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Rice Reforms and Poverty in the Philippines: A CGE Analysis

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ABSTRACT

The quantitative restriction (QR) on rice will last until the end of 2004. This paper uses a computable general equilibrium (CGE) model to analyze the possible poverty and distributional effects of the removal of the QR and the reduction in tariffs on rice imports. Policy experiments indicate that while market reforms in rice lead to a reduction in the overall headcount poverty index, both the poverty gap and the squared poverty gap indices increase. The Gini coefficient rises as well. In general, these results imply that the poorest of the poor are adversely affected.

In particular, while market reforms in rice bring about a reduction in consumer prices that is favorable to all, imports of rice surge and generate displacement effects on poor households that rely heavily on agriculture for factor incomes, particularly on palay rice production and other related activities. Palay production and its output price decline. This translates to lower demand for factor inputs in the sector, lower factor prices in agriculture, and lower factor incomes for these households. Thus, poverty in these groups, as well as general income inequality, deteriorates. However, the results of the experiments involving various poverty-offsetting measures indicate that an increase in direct government transfers to these household groups can provide a better safety net.

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Rice Reforms and Poverty in the Philippines: A CGE Analysis

Caesar B. Cororaton[†]

1. Introduction

The Philippines is one of the three countries granted exemption in 1995 from the removal of quantitative restrictions (QR) on rice under Annex 5 of the World Trade Organization (WTO) agreement. Japan and South Korea are the other two. The exemption will expire on December 31, 2004. The primary objective of this paper is to examine the possible poverty and distributional effects of the removal of the QR and the reduction in tariffs on rice imports. In particular, it attempts to analyze the following issues: (a) Do the poor share in the potential gains from a freer market for rice? (b) What alternative or accompanying policy measures may be needed to ensure a more equitable distribution of the potential gains from a more liberalized market for rice? (c) What is the transmission mechanism through which the removal of the control may affect the poor? These are critical issues that the government must address as it implements market reform and opens the economy to imported rice.

Rice is the staple food for about 80 percent of Filipinos, and is therefore a major item in the consumption basket of consumers. It is the single most important agricultural crop in the Philippines, and is therefore a major source of income for millions of Filipino farmers. Because of its political significance, the government is heavily involved both in its supply and distribution to assure consumers a sufficient and stable supply at low prices and to maintain a reasonable return to rice farmers with adequate price incentives. One major policy instrument of the government at present is the control on imported rice through the QR.

Market reform in general and the removal of the QR on rice in particular could have economy-wide effects. In this regard, it is appropriate to analyze these issues using a computable general equilibrium (CGE) model calibrated to an input-output table and national accounts data. On the other hand, it is appropriate to study the effects of reforms on poverty and income distribution using individual household data to capture the heterogeneity of households. This paper integrates these two approaches. In particular, it specifies and calibrates an agriculture-focused CGE model to a set of actual data and simulates the effects of the removal of the QR on consumer prices and household income, and applies these results to a set of individual household data in the Family Income and Expenditure Survey (FIES) to compute the poverty and income distribution effects.

[†] This paper was written while the author was a Visiting Researcher at the Asian Development Bank Institute from December 2003 to May 2004. Support from the Institute and the comments of John Weiss on the earlier versions of the paper are gratefully acknowledged. However, the author is responsible for remaining errors and gaps in the analysis.

A number of studies in the Philippines have looked at policy issues concerning rice, but the methodology applied is mostly partial equilibrium analysis. Partial equilibrium analysis however underestimates the possible effects of the reforms because rice, being a major agricultural crop, has many direct and indirect linkages with the rest of the economy. Furthermore, most of the empirical work done does not extend the analysis to look at the impact on poverty. While existing literature provides estimates of changes in consumer and producer surpluses, as well as the Gini coefficient, it does not provide insights on the effects on poverty and on the depth of poverty. This paper addresses this methodological gap in the literature.

In the CGE literature there are two broad approaches to integrating a CGE model with national household surveys to analyze poverty and distributional issues. One is through microsimulation wherein the household categories in the model are the same as the household categories in the national household survey. As such, this approach allows for the heterogeneity of individual households during the numerical computation of the equilibrium of the model. The papers of Cogneau and Robillard (2000), Cockburn (2001), and Cororaton and Cockburn (2004) employ this approach.

The other approach is a more recursive one. For a given policy shock, a CGE model with representative households is used to estimate the change in the average income for each household category and the change in prices. These changes are then applied to an assumed income distribution of each household category (either lognormal or beta distribution) to conduct poverty and distributional analyses. The variance and other parameters of the distribution are estimated using data from the national household survey and are assumed fixed in the analyses, while the first moment of the distribution is altered using the results from the CGE model. The papers of De Janvry, Sadoulet and Fargeix (1991) and Decaluwe, Dumot, and Savard (1999) and Decaluwe, Party, Savard, and Thorbecke (2000) employ this approach. The present paper applies this second approach, but uses the actual income distribution from the 1994 FIES.

The paper is organized in seven sections. The second discusses the government policies in the rice sector and the production structure of the sector, including prices. The third looks at current issues of food and poverty. The fourth discusses in detail the model used in the analysis, including the parameters, the elasticities and the model structure at the base. The fifth gives a description of the poverty and distribution measures used in the analysis. The sixth outlines the various policy experiments conducted and discusses the results. The final section summarizes the results of the experiments and draws insights for policy.

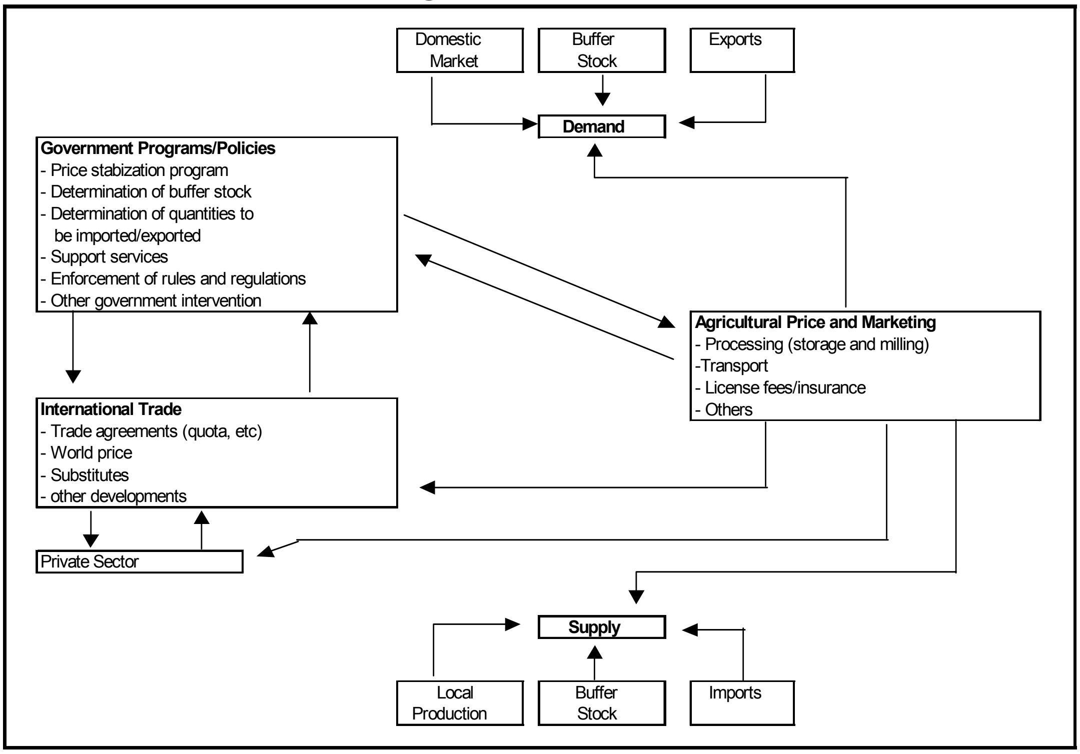
2. The Rice Sector

2.1. Rice Policy

Because of the political significance of rice, the government is heavily involved both in its supply and distribution to assure consumers a sufficient and stable supply at low prices and to maintain reasonable return to rice farmers with adequate price incentives. Figure 1 presents a broad diagram of how government interventions may have influenced activities in rice. Three major components affect the supply of rice: local production, buffer stock, and imports. On the other hand, three factors affect the demand side: domestic market, buffer stock and exports.

The present pricing policy of the government involves the setting and defending of price floor and ceiling. It also minimizes seasonal price variations in the various regions. Furthermore, the government monopolizes the importation and exportation of rice through its various procurement and disbursement operations in order to influence domestic price levels. Currently, government interventions are implemented through the National Food Authority (NFA), which is an attached agency of the Department of Agriculture. The NFA took over the operation of the National Grains Authority (NGA), which was in operation from 1972 to 1981. The administration of NGA in turn succeeded the Rice and Corn Administration, which operated from 1962 to 1972.

Figure 1. Rice Activities



Source: Chupungco (1991)

The literature shows that the government policy on rice is relatively more successful in defending consumer price ceilings than price floors. As a result, farm prices remained below palay support prices for a number of reasons, which include an inadequate NFA procurement budget and delays in NFA purchases. Thus, margins are squeezed, resulting in reduced investment in postharvest facilities and less planting given the unattractive price to farmers. On the other hand, in the long-run the consumer-oriented pricing policy fails to benefit consumers as it reduces rice availability.

The partial equilibrium analysis of Roumasset (2000) indicates that the excess burden of the current rice policy amounted to P48.79 billion in 1999. This estimate does not account for the financial cost of subsidies to the NFA.

In 1999, ADB approved a loan facility amounting to US$75 million to support grain policy reform in the Philippines, called the Grains Sector Development Program (GSDP).[1] The policy framework of GSDP focused on: (i) liberalizing and instituting more cost effective grains pricing and import policies; (ii) improving the administration of grain buffer stocks; (iii) restructuring the NFA from a grains marketing monopoly into a public regulatory agency and separate private sector marketing corporation; and (iv) implementing a well-targeted and effective food subsidy program for the poor.

2.2. Rice Production Structure and Prices

The contribution of palay (unhusked) rice production to the gross domestic product (GDP) ranges from 2 to 3 percent over the last 10 years, while the share of "rice and corn milling" is about 2.3 percent (Table 1). Among agricultural crops, cereals production, particularly palay rice, dominates in terms of area planted, volume of production and value of output (Table 2). From 1993 to 2002, more than 50 percent of agricultural area was planted with palay rice and corn. In recent years, the share of palay rice production increased in terms of area planted and quantity produced, as well as in terms of value of output. In 2002, about 38 percent of the value of output of agricultural crops came from palay rice production.

Table 1. Contribution of Agriculture to GDP (%)

	1993	1997	2003
1. AGRICULTURE, FISHERY, FORESTRY	**21.7**	**18.7**	**14.5**
a. AGRICULTURE	17.4	15.8	12.3
Palay	2.9	3.0	2.2
Corn	1.2	0.9	0.6
Coconut including copra	1.3	1.0	0.7
Sugarcane	0.7	0.5	0.4
Banana	0.7	0.5	0.5
Other crops	5.2	4.9	3.9
Livestock	2.7	2.5	1.9
Poultry	1.9	1.5	1.3
Agricultural activities & services	1.0	0.9	0.7
b. FISHERY	3.9	2.8	2.2
c. FORESTRY	0.4	0.1	0.1
2. INDUSTRY SECTOR	**32.9**	**32.2**	**32.3**
Rice and Corn Milling /a/			
3. SERVICE SECTOR	**45.4**	**49.1**	**53.2**
GROSS DOMESTIC PRODUCT	**100.0**	**100.0**	**100.0**

Source: Economic and Social Statistics Office, National Statistical Coordination Board

/a/ in 1994 Input-Output Table its contribution to total gross value added was about 2.3%

[1] However, the loan facility was cancelled because of unmet conditionalities.

