Unimportant," 1985. ***(No.8502)***
16. Hak Choi, J. Chou and D. E. Nyhus. "A Disaggregated Exports Forecasting Model for Taiwan," 1985. ***(No.8503)***
17. Diagee Shaw. "On-site Samples' Regression: Problems of Nonnegative Integers, Truncation, and Endogenous Stratification," 1987. ***(No.8701)***

18. Li-min Hsueh and Su-wan Wang. "The Implicit Value of Life in the Labor Market in Taiwan," 1988. ***(No.8801)***
19. Chien-hsun Chen. "Modernization in Mainland China: Self-Reliance and Dependence," December, 1990. ***(No.9001)***
20. Tain-jy Chen & Wen-thuen Wang. "The Effects of Production Quotas on Economic Efficiency: The Case of Taiwan's Canned Food Industry," December 1990. ***(No.9002)***
21. Ya-hwei Yang. "The Influence of Preferential Policies on Strategic Industries: An Empirical Study of Taiwan," December 1990. ***(No.9003)***
22. Solomon W. Polachek & Charng Kao. "Lifetime Work Expectations and Estimates of Sex Discrimination," January 1991. ***(No.9101)***
23. Ke-jeng Lan. "Inflation Effects on the Labor Market: A Transition Rate Model," April, 1991. ***(No.9102)***
24. Hui-lin Wu, Quen-leng Miao, and Ke-jeng Lan. "Wage Differentials: Among College-and-Above Graduates in Taiwan," April 1991. ***(No.9103)***
25. George J. Y. Hsu and Tser-yieth Chen. "Uncertainty and Asymmetric Information in the Modelling of Electric-Utility Tariff Regulation," May 1991. ***(No.9104)***
26. Ya-hwei Yang. "An Analysis on the Structure of Interest Rate in the Banking Sector, the Money Market and the Curb Market," June 1991. ***(No.9105)***
27. Jiann-chyuan Wang. "Quota Restriction Policies and Their Impact on Firms' Quantity Setting Decision Under 'Learning-By-Doing'," June 1991. ***(No.9106)***
28. Jiann-chyuan Wang. "Cooperative Research in Taiwanese Manufacturing," October 1991. ***(No.9107)***
29. Mo-huan Hsing. "The Empirical Relevance of the Orthodox Demand Theory," October 1991. ***(No.9108)***
30. Hui-lin Wu and Ke-jeng Lan. "Labor Shortage and Foreign Workers in Taiwan," October 1991. ***(No.9109)***
31. Ji Chou and De-min Wu. "The Cost of Capital and the Effective Tax Rate in Taiwan: 1961 - 1985," October 1991. ***(No.9110)***
32. George J. Y. Hsu, Pao-long Chang, and Tser-Yieth Chen. "Industrial Outage Costs in Taiwan: Estimation from a Proposed Curtailable Rate Program in Taiwan," January 1992. ***(No.9201)***
33. Charng Kao, Solomon W. Polachek, and Phanindra V. Wunnava. "Male-Female Wage Differentials in Taiwan: A Human Capital Approach," Feb. 1992. ***(No.9202)***

34. Lee-in Chen Chiu. "The Economic Reunion of Taiwan and the Mainland China: The Impact on Industrial Development," May 1992. ***(No.9203)***

35. Yi Chou, Pao-long and Chyan Tuan. "TQC Chinese Style and Its Management Implication -- Taiwan V.S. Mainland China," June 1992. ***(No.9204)***

36. Chung-hua Shen and Lee-rong Wang. "Testing Efficiency of the Coffee Futures Market -- A Markov Switching Model," June 1992. ***(No.9205)***

37. Tain-jy Chen and Hsien-yang Su. "On-the-Job Training as a Cause of Brain Drain" July 1992. ***(No.9206)***

38. George J. Y. Hsu, Pao-long Chang and Tser-yieth Chen. "A Priority Service Program and Power Outage Costs: The Case of Taiwan's Cement Industry," October 1992. ***(No.9207)***

39. George J. Y. Hsu and Ai-chi Hsu. "Energy Intensity in Taiwan's Industrial Sectors: Divisia Index vs. Laspeyres Index," October 1992. ***(No.9208)***

40. Lee-in Chen Chiu. "Regional Differential of Enterprise Efficiency and Labor Productivity in Coastal China," December 1992. ***(No.9209)***

41. Chi-ming Hou & Chien-nan Wang. "Globalization and Regionalization -- Taiwan's Perspective," March 1993. ***(No.9301)***

42. Yi Chou. "The Practice Beyond Property Right Boundaries -- Quality Management in Chinese State-owned Enterprises and Rural Enterprises," March 1993. ***(No.9302)***

43. Tzong-shian Yu. "Economic Development in Transition -- The Case of Taiwan," June 1993. ***(No.9303)***

44. Tzong-shian Yu. "An Analysis of the Effects of Economic Policies on Taiwan's Economic Growth and Stability," June 1993. ***(No.9304)***

45. Ke-jeng Lan. "An Evaluation of the Effectiveness of Government Automation Promotion Schemes in the Electrical Component Industry," June 1993. ***(No.9305)***

46. Yi Chou. "Measurement of Technical Efficiency and Its Management Implications -- The Example of Taiwan Sugar Corporation," June 1993. ***(No.9306)***

47. Chien-nan Wang. "On the Choice of Exchange Rate Regimes," June 1993. ***(No.9307)***

48. Yi Chou & Chyau Tuan. "Quality Management of Chinese Township Enterprises in Inland and in Coastal Areas," November 1993. ***(No.9308)***

49. Lee-in Chen, Chiu and Jr-tsung Huang. "Improvement of Capital Productivity and Technical Efficiency via DFI: Evidence from the Industrial Interaction between Taiwan and Mainland China," December 1993. ***(No.9309)***

50. An-loh Lin. "Trade Effects of Direct Foreign Investment: The Bilateral Case," February 1994. ***(No.9401)***

51. Jiann-chyuan Wang and Homin Chen. "The Impact of North American Economic Integration on Taiwan," March 1994. ***(No.9402)***

52. Joseph S. Lee. "Is There a Bona Fide Labor Movement in Taiwan?" April 1994. ***(No.9403)***

53. Jiann-chyuan Wang and Kuen-hung Tsai. "An Evaluation of the Effect of Government Research and Development Promotion Schemes in the Electrical Component Industry," June 1994. ***(No.9404)***

54. Anthony H. Tu. "The Dynamic Self-Hedged Behavior During the Period of 1987 Crash: Evidence from the U.S. Stock Market," August 1994. ***(No.9405)***

55. Ji Chou, Yun-Peng Chu & Shiu-Tung Wang. "Effects of Trade Liberalization on Taiwan -A Computable General Equilibrium Analysis," October 1994. ***(No.9406)***