A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS OF RICE MARKET LIBERALIZATION AND WATER PRICE RATIONALIZATION IN THE DOMINICAN REPUBLIC

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Abstract: Agriculture is often protected from international market forces in the name of food security. The Dominican Republic, the second largest country in the Caribbean, is a case in point. Self-sufficiency in the production of rice, a staple food crop, is a long-standing policy. To keep out rice imports, import tariff and other trade barriers have been applied. Another cause of inefficient resource development is water subsidies. The prices paid by farmers amount to 25 percent of the cost of operating and maintaining irrigation systems and the capital costs of these systems are heavily subsidized by the government. As a result, incentives to adopt on-farm conservation measures are negligible. A computable general equilibrium (CGE) model of the Dominican Republic is used in this study to assess the economy-wide consequences of reducing irrigation subsidies and eliminating the tariff on rice imports. The model's structure allows for examination of the varied effects of price changes on households categorized by income level and by rural versus urban location. The model is calibrated to reflect an initial equilibrium in which water subsidies are capitalized into benchmark land values. After establishing the benchmark equilibrium values of all variables, rice tariffs and water subsidies are reduced in the model and a counterfactual equilibrium, less distorted than the initial one, is calculated.

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Introduction

In the name of food security, agriculture is often protected from international market forces. The Dominican Republic, the second largest country in the Caribbean, is a case in point. Self-sufficiency in the production of rice, which is a staple food crop accounting for 17 percent of total consumer food expenditures in 1994, is a long-standing policy (Greene and Roe, 1992; Valdés *et al*., 1995). To keep out imports, a 40 percent import tariff and other trade barriers have been applied, which has driven up internal market values. In 1994, domestic rice producers received RD$3.26/pound while the border price was RD$1.86/pound (JAD, 1994). Meanwhile, the average retail value was RD$4.24/pound (JAD, 1994).

Policy-induced distortions in agricultural prices have affected the natural environment. Water is scarce in the Dominican Republic, because of climatic conditions and because the upper reaches of the country's watersheds are largely deforested and heavily eroded (World Bank, 1994). Favorable treatment of rice production, which requires large amounts of water, discourages the switch to other crops (e.g., tobacco, fruits, and vegetables) that are less water-intensive and in which the Dominican Republic holds a comparative advantage.

Another cause of inefficient resource development is water subsidies. The prices paid by Dominican farmers amount to 25 percent of the cost of operating and maintaining irrigation systems and the capital costs of these systems are heavily subsidized by the government (IICA, 1999). As a result,

incentives to adopt on-farm conservation measures are negligible. At the same time, the Dominican Institute of Water Resources (INDHRI), which builds and operates irrigation projects, lacks money for maintenance.

Self-sufficiency in rice production and selling irrigation water far below cost have had pervasive economic impacts. By the same token, reforming these two policies is bound to affect virtually every Dominican household. For the poor, who spend a large share of their meager earnings on rice, the benefits of price declines resulting from freer trade are especially important. But lower prices also diminish the incomes of rice producers, who comprise an important segment of the rural population. In addition, farmers bear much of the burden of decreased irrigation subsidies, although consumers are affected as well inasmuch as food prices are driven up because of higher agricultural production costs. Moreover, eliminating discrepancies between domestic rice prices and border values and reducing water subsidies will alter incentives throughout the rural economy. Since the agricultural sector accounts for a large share of Dominican Republic's foreign trade, exchange rates and other macroeconomic variables are sure to be affected. So will patterns of consumer spending and rural land use.

A computable general equilibrium (CGE) model has been used in this study to assess the economy-wide consequences of reducing irrigation subsidies and eliminating the tariff on rice imports. The model's structure allows for examination of the varied effects of price changes on upper-, middle-, and lower-income groups in urban as well as rural areas. Likewise, the CGE model's design allows for analysis of the reallocation of water resources resulting from more efficient pricing of water and rice. Thus, some sectors of the economy are expected to expand while others contract in response to changes in irrigation and rice policy.