Table 2. Agriculture Production (distribution, %)

	1993			1997			2002/p		
	Area	Quantity	Value	Area	Quantity	Value	Area	Quantity	Value
A. Cereals	**51.4**	**21.7**	**40.9**	**51.7**	**22.8**	**41.6**	**50.1**	**24.2**	**47.2**
Palay	26.3	14.4	28.6	30.3	16.5	31.6	31.5	18.2	37.9
Corn	25.2	7.3	12.3	21.5	6.3	10.0	18.6	5.9	9.3
B. Major Crops	**38.4**	**64.9**	**41.9**	**39.0**	**68.6**	**44.9**	**45.9**	**71.7**	**45.5**
Coconut	24.6	17.3	13.2	24.7	20.1	12.0	31.8	18.8	11.6
Sugarcane	3.1	34.9	5.5	3.0	32.6	5.5	2.9	37.4	7.0
Banana	2.6	4.8	6.0	2.7	6.5	7.0	3.1	7.2	9.4
Pineapple	0.3	2.0	3.1	0.3	2.4	4.0	0.4	2.2	3.3
Mango	0.5	0.6	3.6	1.0	1.4	5.6	1.1	1.3	4.8
Other major crops	7.3	5.4	10.6	7.3	5.6	10.8	6.6	4.7	9.3
Other Crops	**10.1**	**13.4**	**17.2**	**9.3**	**8.6**	**13.5**	**3.9**	**4.1**	**7.2**

Source: Philippine Statistical Yearbook

/p: preliminary

There are two varieties of palay rice production: modern variety (MV) and traditional variety (TD). Over the last three decades, the share of MV production has almost doubled from 55 percent in 1970 to 95 percent in 1999 (Table 3). The production of MV palay rice is more productive than TV in terms of yield per hectare. In 1970, the average productivity of MV production was 1.93 metric tons per hectare, compared to 1.51 for TV. During the last three decades, both saw a steady upward trend, with MV's productivity increasing to 3 metric tons per hectare in 1999 and TV's to 2.13.

Table 3. Palay Production (distribution, %)

		Production			Area Harvested			Yield (mt/ha)		
		Total	MV*	TV*	Total	MV	TV	Total	MV	TV
All Ecosystem	1970	100	55	45	100	48	52	1.71	1.93	1.51
	1975	100	71	29	100	62	38	1.76	1.99	1.38
	1980	100	85	15	100	78	22	2.20	2.42	1.45
	1985	100	92	8	100	89	11	2.71	2.80	2.01
	1990	100	93	7	100	89	11	2.81	2.94	1.77
	1995	100	94	6	100	91	9	2.80	2.89	1.97
	1999	100	95	5	100	94	6	2.95	3.00	2.13
Irrigated	1970	100	68	32	100	66	34	2.06	2.12	1.94
	1975	100	82	18	100	80	20	2.31	2.37	2.06
	1980	100	91	9	100	88	12	2.80	2.90	2.10
	1985	100	94	6	100	93	7	3.17	3.21	2.65
	1990	100	95	5	100	93	7	3.29	3.35	2.36
	1995	100	95	5	100	94	6	3.26	3.30	2.49
	1999	100	97	3	100	95	5	3.35	3.38	2.59
Rainfed & Upland	1970	100	38	62	100	33	67	1.42	1.61	1.32
	1975	100	57	43	100	50	50	1.37	1.56	1.18
	1980	100	77	23	100	69	31	1.69	1.89	1.24
	1985	100	86	14	100	83	17	2.11	2.20	1.68
	1990	100	88	12	100	82	18	2.07	2.21	1.43
	1995	100	89	11	100	85	15	2.07	2.14	1.62
	1999	100	92	8	100	90	10	2.15	2.20	1.74

Source: Rice Statistics Handbook, PhilRice - Bureau of Agricultural Statistics, Department of Agriculture

* mt is metric tons, ha is hectares

** MV is modern variety and TV is traditional variety

There are two types of ecosystem in palay rice production: irrigated and non-irrigated (rainfed and upland). The last three decades saw a significant shift to irrigated palay rice farming, from 55 percent in 1970 to 76 percent in 1999 (Table 4). Irrigated palay rice farming is more productive than non-irrigated. In 1999, the former had an average yield of 3.35 metric tons per hectare, while the latter was 2.15 (Table 3).

Table 4. Irrigated & Non-Irrigated (distribution, %)

	Palay Production			Area Harvested		
	Total	Irrigated	Non-Irrigated	Total	Irrigated	Non-Irrigated
1970	100	55	45	100	46	54
1975	100	54	46	100	41	59
1980	100	59	41	100	46	54
1985	100	66	34	100	56	44
1990	100	71	29	100	61	39
1995	100	72	28	100	62	38
1999	100	76	24	100	67	33

Source: Rice Statistics Handbook, PhilRice - Bureau of Agricultural Statistics, Department of Agriculture

Rice is mainly used for food consumption (Table 5). In 1999, about 97 percent of the production was consumed as food. There are two sources of rice: local production and imports. During the last ten years, local production has become less and less able to meet local demand because of high population growth. Thus, rice imports increased from 412,000 metric tons in 1990 to 757,000 metric tons in 1999. There was, however, a blip in 1998, due largely to the sharp drop in palay rice production because of El Nino. In 1998, imported rice amounted to 1,856,000 metric tons.

Table 5. Production and Consumption of Rice

	Production (' 000 mt)	Consumption (' 000 mt)				Surplus/ (Deficit) /a/ (' 000 mt)	Population ('000)
		Total	Food	Seeds	Feeds & Wastes		
1970	3,246	3,367	3,014	142	211	(120)	36,852
1975	3,988	4,262	3,833	170	259	(274)	42,259
1980	4,970	4,945	4,453	169	323	25	48,317
1985	5,759	5,693	5,156	162	374	67	54,257
1990	6,095	6,507	5,949	163	396	(412)	60,910
1995	6,852	7,182	6,553	183	445	(330)	68,349
1997	7,325	7,878	7,214	187	476	(553)	71,550
1998	5,076	6,932	6,722		210	(1,856)	73,239
1999	7,011	7,768	7,532		236	(757)	74,967

Source: 1970-97 Rice Statistics Handbook, PhilRice - Bureau of Agricultural Statistics, Department of Agriculture, 1998-99 National Statistical Coordination Borad

/a/ Supplied by imports

Data on the disposition of palay rice production by farm households indicate that 22 percent of production was sold on the market in 1970, and 35 percent was used for personal food consumption (Table 6). The structure changed dramatically over time. In 1997, 46 percent of palay rice production of farm households was sold on the market, while the share for personal food consumption dropped to 29 percent. This trend implies that palay rice activities have become market oriented, and therefore increasingly vulnerable to market changes.

Table 6. Relative Distribution of Palay Production Utilization and Disposition of Farm Households, %

	Landlord's Share	Sold	Food	Seeds	Feeds	Others*	total
1970	20	22	35	3	1	18	100
1975	14	28	41	3	1	14	100
1980	13	39	34	3	1	11	100
1985	12	39	30	4	1	14	100
1990	10	41	30	4	1	15	100
1995	8	42	31	0	0	18	100
1997	9	46	29	0	0	17	100

* Seeds and/or feeds

Source: Rice Statistics Handbook, PhilRice - Bureau of Agricultural Statistics, Department of Agriculture

Fertilizer is a critical input into palay rice production. In fact, the use of fertilizers increased significantly over the last 15 years. Of the total area planted for palay rice in 1988 for both ecosystems, about 68 percent made use of fertilizers (Table 7). In 1997, the ratio increased to 86 percent, translating to an average use of 4.4 50-kilogram bags of fertilizer[2] per hectare.

The intensity of fertilizer use in irrigated palay rice farms is higher than in non-irrigated farms. While almost 95 percent of irrigated palay rice farms used fertilizer in 1997, only 70 percent application was observed for non-irrigated palay rice farms.

[2] Including Urea, Ammosul, Complete, Ammopohos, and others.

Table 7. Fertilizer Use

		Area Planted ('000 hectare)	Area Applied		Average Fertilzer Use per hectare (bag of 50 kg)
			Area	%	
All Philippines	1988	3,571	2,422	67.8	3.5
	1989	3,571	2,772	77.6	3.6
	1990	3,415	2,726	79.8	3.9
	1991	3,488	2,871	82.3	3.6
	1992	3,287	2,610	79.4	3.9
	1993	3,346	2,735	81.7	4.1
	1994	3,735	3,026	81.0	4.1
	1995	3,814	3,191	83.7	4.0
	1996	4,009	3,429	85.5	4.4
	1997	3,902	3,362	86.2	4.4
Irrigated	1991	2,092	1,894	90.5	
	1992	2,020	1,756	86.9	
	1993	2,047	1,821	89.0	
	1994	2,264	2,058	90.9	
	1995	2,366	2,216	93.7	
	1996	2,508	2,389	95.3	
	1997	2,529	2,397	94.8	
Rainfed	1991	1,396	977	70.0	
	1992	1,267	854	67.4	
	1993	1,300	915	70.4	
	1994	1,471	968	65.8	
	1995	1,448	975	67.3	
	1996	1,502	1,039	69.2	
	1997	1,373	965	70.3	

Source: Rice Statistics Handbook, PhilRice - Bureau of Agricultural Statistics, Department of Agriculture

Government intervention in rice activities is through NFA's procurement of palay rice from the farmers and rice injections into the market. In principle, the former protects farmers from low market prices of palay rice and therefore assures them of adequate income, while the latter protects the general consuming public from high market prices for rice. On the procurement side, data would indicate that NFA's intervention has declined through time from 7.2 percent of total production in 1980 to 0.6 percent in 1994 and to 0.1 percent in 1995 (Table 8). It recovered slightly to 1.1 percent in 1996, but declined again to 0.9 percent in 1997. This is largely due to NFA's budgetary problems.[3] On the other hand, NFA's rice injections into the system have been relatively significant. In 1996, NFA's injection of rice into the market was 9.2 percent of the overall supply. It dropped slightly to 8.2 percent in 1997.

[3] To date, NFA is saddled with huge financial losses.

Table 8. National Food Authority's Palay Procurement and Rice Injection

	Palay (' 000 mt)			Rice (' 000 mt)		
	Procurement (a)	Production (b)	(a)/(b), %	Injection (c)	Supply (d)	(c)/(d), %
1975	233	6,381	3.7	227	4,262	5.3
1980	551	7,646	7.2	280	4,945	5.7
1985	401	8,806	4.6	365	5,693	6.4
1990	572	9,319	6.1	667	6,095	10.9
1991	555	9,673	5.7	158	6,196	2.6
1992	420	9,129	4.6	521	4,965	10.5
1993	155	9,434	1.6	489	5,357	9.1
1994	61	10,538	0.6	112	6,284	1.8
1995	8	10,541	0.1	257	7,182	3.6
1996	124	11,284	1.1	733	7,975	9.2
1997	101	11,269	0.9	623	7,625	8.2

Source: Rice Statistics Handbook, PhilRice - Bureau of Agricultural Statistics, Department of Agriculture

Both the wholesale and retail prices of rice are significantly higher than the farmgate prices of palay rice (Table 9). For the years where data are available, the gap has more than doubled. For example, in 1988 the farmgate price of ordinary palay rice was P3.2 per kilo, while the wholesale price of the same variety was P7.2 per kilo. The latter is 2.25 times (or 125 percent) higher than the former. There are no data available for the retail price of ordinary rice for the same year, but the data in the following year indicate a price of P7.9 per kilo, a figure 2.48 times higher (or 148 percent). In 2001, the gap is still more than double. The price gaps are much higher for high-quality rice.

The retail price of rice in the local market is largely determined by the QR on rice imports, which limits the flow of imported rice and artificially creates a scarcity rent that jacks up the local price, as theoretically depicted below. Meanwhile, actual data indicate that the gap between local prices of rice and world prices is large indeed. Take the case of the retail price of ordinary rice and the world price of rice for 35 percent broken, which are comparable in terms of quality. The gap has widened from 20 percent in 1989 to 130 percent in 2001.

3. Food and Poverty

About half of rural households live below poverty, while one-fifth of urban households fall below the poverty threshold (Table 10). More than 60 percent of expenditure of rural poor households is on food; about half is on cereals, consisting of rice and corn, with the former having a much larger share. An almost similar structure is observed in the expenditure pattern of urban poor households. Furthermore, rural and urban poor households—landless agricultural laborers, small-scale farmers, and urban unskilled workers—are principally net buyers of rice (David and Otsuka (1994)). These indicate that policy reforms on rice may have a significant impact on the consumption pattern of both rural and urban poor households, and therefore on poverty.

Table 9. Palay and Rice Prices

	Domestic Price, (pesos/kilo)*												World Price (pesos/kilo)**		Ordinary Rice Retail Price / 35% broken
	Palay, Farmgate Price				Rice, Wholesale Price				Rice, Retail Price						
	Fancy	Ordinary	Special	Other Variety	Fancy	Ordinary	Special	Premium	Fancy	Ordinary	Special	Premium	5% broken	35% broken	
1983	n.a	n.a	n.a	n.a	3.2	2.8	3.0	n.a	3.5	n.a	3.2	n.a	3.1	2.7	
1984	n.a	n.a	n.a	n.a	5.0	4.5	4.8	n.a	6.1	n.a	5.0	n.a	4.2	3.9	
1985	n.a	n.a	n.a	n.a	6.9	6.0	6.5	n.a	8.1	n.a	6.9	n.a	4.0	3.7	
1986	n.a	n.a	n.a	n.a	6.5	5.4	5.8	n.a	7.5	n.a	6.3	n.a	4.3	3.7	
1987	3.5	n.a	n.a	n.a	6.5	5.8	5.8	n.a	7.8	n.a	6.4	n.a	4.7	4.2	
1988	n.a	3.2	3.2	3.2	7.7	7.2	6.5	n.a	8.2	n.a	7.0	n.a	6.4	5.7	
1989	4.6	n.a	n.a	4.0	n.a	7.3	7.9	n.a	0.0	7.9	8.5	n.a	6.9	6.3	1.2
1990	5.1	n.a	n.a	4.8	10.1	8.5	8.8	n.a	11.6	8.9	9.5	n.a	7.0	6.0	1.5
1991	n.a	n.a	n.a	4.7	10.1	8.5	9.0	n.a	12.6	9.1	10.1	n.a	8.6	6.6	1.4
1992	n.a	n.a	n.a	4.8	10.7	8.9	9.5	n.a	0.0	9.7	10.4	n.a	7.3	5.9	1.6
1993	n.a	n.a	n.a	5.4	11.0	9.8	10.5	n.a	0.0	10.8	11.8	n.a	7.3	5.5	2.0
1994	8.0	n.a	n.a	5.9	n.a	11.3	12.1	n.a	16.0	12.2	13.3	n.a	7.1	9.2	1.3
1995	8.1	n.a	n.a	7.4	n.a	14.1	15.1	n.a	19.7	15.1	16.5	n.a	8.2	7.5	2.0
1996	10.3	7.5	8.7	8.2	21.8	15.8	17.4	19.5	23.9	17.1	19.0	21.3	8.9	7.2	2.4
1997	9.9	7.5	8.5	8.0	21.6	15.2	16.9	19.0	24.4	16.5	18.5	20.8	9.0	7.3	2.3
1998	10.7	8.1	9.0	n.a	22.3	15.8	17.4	19.7	24.9	17.1	19.0	21.4	12.4	10.2	1.7
1999	11.1	7.7	8.6	n.a	23.0	15.7	17.4	19.7	25.2	17.3	19.2	21.5	9.7	8.3	2.1
2000	n.a	n.a	n.a	n.a	23.3	16.2	17.8	19.9	25.7	17.6	19.5	21.7	8.9	7.4	2.4
2001	11.0	7.9	8.6	n.a	23.7	16.0	17.6	20.0	26.9	17.5	19.4	21.8	8.8	7.6	2.3

* Source: Bureau of Agricultural Statistics

** Source: World Bank (fob Bangkok; converted into pesos using average nominal exchange rate)

Grains production utilizes most agricultural resources. In particular, about 5 million hectares of arable land are devoted to rice and corn production, with two-thirds under palay. Furthermore, the majority of the rural population—about 1.8 million people—depend on the grains s-ector. This implies that if the government fails to intervene due to budgetary and other administrative problems so that farm palay prices fall below the support price, the impact on farm incomes could be substantial.

Table 10. Food and Poverty

	Rural				Urban			
Poverty Incidence	**1997**		50.7%		**1997**		21.6%	
	2000		48.8%		**2000**		18.6%	
	Poor		**Nonpoor**		**Poor**		**Nonpoor**	
Consumption	**1997**	**2000**	**1997**	**2000**	**1997**	**2000**	**1997**	**2000**
Food Consumption*	63.6%	63.6%	47.6%	47.6%	61.4%	60.8%	38.8%	38.7%
Cereals*	29.5%	28.8%	15.4%	14.6%	24.5%	23.0%	8.6%	8.2%

*Percent of Total Expenditure Survey

Source: 1997 and 2000 Family Income and Expenditure

4. CGE Model

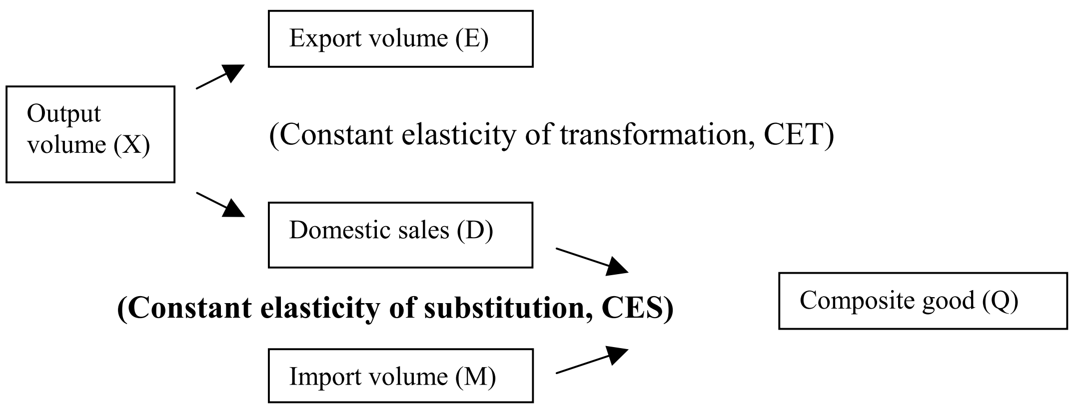
This section discusses the basic structure of the model. It introduces modifications to the basic structure to adequately address the issues in the paper. In particular, the agriculture module is modified to allow the use of land and water in production. Rice importation is augmented to include the import quota. The fertilizer price formation is modified to allow for a government subsidy. Trading in both palay and rice is expanded to accommodate NFA's buffer stock management, which allows the setting of a rice price ceiling for consumers and a palay price floor for farmers.

4.1. Basic Structure

A CGE model is used to carry out the analysis in the paper. An overview of the basic structure of the model is given below.

Figure 2 presents the basic price and volume relationships in the model. The model specifies a transformation function between exports (E) and domestic sales (D) using constant elasticity of transformation (CET). If the export price (Pe) increases relative to the local price (Pl), then export supply will increase while supply for domestic sales will decline. The supply side of the model assumes profit maximization. The first-order conditions for profit maximization generate the necessary supply functions and input demand functions.

Figure 2. The Basic Model



Prices:

Output price : $Px \cdot X = Pe \cdot E + Pl \cdot D$, where Pl is local prices

Export price: $Pe = Pwe \cdot er$, where Pwe is world price of exports and er is exchange rate

Domestic price: $Pd = Pl \cdot (1 + itx)$, where itx is indirect tax rate

Import price: $Pm = Pwm \cdot er \cdot (1 + tm) \cdot (1 + itx)$, Pwm is world price of imports and tm is tariff rate

Composite price: $Pq \cdot Q = Pd \cdot D + Pm \cdot M$

On the demand side, substitution is specified between imports and domestic goods using a constant elasticity of substitution (CES) function. In the CGE literature, this substitution can also be interpreted as product differentiation, where imports and domestically produced goods are treated as imperfect substitutes. If the import price in local currency (Pm) declines relative to domestic price (Pd), the demand for imports will increase while demand for local goods will decline. The first-order conditions for cost minimization generate the import and domestic demand functions.

Output price (Px) is the composite of export price (Pe) and local prices (Pl). Indirect taxes are added to the local price to determine domestic prices (Pd), which together with import price (Pm) will determine the composite commodity price (Pq). The composite price is the price paid by the consumers.

The import price (Pm) is denominated in domestic currency, and is affected by the world price of imports, exchange rate (er), tariff rate (tm), and indirect tax rate (itx). The direct effect of a tariff reduction, for example, is a reduction in Pm. If the reduction in Pm is significant enough, the composite price (Pq) will also decline.

Households maximize utility based on a linear expenditure system (LES). The relationship for intermediate demand assumes a set of fixed Leontief coefficients. The model consists of a one-period (static) set of relationships. Sectoral capital, as well as labor supply, is fixed. Furthermore, it assumes that total savings are invested.

The macroeconomic closure is as follows:

Total (E−M) = Total (S−I) + Total (Tx−G)

where E is total exports of goods and services, M is total imports of goods and services, S is total private savings, I is total private investment, Tx is total government income and G is total government expenditure.

The total (E−M), which is the external balance, is assumed to be fixed. This is also equivalent to assuming constant foreign savings. However, sectoral exports and imports are not fixed. They respond to changes in the relative price ratio between Pe and Pl, which is the real exchange rate. The nominal exchange rate, er, is fixed.