The CGE Model and Data

Our CGE model, which is adapted from Díaz-Rodríguez (2000), is a numerical variant of the Walrasian general equilibrium framework in which producers maximize profits and consumer maximize utility in a decentralized manner, and prices and quantities adjust until markets clear in long-run equilibrium. The model is calibrated to reflect an initial equilibrium in which water subsidies are capitalized into benchmark values of the capital-land primary input. After establishing the benchmark equilibrium values of all variables, rice tariffs and water subsidies are reduced in the model and a counterfactual equilibrium, less distorted than the initial one, is calculated.

The model has six production sectors. The first five are rice farming, other crop production, agro-industry, manufacturing, and services. The sixth sector combines surface water and intermediate inputs to produce distributed water, which is purchased by the other five production sectors as well as households. Output markets are assumed to be perfectly competitive, which means that producers are price takers and economic profits are zero. Producers combine primary inputs in variable proportions under the assumptions of profit maximization and constant-elasticity-of-substitution (CES) technology. Value-added in the economy is derived from three factors of production: labor, a capital-land aggregate, and surface water. Combining capital and land into a single aggregate is a compromise widely employed in CGE modeling because of the inability of statistical agencies in many countries, including the Dominican Republic, to accurately sort out these two components of value added. Supplies of the capital-land aggregate and labor are assumed to be fixed. There are two types of labor: rural labor is employed only in the production of rice and other crops, while urban labor is

employed only in agro-industry, manufacturing, and services. We assume full employment and no international migration. The supply of surface water is also fixed, a reasonable assumption in a static model in which canals, pipes, and related infrastructure operate at nearly 100 percent capacity. All three factors of production are mobile and can be re-allocated across sectors in response to changes in sectoral factor returns. Prices of labor, capital-land, and surface water adjust so that producers are willing to hire the fixed aggregate amounts available.

The ownership of surface water is assumed to be shared by the government and rural households according to the current rate of subsidization. The government share of water ownership is equal to the ratio of the current water tariff to total operating-and-maintenance (O&M) costs of INDHRI water while the household share is equal to one minus this rate. The shares of ownership or labor and capital are based on data supplied by the Central Bank . Rural labor income accrues only to rural households and urban labor income accrues only to urban households. Income from the capital-land aggregate accrues to all households.

Households are segmented according to location (rural versus urban) and income (low, medium, and high). Each of the six household groups consumes goods and services and provides labor, which is heterogeneous, and capital-land, which is homogeneous. Each group's purchases are determined using constant-linear-expenditure-share (CLES) demand functions derived from Cobb-Douglas utility functions.

Each of the five production sectors, with the exception of the distributed water sector, engages in international cross-hauling (both producing exports and purchasing imports). The water sector produces only for the domestic market and has no imports. In the five other sectors, traded goods and

domestic goods within each production sector are treated as imperfect substitutes to reflect the empirical reality that many goods imported into the Dominican Republic are also produced locally and that many producers sell to both export and domestic markets. For imports, substitution between foreign and domestic goods is determined using a constant-elasticity-of-substitution (CES) aggregation function. For exports, the allocation of production to the foreign and domestic markets is determined by a constant-elasticity-of-transformation (CET) aggregation function.

Sources of savings are households, enterprises, governments, and foreign agents (operating through a residual foreign sector). Savings rates of households are fixed. The savings rate of enterprises is variable so that government behavior can be specified as revenue neutral. Revenue neutrality is an important assumption when welfare comparisons of government policies are to be undertaken (Shoven and Whalley, 1977). The level of foreign saving is fixed, and the balance of trade is restored to equilibrium following a shock to the model through adjustments in the exchange rate. The numJraire in our model is the ratio of nominal to real gross domestic product (GDP).

A 1991 social accounting matrix (SAM) developed by the Dominican Central Bank was the primary source of data for the analysis. We adjusted the SAM to reflect distortions in land that are created by the water subsidy, defined as the difference between the water tariff and the actual operating-and-maintenance costs of distributed water. In the benchmark SAM, the water subsidy is allocated to the owners of land. In addition, we constructed a water distribution sector based on information provided by INDRHI. Input-output coefficients, sectoral quantities, production taxes and import taxes, sectoral factor demands, allocation of investment, and household and government consumption shares were all derived from the adjusted SAM.