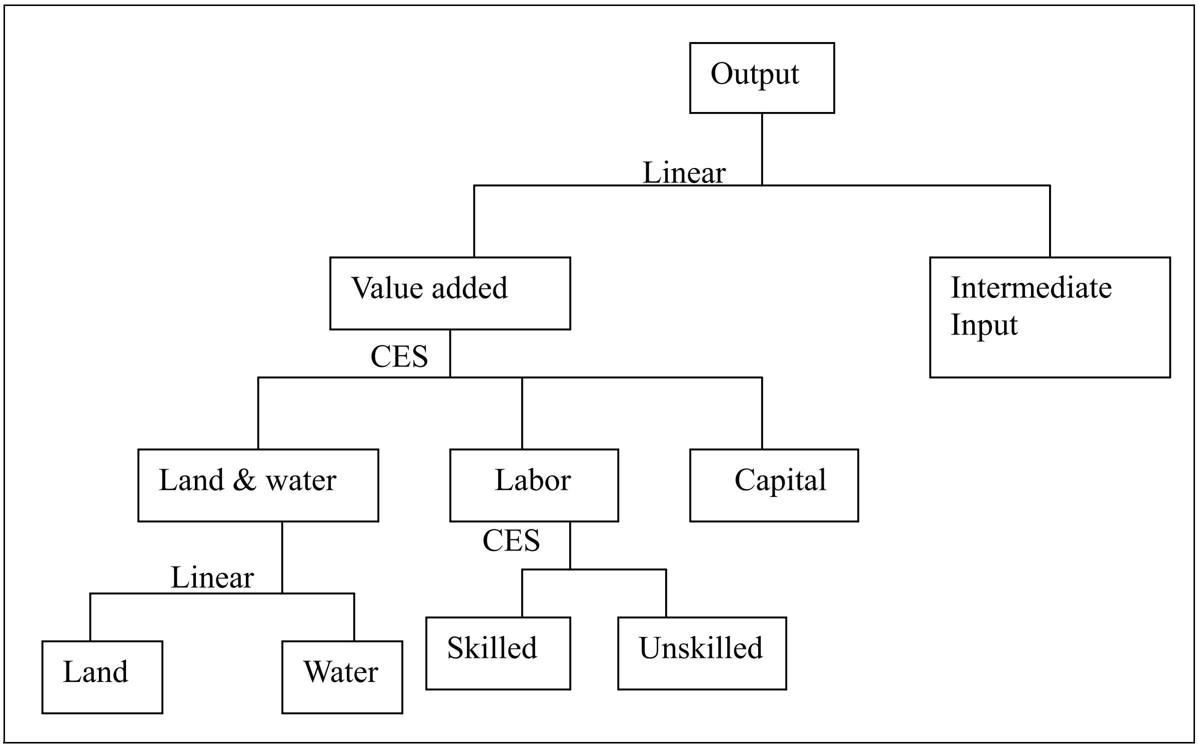
The total (S−I), which represents the private sector balance, is solved in the model. The total (Tx−G), which is the government balance, is closed using various closure rules that are discussed in detail below. However, in all the macroeconomic closure rules that are applied, government expenditure remains fixed.

4.2. Modifications

Agricultural Production. The basic model as described above uses equality constraints. However, this may be inadequate if applied to issues pertaining to agriculture. For example, land and water inputs may not be as substitutable as capital and labor in a well-behaved production function. Often, they are used in fixed proportions. In a numbers of instances, land and water may not be paid according to their marginal product contributions, or may not even be paid at all. Highly seasonal agriculture production results in the underutilization of land and water during certain periods of a given year. Thus, inequality constraints are more appropriate in modeling agriculture (Hazell and Norton (1986)).

Figure 3 shows how the agricultural module of the model is re-specified. Similar to the basic model, output is a linear combination of value added and intermediate inputs, with the latter determined by a set of fixed Leontief coefficients. However, this added time value is a CES combination of three factor inputs: capital, an aggregate labor input, and an aggregate land and water input. Capital is fixed, while aggregate labor is specified as a nested CES function of skilled and unskilled labor. Following Robinson and Gehlhar (1996) the aggregate land and water input is specified as a nested linear combination of land and water.

Figure 3. Agriculture Production Module



Source: Robinson and Gehlar (1996)

Following Lofgren and Robinson (1997), the agriculture module is formulated as mixed-complementarity problems (MCP). Basically, a model based on MCP contains a system of simultaneous equations (linear or nonlinear), which are a mixture of strict equalities and inequalities. The system works in such a way that each of the inequalities is linked with a bounded variable in a complementary-slackness relationship (Rutherford (1995)). The basic idea is similar to the Kuhn-Tucker necessary and sufficient conditions for optimality.

The agriculture production sector module in the revised model is specified as MCP. The details are presented in Table 11. Equation (1) is the value added (VA) CES function of three factor inputs: an aggregate labor (L), capital (K), and aggregate input consisting of land and water (LW). ρ is a substitution parameter, κ is a scale parameter and ω are factor weights. Equation (2) is a nested aggregate labor CES function of skilled (Ls) and unskilled labor (Lu). Like (1), this equation has 3 sets of parameters (φ, β, ψ). Equations (3) and (4) are demand functions for land (LN) and water (WA), respectively, which are linearly related to (LW) using fixed coefficients (α).

Equation (5) is the demand for the aggregate labor function, which is the first-order condition of profit maximization using the production function in (1). Pva is the value added price. Equation (6) is the first-order condition for cost minimization with (2) as the production constraint. This equation yields the demand functions for the two types of labor. Equation (7) gives the average wage (w), which is the average of the wage for skilled labor (ws) and unskilled labor (wu).

Equations (8) to (13) are a set of relationships that capture the complementary slackness conditions for optimization involving land and water. In particular, the conditions involve the relationship between the overall rent for the use of land and water, and their demand and supply situation. Like (5), Equation (8) is the demand for aggregate LW, and is derived as one of the first-order conditions for profit maximization. Equation (9) is the average rent for the use of (LW). It is the weighted average of the rent for land use and the rent for water use. However, both the rents for land use and water use have two components: (rln + rln_p) for land use and (rwa + rwa_p) for water use. The variables with the suffix _p signify the rent when land and water constraints are not binding. In this case these variables have a value of 1 when the supply of both water (WAS) and land (LNS) are greater than the corresponding demand. These are presented in Equations (10) and (11). When the constraints are binding, however, the overall rent for land use is (rln + rl_p) and for water use (rwa + rwa_p). The economic interpretation for this is that when the constraint is binding, the shadow price for the use of the resource is higher. Thus, if in agriculture the supply of water is binding, the overall cost of production is higher. If the water supply is increased (e.g. improvements in irrigation are carried out), this relaxes the constraints and reduces the cost of production. Equations (12) and (13) are the demand for land and water.[4]

Equation (14) is the zero-profit condition, which is required in competitive equilibrium models. It shows that value added is fully used to pay for the use of capital ($r \cdot K$), labor ($w \cdot L$) and land and water. Lastly, Equations (15) and (16) determine the market for skilled and unskilled labor.

[4] For a detailed discussion see Robinson and Gehlhar (1995)

Table 11. Agriculture Production Module Specified as MCP

(1) $VA = \kappa \cdot \left(\omega_L \cdot L^{-\rho} + \omega_K \cdot K^{-\rho} + \omega_{LW} \cdot LW^{-\rho}\right)^{-1/\rho}$	: value added
(2) $L = \varphi \cdot \left(\psi_s \cdot L_s^{-\beta} + \psi_u \cdot L_u^{-\beta}\right)^{-1/\beta}$	: labor aggregation function
(3) $LN = \alpha_{ln} \cdot LW$	: demand for land
(4) $WA = \alpha_{wa} \cdot LW$	: demand for water
(5) $L = VA \cdot \left(\dfrac{Pva \cdot \omega_L}{w \cdot \kappa^{\rho}}\right)^{1/1+\rho}$	: demand for aggregate labor
(6) $\dfrac{L_s}{L_u} = \left[\left(\dfrac{w_u}{w_s}\right) \cdot \left(\dfrac{\psi_s}{\psi_u}\right)\right]^{1/1+\beta}$	: demand for skilled and unskilled labor
(7) $w = \left(\dfrac{w_s \cdot L_s + w_u \cdot L_u}{L}\right)$	: average wage
(8) $LW = VA \cdot \left(\dfrac{Pva \cdot \omega_{LW}}{rlw \cdot \kappa^{\rho}}\right)^{1/1+\rho}$	: demand for composite land_water
(9) $rlw = \left[\dfrac{(rln + rln\_p) \cdot LN + (rwa + rwa\_p) \cdot WA}{LW}\right]$	: rent for land_water use
(10) $LNS \cdot rln\_p \geq \sum_i LN_i$	: land constraint
(11) $WAS \cdot rwa\_p \geq \sum_i WA_i$	: water constraint
(12) $lns \geq \sum_i ln_i$	: land market
(13) $was \geq \sum_i wa_i$	: water market
(14) $r \cdot K = Pva \cdot va - w \cdot L - (rwa + rwa\_p) \cdot wa - (rln{+}rln\_p) \cdot ln$	: 0-profit condition
(15) $LS_s = \sum_i L_s$	: market for skilled labor
(16) $LS_u = \sum_i L_u$	: market for unskilled labor

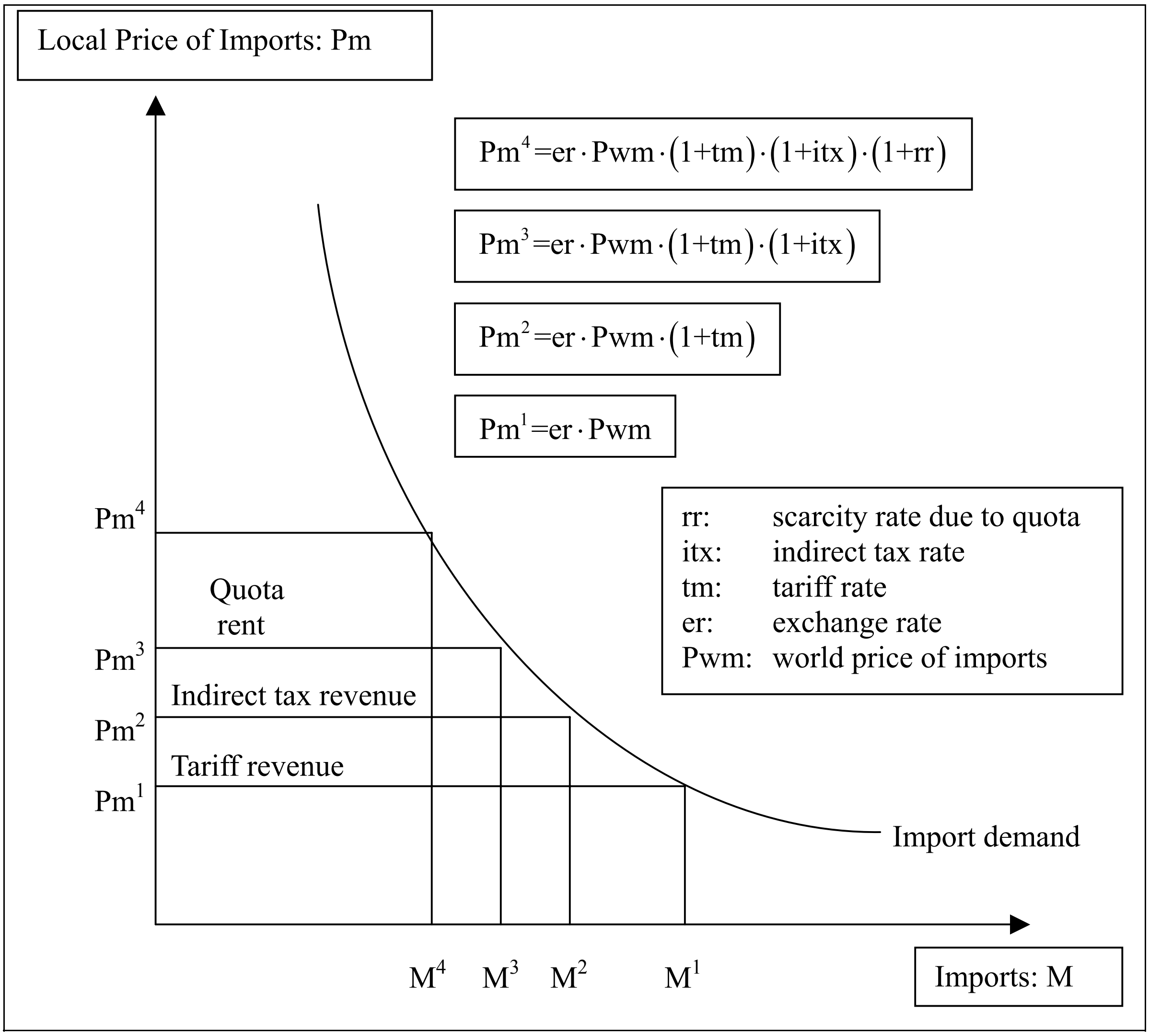
Import Quota. There are complicated issues to deal with when modeling import quotas (Francois and Reinert [1997]). In their paper, the import quota is viewed as a price distortion effect. If the domestic price of a good that is under an import quota is compared with its equivalent world price, then the price distortion effect of the quota can be computed. In the literature, this is called the price-gap method of estimating the tariff-equivalent of a quota, which is analogous to an ad valorem tariff rate.

Figure 4 shows the theoretical framework for modeling the import quota. The vertical axis shows the local price of imports, while the horizontal axis is the import volume. The import demand is downward sloping. The small country assumption is used in the analysis. This means that supply is perfectly elastic at a given world price of imports. If there is no import distortion, imports will be at M^1. The corresponding price of imports is Pm^1, which is the world price (Pwm) converted into domestic prices using the exchange rate (er). If a tariff (tm) is introduced, then import volume falls to M^2. The price of imports will be Pm^2. When imported goods are sold in the domestic market, they face an additional indirect tax (itx) similar to other domestic goods sold in the market. In this case, the import volume is reduced to M^3, while the price is increased to Pm^3.

Furthermore, if imports are restricted by a quota, say at M^4, then the corresponding price will be higher. Thus, on top of the tariff rate and the indirect tax rate, there is an additional price mark-up due to the scarcity premium, which we call rr. The final local market price of imports will be Pm^4. This distortion will generate three types of revenue: tariff revenue, $(Pm^2 – Pm^1) \times M^4$, and the indirect tax revenue, $(Pm^3 – Pm^2) \times M^4$, both of which will go to the government, and the quota rent, $(Pm^4 – Pm^3) \times M^4$, which will go to the holder of the import rights. This analysis of the quota is modeled as MCP, and presented in Table 12.

Equation (17) is a CES aggregation of imported (M) and domestically produced commodities (D). The resulting good is called the composite commodity (Q). This equation captures product differentiation between (M) and (D). Equation (18) is the first-order condition for cost minimization with (17) as the constraint. This equation yields the demand for imports. Thus, if the import price (Pm) decreases relative to domestic prices (Pd), imports will increase relative to domestically produced goods. Equation (19) gives the domestic price of imports inclusive of tariffs (tm), indirect tax (itx), and import quota scarcity premium (rr).

Figure 4. Domestic-Held Import Quota



Equation (20) defines the price of the composite good (Pq), which is the weighted average of import and domestic prices. Equation (21) is the domestic price (Pd) inclusive of indirect taxes. The local price before the indirect tax is (Pl), the cost of production of domestically produced goods. Equations (22) and (23) give a complementary slackness relationship between the import quota scarcity premium (rr) and the quota rent (Re). If the quota is not binding, then (rr) is zero; otherwise it has a positive value.

Equation (24) shows the consumer price (Pc) equal to the composite price (Pq). Thus, if (rr) is positive, (Pq) will be higher, and so will be (Pc). Equations (25) and (26) allocate the quota rent to the holders of import rights. In the case of the Philippines, NFA is the major holder of quota rights. However, it issues a very limited number of import licenses to private importers. Thus, household income (25) will increase by its share in the quota rent, while government income will also increase by its share in the rent. The other components of household income (Yh) consist of factor incomes, transfers and other incomes. The other components of government income (Yg) are revenues from taxation, and other incomes.

Table 12. Import Quota Specified as (MCP)

(17) $Q = \varphi \cdot \left(\mu_m \cdot M^{-\lambda} + \mu_d \cdot D^{-\lambda}\right)^{-1/\lambda}$	: composite good (imported & local goods)
(18) $\frac{M}{D} = \left[\left(\frac{Pd}{Pm}\right) \cdot \left(\frac{\mu_m}{\mu_d}\right)\right]^{1/1+\lambda}$	: demand for imports
(19) $Pm = er \cdot Pwm \cdot (1 + tm) \cdot (1 + itx) \cdot (1 + rr)$	: local price of imports
(20) $Pq = \left(\frac{Pm \cdot M + Pd \cdot D}{Q}\right)$	: price of composite good
(21) $Pd = Pl \cdot (1 + itx)$	: price of local goods
(22) $Re = er \cdot Pwm \cdot (1 + tm) \cdot (1 + itx) \cdot rr \cdot M$	: quota rent
(23) $\left(\overset{*}{M} - M\right) \geq 0$	: import quota
(24) $Pc = Pq$	: consumer prices
(25) $Yh' = Yh + \upsilon_h \cdot Re$	: household income + share in quota rent
(26) $Yg' = Yg + \upsilon_g \cdot Re$	: government income + share in quota rent

Price Ceiling on an Industrial Input into Agriculture. Fertilizer is an industrial input that is used heavily in agricultural production. It is also critical to palay rice production, as presented in Table 7. One policy instrument that may be used in supporting agriculture is a fertilizer price subsidy. In this model, the price subsidy is also specified as MCP as in Robinson, et al (1997). The relationships are presented in Table 13.

Table 13. Price Ceiling on Industrial Input into Agriculture Specified as MCP

(27) $Pci = Pqi \cdot (1 + tc - spc)$	: price of industrial input into agriculture
(28) $\left(\overset{*}{Pci} - Pci\right) \geq 0$	: price ceiling
(29) $Contax = (1 + tc - spc) \cdot Qi \cdot Pqi$	: consumption tax, inclusive of price subsidy
(30) $Yg'' = Yg' + Contax$	: government income with consumption tax

Equation (27) gives the price of the industrial input. It is the composite price (Pq) of imported and domestically produced inputs. To make it more general, it is further augmented to include a consumption tax (tc) for the use of the input and price subsidy (spc). The ceiling on price is in Equation (28). In this equation, if the input price (Pc) exceeds the ceiling price (Pc*), then the price subsidy (spc) will be positive. The model will search for the value of the price subsidy that will retain the inequality in (28).

One should note that the price subsidy is introduced not on the production side, but in consumption. Furthermore, the subsidy changes the relative sectoral consumption price, i.e. $\frac{pc_i}{pc_j}$ for sector $i \neq j$

Equation (29) gives the effect of the price subsidy on the income of the government. If the subsidy is positive, it will entail a reduction in government income. Equation (30) is the augmented government income.

<u>Price Ceiling, Price Floor, and Buffer Stock Management</u>. One of the key government interventions in rice activities in the Philippines is the setting of a price ceiling to protect consumers, the setting of price floors to protect rice farmers, and the maintenance of a buffer stock to assure an adequate supply of rice. All these are done through NFA. In the model, this mechanism is specified as MCP as in Robinson et al (1997) and presented in Table 14.

Table 14. Price Ceiling, Price Floor, and Buffer Stock Management

(31) $\left(Px - \overset{*}{Px}_f\right) \geq 0$	: farm gate price floor
(32) $\left(\overset{*}{Pc} - Pc\right) \geq 0$	: consumer price ceiling
(33) $\left(N\_stk - N\_\overset{*}{stk}_l\right) \geq 0$	: stock lower bound
(34) $\left(N\_\overset{*}{stk}_h - N\_stk\right) \geq 0$	: stock upper bound
(35) $N\_stk = N\_stk_0 + N\_buy - N\_sel + N\_m - N\_e$	: buffer stock management
(36) $Q = C + Inv + Intd - N\_sel + N\_buy$	: product market equilibrium
(37) $Cab = Cab' + er \cdot Pwm \cdot N\_m - er \cdot Pwe \cdot N\_e$	: current account balance
(38) $Yg''' = Yg'' + Pc \cdot N\_sel - Pc \cdot N\_buy + er \cdot Pwe \cdot N\_e - er \cdot Pwm \cdot N\_m$	: gov't revenue

Equation (31) sets the farmgate price floor, while Equation (32) sets the consumer price ceiling. Equation (33) sets the lower bound of NFA's buffer stock of rice, while Equation (34) sets the upper bound. Equation (35) is the buffer stock equation of NFA. If the farmgate price of palay (Px) goes below the set price floor (Pxf*), then NFA will start buying palay (N_buy) to support the farmers. The support buying is an artificial demand and will continue until the inequality in (31) is recovered. However, these support buying activities will increase the level of the buffer stock.[5] In the product market equilibrium equation in (36), the support buying by the NFA effectively increases the overall demand for the commodity (demand elements come in as positive in the right-hand side of the equation). Also, since NFA is a government agency, its support buying of palay means additional expenditures for the government, as shown in Equation (38).

On the other hand, if the consumer price of rice exceeds the set price ceiling, NFA will sell rice (N_sel) to the general public to increase the supply of rice artificially. The selling of rice will persist until the inequality in (32) is recovered. However, the selling of rice to the domestic market drains the buffer stock level of NFA in (35). If the selling continues and violates (33), i.e., the buffer stock level goes below the critical level set by (N_stk_l*), then NFA will start importing rice (N_m) to replenish the amount of rice sold onto the market. These rice imports will be reflected in the current account balance in Equation (37). Furthermore, the government will have to pay for this imported rice as shown in Equation (38). A similar mechanism will occur, but in the reverse direction, if the buffer stock exceeds the upper bound as a result of heavy support buying of palay. The government then has to export the excess stock of rice, which will in turn generate revenue. Exports of rice will be reflected in the current account balance.

The model is programmed with the GAMS (General Algebraic Modelling System). The model is solved using the solver called MILES (Mixed Inequality and nonLinear Equation Solver).[6]

4.3. Base Model Structure, Parameters, and Elasticities

The production sector is disaggregated into 15 sectors, with 6 agricultural sub-sectors, 6 industrial sub-sectors, and 3 service sectors. Palay rice production is disaggregated into irrigated and non-irrigated production. Corn also has a separate sector. In the manufacturing sub-sector, 'rice and corn milling' is a separate sector as well. However, there is no information available to break up these into two separate milling activities. Fertilizer has a separate sector because of its importance to agricultural production. The 1994 Input-Output (IO) table is the source of basic data on sectoral production and production technology.

The model incorporates two types of labor: agricultural and production labor. Agricultural labor is devoted only to the agricultural sector. However, production labor

[5] In the model 65% of palay milled comes out as final rice.

[6] The model is coded in GAMS and is available from the author upon request.

can work in both agriculture and non-agriculture sectors. Furthermore, there are two classes of labor within each type: skilled and unskilled. Skilled labor includes professionals, managers, and other related workers with at least a high school diploma. The rest are unskilled. The Labor Force Survey (LFS) is the source of basic information on labor types and classes.

Table 15. Definition of Household Groups

Urban	urb1	worked for private household and private establishment; zero education up to third year high school
	urb2	worked for private household and private establishment; high school graduate and up
	urb3	worked for government/government corporation
	urb4	self-employed without employee; zero education up to third year high school; including unemployed during 1994 survey.
	urb5	self-employed without employee; high school graduate and up; including unemployed during 1994 survey.
	urb6	employed in own family-operated farm or business; worked with pay in own family-operated farm or business; and worked without pay in own family-operated farm or business
Rural	rur1	worked for private household and private establishment; zero education up to third year high school
	rur2	worked for private household and private establishment; high school graduate and up
	rur3	worked for government/government corporation
	rur4	self-employed without employee; zero education up to third year high school; including unemployed during 1994 survey.
	rur5	self-employed without employee; high school graduate and up; including unemployed during 1994 survey.
	rur6	employed in own family-operated farm or business; worked with pay in own family-operated farm or business; and worked without pay in own family-operated farm or business

Source: 1994 Family Income and Expenditure Survey

The household sector is broken down into 12 socio-economic groups (Table 15). There are six urban household groups and six rural household groups, each category being broken down according to the type of occupation and the level of education of the head of the family, which is consistent with the classes and types of labor described above. The 1994 Family Income and Expenditure Survey (FIES) is the source of information on households.

Table 16 presents some of the characteristics of the household groups. Among urban household groups, urb1 has the lowest per capita income, followed by urb4. While both groups have a low level of education, the former is employed while the latter is self-employed. Households in the informal urban sector and the unemployed are included in the latter. The highest poverty indicators (headcount, gap, and severity) among urban households are found in these two groups.

Table 16. Household Income, Poverty Line and Poverty Indices
(1994 prices)

Households	Per capita Income (p)	Poverty Line (p)	Poverty Headcount,%	Poverty Gap,%	Poverty Severity,%
Philippines	15,730	8,897	40.7	13.7	6.2
urb1	13,000	9,688	41.7	12.9	5.6
urb2	26,954	10,181	15.5	3.7	1.3
urb3	26,468	9,665	10.2	2.5	0.9
urb4	14,472	9,584	42.3	14.9	6.9
urb5	27,980	10,138	16.9	4.8	2.1
urb6	35,650	9,647	18.2	6.0	2.8
rur1	8,247	7,827	58.7	19.7	8.8
rur2	13,723	8,177	31.3	9.7	4.3
rur3	18,123	8,106	22.4	6.8	2.9
rur4	8,559	7,984	61.0	21.9	10.3
rur5	13,756	8,259	37.5	12.0	5.0
rur6	13,641	7,607	39.9	12.0	5.2

Source: 1994 Family Income and Expenditure Survey

A similar pattern is observed in rural households, although the numbers are higher for poverty and lower for income. The lowest per capita income is in rur1, followed by rur4. Worse poverty indicators than among rural households are observed in these groups. Furthermore, among all households, rur4 has the highest headcount ratio of 61.0 percent, followed by rur1 with a ratio of 58.7 percent.

Table 17. Consumption Shares of Household Groups, %

	urb1	urb2	urb3	urb4	urb5	urb6	rur1	rur2	rur3	rur4	rur5	rur6
Irrigated Palay	-	-	-	-	-	-	-	-	-	-	-	-
Non_Irrigated Palay	-	-	-	-	-	-	-	-	-	-	-	-
Corn	0.2	0.2	0.1	0.2	0.1	0.1	0.3	0.2	0.2	0.3	0.2	0.2
Sugarcane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Livestock	8.7	6.3	5.8	7.6	6.0	4.8	11.0	8.9	7.7	10.5	8.7	9.3
Other Agriculture	4.0	2.9	2.7	3.5	2.8	2.2	5.1	4.2	3.6	4.9	4.0	4.3
AGRICULTURE	**12.9**	**9.4**	**8.6**	**11.3**	**8.9**	**7.2**	**16.3**	**13.3**	**11.5**	**15.7**	**13.0**	**13.9**
Food Processing	9.3	6.7	6.1	8.1	6.4	5.2	11.7	9.5	8.2	11.2	9.3	9.9
Rice and Corn Milling	11.1	8.0	7.3	9.6	7.7	6.2	14.0	11.4	9.8	13.4	11.1	11.9
Sugar Milling	1.2	0.8	0.8	1.0	0.8	0.6	1.5	1.2	1.0	1.4	1.2	1.2
Fertilizer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other manufacturing	26.4	23.7	23.1	24.5	23.3	22.5	29.3	27.4	25.6	27.4	26.6	27.2
Other industry	1.6	2.0	1.9	1.6	1.8	2.2	1.2	1.3	1.4	1.2	1.3	1.3
INDUSTRY	**49.5**	**41.3**	**39.3**	**44.8**	**40.0**	**36.7**	**57.7**	**50.9**	**46.2**	**54.7**	**49.6**	**51.6**
Transportation	3.1	3.8	4.6	3.7	4.0	4.6	1.9	2.6	3.4	2.2	2.8	2.5
Other Services	34.5	45.5	47.5	40.3	47.0	51.5	24.1	33.2	39.0	27.5	34.7	32.0
Government Services	-	-	-	-	-	-	-	-	-	-	-	-
SERVICES	**37.6**	**49.3**	**52.1**	**43.9**	**51.0**	**56.1**	**26.0**	**35.8**	**42.3**	**29.7**	**37.5**	**34.5**
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: 1994 Social Accounting Matrix (Cororaton, 2003). The source of basic data is 1994 FIES

The structure of household consumption according to the production sector classification in the model is presented in Table 17. The source of the basic information is the 1994 FIES. While 'other services' and 'other manufacturing' have the highest shares in the household consumption basket, the share of 'rice and corn milling' is also significant, especially for household groups rur1 and rur4.

Table 18. Sources of Household Income, %

	urb1	urb2	urb3	urb4	urb5	urb6	rur1	rur2	rur3	rur4	rur5	rur6
Labor type 1 /a/	-	4.6	0.9	-	0.9	0.2	-	20.0	4.7	-	-	1.8
Labor type 2	17.4	-	-	8.6	-	0.8	29.8	-	-	19.5	5.6	9.0
Labor type 3	-	75.9	91.5	-	45.4	23.4	-	67.4	88.8	-	50.7	11.6
Labor type 4	42.0	-	-	5.6	-	-	14.2	-	-	17.1	-	5.7
Capital in Agriculture	10.7	0.9	0.3	4.9	0.3	0.6	20.1	3.6	1.2	11.2	3.5	6.1
Capital in Industry	3.3	1.1	0.8	23.3	7.0	41.3	2.0	0.5	0.9	15.4	11.9	33.1
Capital in Service	9.5	3.6	6.1	39.9	17.5	24.7	3.5	1.9	2.8	16.4	19.5	18.0
Land	3.1	0.3	0.1	1.4	0.1	0.2	5.7	1.0	0.3	3.2	1.0	1.7
Dividends	-	12.3	-	3.2	25.4	2.3	-	1.3	0.0	-	-	-
Govertment transfers	12.3	1.1	0.3	5.6	0.3	0.7	23.2	4.1	1.3	13.0	3.9	7.0
Foreign Income	1.7	0.2	0.1	7.4	3.1	5.9	1.6	0.2	0.0	4.2	3.8	5.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: 1994 Social Accounting Matrix (Cororaton, 2003). The sources of basic data are: 1994 FIES and Labor Force Survey
/a/ Type 1 is agriculture labor high school graduate and up; Type 2 agriculture labor below high graduate
Type 3 is production labor high school graduate and up; Type 4 production labor below high graduate

On the other hand, the structure of the sources of household income is presented in Table 18. Income sources include labor income (broken down into the types and classes of labor), capital used in the agriculture, industry, and service sector, land, and other sources, which include dividends, transfers and foreign income.

The trade and production elasticities used in the model were derived from another CGE model of the Philippines (Clarete and Warr [1992.] They are presented in Table 19. Other features of the structure of the model at the base, such as trade shares and intensities, value added and output shares, are also presented in the table. One may observe that 'other manufacturing' dominates both the export and import flows of the economy.

Table 19. Elasticities and Parameters

Sectors	Elasticities /a/				Exports (%)		Imports (%)		Value Added (%)		Output
	Sig_m	Sig_e	Sig_va	Sig_l	Share	Intensity /b/	Share	Intensity /c/	Share	Ratio to Output	Share (%)
Irrigated Palay	3.7	0.20	0.8	0.50	0.00	-	0.0	0.014	2.0	78.8	1.28
Non_Irrigated Palay	3.7	0.30	0.8	0.50	0.00	-	0.0	0.00	0.8	78.6	0.55
Corn	3.7	0.35	0.8	0.50	0.01	0.2	0.2	4.55	1.1	76.3	0.74
Sugarcane	0.2	0.30	0.8	0.50	0.00	-	0.0	0.00	0.6	71.9	0.41
Livestock	1.4	0.60	0.8	0.50	3.38	8.4	0.7	1.75	8.3	68.2	6.19
Other Agriculture	1.1	1.50	0.8	0.50	3.07	10.8	0.6	2.30	7.2	85.9	4.31
AGRICULTURE					**6.46**	**7.5**	**1.5**	**1.79**	**20.0**	**75.8**	**13.5**
Food Processing	1.1	1.50	1.1	0.30	2.21	9.0	1.3	5.50	2.2	29.4	3.90
Rice and Corn Milling	3.7	0.60	1.1	0.29	0.04	0.2	0.3	1.19	2.5	32.0	3.93
Sugar Milling	3.7	1.50	1.1	0.49	0.40	8.9	0.2	5.36	0.4	31.3	0.71
Fertilizer	0.6	1.37	1.1	0.41	0.53	43.0	1.3	65.10	0.1	20.5	0.34
Other manufacturing	0.8	2.50	1.1	0.40	53.62	30.8	78.3	39.15	16.9	26.4	32.81
Other industry	0.8	0.90	1.1	0.30	2.91	5.4	7.3	12.36	9.4	49.2	9.73
INDUSTRY					**59.71**	**21.2**	**88.8**	**28.33**	**31.6**	**31.4**	**51.4**
Transportation	0.25	0.60	1.2	0.30	4.44	15.7	0.9	3.52	3.9	48.8	4.10
Other Services	0.25	1.30	1.2	0.25	29.39	16.9	8.8	5.73	36.9	74.4	25.34
Government Services						-	0.0	0.00	7.7	69.0	5.68
SERVICES					**33.83**	**14.3**	**9.7**	**4.54**	**48.5**	**70.5**	**35.1**
TOTAL					**100.0**	**16.5**	**100.0**	**16.4**	**100.0**	**51.1**	**100.0**

/a/ Based on estimates of Clarete and Warr (1992). Sig_m is Armington elasticity in the import function; Sig_e is the constant elasticity of transformation in the export function, Sig_va is the production elasticity in the value addedd function, and Sig_l is the labor elasticity in the labor aggregation function; /b/ ratio to output; /c/ ratio to total supply

5. Poverty and Distribution Measures

The income distribution effects are measured in terms of the change in the Gini coefficient before and after the policy shift. The formula for the Gini coefficient used is

$$\text{Gini coefficient} = \left(\frac{1}{2\times n^2}\right)\times\left[\sum_i w_i \times \sum_j w_j \left|y_i - y_j\right|\right]$$

where n is the overall population; i and j are household indices; w_i and w_j are the number of people in household i and j, respectively (note that $\sum_i w_i = n$ and $\sum_j w_j = n$), and y_i and y_j are income of household i and j, respectively.

On the other hand, the effects on poverty are measured using the change in the Foster-Greer-Thorbecke (FGT) indices before and after the policy shift. In general, the FGT poverty measure is[7]

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right)^\alpha$$

[7] See Ravallion (1992) for a detailed discussion.

where n is population size, q is number of people below the poverty line, y_i is income, z is the poverty threshold. The poverty threshold is equal to the food threshold plus the non-food threshold, where threshold refers to the cost of basic food and non-food requirements. The parameter α can have three values, each one indicating a measure of poverty. The headcount index of poverty has $\alpha = 0$. This is the common index of poverty, which measures the proportion of the population whose income (or consumption) falls below the poverty threshold. The poverty gap index has $\alpha = 1$. This measures the depth of poverty in the sense that it indicates how far below on average the poor are from the poverty threshold. The poverty severity index has $\alpha = 2$. This measure is sensitive to the distribution among the poor, as more weight is given to those furthest below the poverty threshold. This is because the poverty severity index corresponds to the squared average distance of income of the poor from the poverty line, and hence gives more weight to the poorest of the poor in the population.

To capture the extent of poverty before the policy experiment on rice reform, actual household income and the poverty line from the 1994 FIES were used to compute the FGT indices. These indices serve as the base in the analysis. Households were grouped according to the classification in Table 15.

The policy experiment using the CGE model generates the change in the average income of the representative household groups defined in Table 15. These average income changes are applied to the actual household income in the FIES to determine the impact of the policy on household income.

The CGE simulation also generates the change in the consumer price of goods defined in the model. The consumption weights of each household group in Table 17 were used to calculate the weighted consumer price of each of the groups. The computed change in the weighted consumer price was used to compute the nominal change in the poverty line after the policy experiment. In particular, the actual poverty threshold at the base is set at $Z_0 = P_0 \times \overline{X}_0$, where Z_0 is the poverty threshold, P_0 the consumer price, and $\overline{X}_0$ is the 'minimum basic needs'. The 'minimum basic needs' are assumed to be fixed before and after the policy experiment.

The new poverty threshold is computed by replacing P_0 with a new price that is derived using the results for the weighted consumer price from the CGE model. That is, $Z_1 = P_1 \times \overline{X}_0$ where Z_1 is the new poverty threshold and P_1 is the new price derived using the results from the CGE simulation. Since the 'minimum basic needs' are assumed fixed, in effect this process changes the nominal value of the poverty threshold.

The change in household income and the change in the nominal value of the poverty threshold after the policy experiment generate a new set of FGT indices These are compared with the FGT at the base to determine whether a policy change is poverty-improving or not.

6. Policy Simulation

6.1. Definition of Policy Experiments

Table 20 summarizes the policy experiments conducted in the paper. The first experiment involves a reform of the trade policy for rice consisting of a zero import quota and a reduced tariff on rice imports to 10 percent without poverty-offsetting measures. The rest of the experiments involve various combinations of policy reform and poverty-reducing measures.

Table 20. Definition of Policy Experiments

Experiment	Policy Change	Poverty-Offsetting Measure	Government Balance	Compensatory Tax
SIM_1	zero import quota on rice; tariff rate on rice imports reduced to 10 %	none	government income fixed	indirect output tax
SIM_2	-same-	50 % reduction in the direct income tax rate of the following household groups: urb1, rur1, and rur4	government income fixed	indirect output tax
SIM_3	-same-	10% increase in government transfers to the following household groups: urb1, rur1, and rur4	government balance fixed	indirect output tax
SIM_4	-same-	50% fertilizer price subsidy	government income fixed	direct income tax
SIM_5	-same-	50% fertilizer price subsidy	government income fixed	indirect output tax

Experiment **SIM_1** is carried out in two steps. The first is the setting of the QR on imported rice. The QR is set so that the resulting local price of imported rice is 2.2 times (or 120 percent) the price without the QR. This is the average price gap over the period 1995-2001 (Table 9). The second step is the complete elimination of the QR and the reduction of the tariff rates of palay and rice imports from 40 percent to 10 percent. The solutions of the model in the first and second steps are compared to determine the impact on resource allocation, household income and consumer prices.

Government income is fixed in the experiment. Thus, any loss in government revenue from the implementation of the policy reform is compensated by an additional indirect output tax. The compensatory indirect output tax is applied in the following manner

$$Pd_i = Pl_i \times (1 + itx_i \times [1 + ntaxr])$$

where Pd_i is the domestic price of sector i, Pl_i the local prices before taxes, itx_i the indirect tax rate at the base, and ntaxr the endogenously determined compensatory tax. Note that ntaxr in this case introduces two effects: (a) it creates an additional wedge between domestic and local prices, and (b) it changes the relative sectoral domestic price, i.e. $\frac{Pd_i}{Pd_j}$ for sector $i \neq j$. Both will generate inefficiency effects.

Experiment **SIM_2** is similar to the first except that the direct income tax rates of the following household groups: urb1, rur1 and rur4, are reduced by 50 percent as a poverty-offsetting measure. The loss in government revenue is offset by a compensatory indirect output tax similar to SIM_1.

Experiment **SIM_3** is also similar to the first except that government transfers to the following household groups: urb1, rur1 and rur4, are increased by 10 percent as a poverty-offsetting measure. Overall government balance is held fixed by introducing an offsetting compensatory indirect output tax similar to SIM_1.

Experiment **SIM_4** is also similar to the first except that the price of fertilizer is subsidized by 50 percent by the government as a poverty-offsetting measure. The price subsidy specification is given in Table 13. The subsidy is financed by a compensatory direct income tax, which is applied in the following manner

$$Dyh_h = Y_h \times \left(1 - dtxr_h \times \left[1 + ntaxr\right]\right)$$

where Dyh_h is the disposable income of household h, Y_h is income, $dtxr_h$ is the direct income tax rate at the base, and ntaxr is the compensatory tax.[8] The price subsidy is negative income for the government. When the subsidy is implemented, ntaxr will have a positive value until total government income is maintained at a specified level. A positive ntaxr will increase the direct income tax rate, which in turn will lead to higher government direct tax revenue and lower household disposable income. Note further that by design, the compensatory tax is progressive in the sense that the increase in the direct income tax is higher for those households with higher direct income tax rates, $dtxr_h$. Thus, in this system there is a built-in redistribution effect of the compensatory direct income tax.[9]

Experiment **SIM_5** is similar to SIM_4 except that the subsidy is financed by a compensatory indirect output tax similar to SIM_1.

6.2. Simulation Results

6.2.1. Removal of the QR and Reduction in the Tariff

SIM_1. The import price of 'rice and corn milling' in local currency (δpm_i) drops significantly by –64 percent as a result of the removal of the QR (Table 21). This

[8] Note that labor supply is fixed. Therefore, the compensatory direct income tax is not distortive in the sense that it does not affect relative commodity prices.

[9] Alternatively, one can specify a compensatory direct income tax that is neutral with respect to distribution.

translates into a surge in rice imports (δm_i) by 3,676 percent.[10] On the other hand, the consumer prices (δpc_i) for irrigated palay, non-irrigated palay, and 'rice and corn milling' decline by -4.1 percent, -3.2 percent, and -4.9 percent, respectively. Domestic demand (δd_i) in these sectors also declines. From Equation (18) in Table 12, these results depend upon the parameter $1/(1+\lambda)$ for these commodities, which is the elasticity of substitution[11].

Table 21. Effects on Prices and Volume (SIM_1)

Sectors	Price Changes (%)					Volume Changes (%)				
	δ pmi	δ pci	δ pdi	δ pli	δ pxi	δ mi	δ di	δ qi	δ ei	δ xi
Irrigated Palay	-26.68	-4.13	-4.13	-4.18	-4.18	164	-1.93	-1.90	0.00	-1.93
Non_Irrigated Palay		-3.20	-3.20	-3.24	-3.24	0.00	-1.56	-1.56	0.00	-1.56
Corn	0.00	-1.74	-1.86	-1.88	-1.88	-7.38	-0.68	-1.06	-0.02	-0.68
Sugarcane		-1.07	-1.07	-0.99	-0.99	0.00	0.34	0.34	0.00	0.34
Livestock	0.00	-0.88	-0.88	-0.90	-0.90	-1.06	0.18	0.16	0.72	0.23
Other Agriculture	0.00	-1.06	-1.07	-1.19	-0.99	-1.08	0.15	0.12	1.84	0.33
AGRICULTURE	**-0.06**	**-1.39**	**-1.40**	**-1.46**	**-1.36**	**-1.84**	**-0.15**	**-0.18**	**1.25**	**-0.04**
Food Processing	0.00	-0.38	-0.49	-0.40	-0.40	-0.40	0.10	0.06	0.00	0.16
Rice & Corn Milling /a/	-64.16	-4.89	-3.87	-3.82	-3.82	3,676	-1.99	1.88	0.00	-1.99
Sugar Milling	0.00	-0.48	-0.49	-0.50	-0.50	-1.60	0.29	0.13	0.00	0.35
Fertilizer	0.00	-0.10	-0.20	-0.20	-0.10	-0.24	-0.12	-0.20	0.00	0.00
Other manufacturing	0.00	-0.09	-0.20	-0.20	-0.20	-0.08	0.07	0.00	0.00	0.20
Other industry	0.07	-0.19	-0.20	-0.20	-0.10	-0.23	-0.10	-0.12	0.00	-0.09
INDUSTRY	**-0.46**	**-0.51**	**-0.61**	**-0.60**	**-0.50**	**0.61**	**-0.18**	**0.13**	**0.00**	**-0.04**
Transportation	0.00	-0.10	-0.10	-0.10	-0.10	-0.02	0.01	0.01	0.08	0.02
Other Services	0.00	0.00	0.00	0.00	0.00	0.08	0.07	0.07	0.04	0.07
Government Services					0.10	0.00	0.00	0.00	0.00	-0.01
SERVICES	**0.00**	**-0.01**	**-0.01**	**-0.01**	**0.00**	**0.07**	**0.06**	**0.06**	**0.05**	**0.05**
TOTAL	**-0.41**	**-0.48**	**-0.53**	**-0.54**	**-0.43**	**0.52**	**-0.09**	**0.06**	**0.10**	**-0.01**

where xi : total output pxi : output prices
mi : imports qi : composite commodity pqi : composite commodity prices
ei : exports pdi : domestic prices pmi : import (local) prices
di : domestic sales pli : local prices

As expected, the general equilibrium impact of this policy change is negative for agriculture, particularly irrigated and non-irrigated palay in terms of price and volume effects. The output prices (δpx_i) of irrigated palay, non-irrigated palay and 'rice and corn milling' drop by –4.2 percent, –3.2 percent, and –3.8 respectively, while the volume of output (δx_i) declines by –1.9 percent, –1.6 percent, and –2 percent, respectively.

Incidentally, these results can be reversed to argue that the distortive effects of the QR on rice imports attract resources into palay production and away from other agricultural crops. This movement of resources creates inefficiency in resource allocation within the agriculture sector as well as in the rest of the economy.

[10] Although the increase is large, the share of rice imports remains relatively small compared to the share of domestic rice.

[11] The elasticity of substitution for these commodities is high at 3.7 (Table 19). This parameter came from the APEX model (Agricultural Policy Experiment Model, Clarete and Warr (1992)) whose parameters were estimated econometrically using Philippine data.

One result that ought to be highlighted is the overall decline in consumer prices (δpc_i) by –0.5 percent. This should be favorable to all consumers in two ways: it increases real consumption and reduces the nominal value of the poverty threshold, as discussed earlier.

Table 22. Effects on Factors, % (SIM_1)

Sectors	Value Added Changes (%)		Return to Capital (%)	Labor Demand (%)			
	δpvai	δvai	δri	L1*	L2*	L3*	L4*
Irrigated Palay	-4.93	-1.93	-7.27	-4.56	-4.56	-5.39	-5.17
Non_Irrigated Palay	-3.81	-1.56	-5.71	-3.29	-3.29	-4.13	-3.90
Corn	-2.17	-0.68	-2.95	-1.10	-1.10	-1.96	-1.73
Sugarcane	-1.29	0.34	-0.89	0.63	0.63	-0.24	-0.01
Livestock	-1.09	0.23	-0.70	0.67	0.67	-0.21	0.03
Other Agriculture	-1.19	0.33	-0.70	0.69	0.69	-0.18	0.05
AGRICULTURE	**-1.68**	**-0.07**	**-1.61**	**0.00**	**0.00**	**-0.41**	**-0.14**
Food Processing	0.10	0.16	0.30			0.43	0.57
Rice and Corn Milling	-6.11	-1.99	-7.79			-8.45	-8.32
Sugar Milling	0.20	0.35	0.50			0.67	0.90
Fertilizer	-0.20	0.00	-0.20			-0.06	0.13
Other manufacturing	0.10	0.20	0.30			0.38	0.57
Other industry	-0.30	-0.09	-0.30			-0.28	-0.14
INDUSTRY	**-0.50**	**-0.06**	**-0.70**			**-0.19**	**-0.06**
Transportation	-0.10	0.02	-0.10			-0.02	0.12
Other Services	0.10	0.07	0.20			0.19	0.30
Government Services	0.00	-0.01				-0.01	
SERVICES	**0.07**	**0.05**	**0.18**			**0.10**	**0.20**
TOTAL	**-0.46**	**-0.01**	**-0.43**			**0.00**	**0.00**
	Average wage -->			-1.68	-1.68	0.00	-0.50

where pvai : value added prices ri : return to capital

vai : value added *L1, L2, L3, & L4: Labor type 1, 2, 3, & 4

The effects on the factors of production are critical in completing the analysis of their impact on poverty and distribution. Because of the drop in output and price of palay and rice, the demand for factors and the factor prices drop as well. For example, the return to capital used in palay production and in 'rice and corn milling' drops significantly relative to the other sectors (Table 22). The demand for labor also drops in those sectors. Wages for agriculture labor and unskilled production workers decline by –1.7 and –0.5 percent, respectively. Put together, these effects on value added are unfavourable to the palay rice sector in general.

The effects on income, weighted consumer prices, poverty and distribution across household groups are summarized in Table 23. Largely because of the drop in factor prices, overall household income declines as the QR is removed and the tariff on rice imports is reduced. Because this drop is mainly caused by the surge in rice imports, it can be thought of as a displacement effect. The largest drop is observed in households in **rur1** (−1.4 percent), followed by **rur4** (−0.97 percent), and **ur1** (−0.94 percent). These households are highly dependent on factor incomes derived from agriculture (Table 18). Furthermore, these household groups have the lowest per capita income (Table 16). Thus, the impact worsens the income inequality problem as indicated by the increase of 0.24 percent in the Gini coefficient.

Table 23. Effects on Household Income, Consumer Prices, and Poverty, % (SIM_1)

	Disposable Income	Consumer Prices /a/	Poverty		
			Headcount	Gap	Severity
Philippines	**-0.23**	**-0.65**	**-0.08**	**0.04**	**0.08**
urb1	-0.94	-0.73	0.11	0.46	0.53
urb2	-0.10	-0.54	-1.54	-1.40	-1.56
urb3	0.00	-0.50	0.00	-1.51	-1.74
urb4	-0.50	-0.64	-0.27	-0.27	-0.35
urb5	-0.04	-0.52	-0.97	-1.18	-1.26
urb6	-0.32	-0.42	0.00	-0.22	-0.25
rur1	-1.41	-0.92	0.30	0.97	1.21
rur2	-0.48	-0.76	-0.98	-0.63	-0.70
rur3	-0.11	-0.66	-1.36	-1.24	-1.50
rur4	-0.97	-0.88	0.15	0.16	0.20
rur5	-0.29	-0.74	-0.55	-0.95	-1.22
rur6	-0.69	-0.79	0.00	-0.23	-0.27
Change in Gini Coefficient	**0.243**				

/a/ sectoral consumer prices weighted by household consumption weights

The drop in consumer prices faced by the various household groups mitigates the negative effects on income as indicated by the overall drop in the headcount index of –0.08 percent. However, the drop in consumer prices is not significant enough to counter the negative income effects on critical households with a very high incidence of poverty, or the poorest of the poor. For example, the headcount index for **rur1** increases by 0.3 percent, for **rur4** by 0.15 percent, and for **urb1** by 0.11 percent. The worsening of poverty in these groups can also be observed from the larger increases in the poverty gap and severity indices. As these indices give more distributional weight to those furthest below the poverty threshold, the average income of the poor in those household groups has moved further away from the poverty threshold. This also means that the degree of their poverty has increased as the QR on rice is eliminated and tariff on rice imports is reduced.

On the whole, while the overall poverty headcount drops, the elimination of the QR and the reduction of the tariff on rice imports can be described as generally not pro-poor. It also worsens the income inequality problem. The drop in consumer prices is not significant enough to mitigate the negative effect on income, especially in household groups where the problem of poverty is severe. The next four experiments implement policy measures that can offset the negative poverty effects on households that are adversely affected, particularly urb1, rur1, and rur4.

6.2.2. QR Removal, Tariff Reduction, and Poverty-Offsetting Measures

Table 24 summarizes the results of the experiments where the removal of the QR and the reduction in the tariff on rice imports are accompanied by various poverty-offsetting measures. The results for the Philippines and for the three poorest household types that are negatively affected by the reform are presented in the table.

Table 24. Poverty Effects under Various Scenarios (% from base)

		Poverty			Change in Gini Coefficient
		Headcount	Gap	Severity	
SIM_2	**Philippines**	**-0.450**	**-0.608**	**-0.761**	**0.032**
	Urb1	-1.818	-2.197	-2.557	
	Rur1	0.000	0.142	0.181	
	Rur4	-0.575	-0.953	-1.209	
SIM_3	**Philippines**	**-0.674**	**-1.194**	**-1.523**	**-0.144**
	Urb1	-1.365	-1.508	-1.758	
	Rur1	-2.062	-3.136	-3.901	
	Rur4	-0.797	-1.596	-2.028	
SIM_4	**Philippines**	**-0.398**	**-0.579**	**-0.761**	**-0.056**
	Urb1	-0.247	-0.565	-0.657	
	Rur1	-0.680	-0.714	-0.893	
	Rur4	-0.528	-0.780	-0.995	
SIM_5	**Philippines**	**-0.209**	**-0.300**	**-0.373**	**0.095**
	Urb1	0.000	-0.093	-0.107	
	Rur1	-0.167	-0.238	-0.294	
	Rur4	-0.152	-0.337	-0.429	

SIM_2 involves a 50 percent reduction in the direct income tax rate of the three household groups, financed by a compensatory indirect output tax. It shows a favorable effect on overall poverty as the three poverty indices indicate negative changes. However, no improvement is observed for rur1, which is the poorest household. This is because this group has an almost zero direct tax rate, and thus a 50 percent reduction in the rate does not make any difference. Thus, the poverty situation for this group deteriorates. Income distribution also worsens as indicated by the increase in the Gini coefficient, because the poorest household group is not favorably affected while the other groups are.

SIM_3 involves a 10 percent increase in government transfers to the three groups, financed by a compensatory indirect output tax. The overall improvement in poverty is better here than in the previous case, as indicated by a larger reduction in all poverty indices. The largest improvement is observed in rur1 because, being the poorest group, it receives a larger amount of government transfer. Thus, a 10 percent increase has a greater benefit on this group than on the other two. Also, there is an improvement in distribution as indicated by a reduction in the Gini coefficient.

SIM_4 involves a 50 percent fertilizer price subsidy by the government financed by a progressive compensatory direct income tax. This experiment also brings about a favorable poverty effect as the three indices show reductions for the three groups. Income distribution also improves. However, the improvement in poverty and distribution is lower than in SIM_3.

SIM_5 also involves a 50 percent fertilizer price subsidy by the government. However, the subsidy is financed by a compensatory indirect output tax, which as shown earlier creates distortionary effects. The results indicate that while the overall poverty as well as the poverty for the three groups improves, the effect is lower compared to SIM_4. This is because the increase in the indirect tax creates an additional wedge between the Pd and Pl in all commodities. Thus, it reduces the full price effects of the removal of the QR, the reduction in the tariff, and the fertilizer price subsidy. This additional price wedge is not created in SIM_4.

Thus, the results of the experiments indicate that the policy that would lead to higher poverty-offsetting effects for the three poorest household groups that are adversely affected by market reforms in rice is an increase in the direct government transfers to these groups.

7. Conclusion and Policy Recommendation

The QR on rice will be phased out by the end of 2004. While this policy reform may be justified for efficiency purposes,[12] the displacement effects of the expected surge in rice imports will translate into larger negative income effects for household groups where the problem of poverty is most severe. This is because these groups rely heavily on agriculture, particularly palay rice production, which is expected to contract when the QR is removed and the tariff is reduced. As a result, factor demand and factor prices in agriculture will drop. Factor incomes derived from agricultural production will decline as well. While all household groups will enjoy reduced prices of rice as the QR is removed and the tariff reduced, the drop in consumer prices will not be significant enough to mitigate the decline in income for those groups that are adversely affected. Thus, all poverty indicators for these groups show higher values, indicating a worsening of their poverty situation. Furthermore, the overall Gini coefficient increases, which indicates a worsening of income inequality.

The policy lesson that may be drawn from this exercise is that while market reform is generally necessary, it has to be carried out carefully, especially if implemented on a critical commodity such as rice. Although market reforms in rice can potentially have favorable effects on consumer prices in general, some household groups may be adversely affected by the expected surge in rice imports. Policy

[12] It has been established numerically in the paper that resource allocation favors palay and rice production over 'other agricultural crops' under a regime of rice protection.

measures may have to be designed to counter these effects. Among the various poverty-offsetting measures experimented with in the paper, the results indicate that an increase in direct government transfers to the adversely affected household groups provides a better safety net. However, this is more of a short-run policy measure. Other policy measures that may have favorable longer-term implications include productivity improvement through a vigorous program of intensified use of high-yielding rice varieties, irrigation, better farm-to-market roads, and measures to encourage the growth of other non-rice crops.

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