Elasticities of substitution between domestic and foreign goods and services are similar to those used by Aristy-Escuder and Robinson (1995) and are within the range of econometric estimates found in the CGE literature (Agcaoili-Sombilla and Rosegrant, 1994; De Melo and Tarr, 1992; Shiells *et al*., 1986; Stern and Schumacher, 1976). Import (Armington) substitution elasticities range from a low of 1.1 in the rice sector to 2.0 in the "other industries" sector. Export substitution elasticities range from 0.75 (services) to 1.5 (rice, other crops, and agro-industry). Sensitivity analysis was conducted by halving and doubling all trade elasticities. Estimates of input substitution elasticities used in the model ranged from 0.4 to 1.0 (De Melo and Tarr, 1992).

The effects of policy reform in the Dominican Republic are evaluated by calculating changes in real GDP as well as increases or decreases in real consumption by each of the six household groups. We used real consumption in place of changes in income or net welfare to assess impacts on living standards in different segments of the population. All calculations are based on the assumption of government net revenue neutrality (Shoven and Whalley, 1977). Taxes paid by enterprises are increased or decreased in response to any change in spending or tax collections resulting directly from a policy change – in this case, reduced irrigation subsidies or elimination of the tariff on imported rice.

Economy-Wide Impacts of Policy Reform

We examine the economy-wide consequences of two policy reforms. One reform is repeal of the 40 percent tariff on imported rice. The other is a reduction in irrigation subsidies.

Total elimination of the latter subsidies is politically infeasible. Many farmers have borrowed money to purchase land at prices inflated because water is artificially cheap. Others have used real

estate as collateral for loans. Either way, complete elimination of subsidies would cause land values to plummet, which would in turn create widespread financial distress, even bankruptcy. Recognizing this, we have chosen to investigate the impacts of quadrupling water tariffs – a reform that would eliminate all subsidization of operating and maintenance costs. Although it is large, a 300 percent increase in water prices is not politically out of the question. Yap-Salinas (1995) reports on a Dominican pilot project that featured a 15-fold price increase in the price of irrigation water. Since this coincided with major improvements in service quality, the farmers participating in the project found higher prices acceptable.

Our simulations indicate the impacts of the two policy changes on production, prices, factor use, and consumption in all sectors of the economy. Special attention is paid to changes in agricultural water use.

Effects of Free Trade in Rice. Dominican commodity exports and imports comprise a tiny share of total world trade. Accordingly, prices outside the country are not affected at all as national trade barriers rise or fall, and elimination of the 40 percent tariff causes the domestic price paid for imported rice in the Dominican Republic to go down by 28 percent (Table 1). Changes in imports resulting from the latter decline depend a lot on the Armington elasticity of substitution between domestically produced and imported grain. The same holds for other impacts of freer trade, including consumption increases as well as changes in different sectors' output.

As indicated in Table 1, the decline in the price that households pay for rice is a little less than 12 percent and the increase in absorption (final-demand purchases by the private and public sectors) exceeds 5 percent for the base-case (intermediate) trade elasticity (see absorption column). For the lower and higher trade elasticities, the price declines are 11 and 13 percent, respectively, and

absorption goes up by 5 and 6 percent, respectively. The farm-level (output) price changes as imports grow cheaper, declining by less than one-half percent for the low-elasticity scenario and a little more than 1 percent if the Armington elasticity is high. But given the assumption that capital-land is entirely mobile across sectors, which implies that the supply of rice (like that of any other good or and service) is highly elastic, the reductions in domestic production of the commodity induced by these modest price changes can be substantial. These range from 1 percent for the case of the low trade elasticity to 7 percent for the intermediate case to 20 percent if the trade elasticity is high (Table 1). For each of these scenarios, the decline in domestic rice output is exceeded by the increase in imports – 18, 32, and 61 percent, respectively, if the elasticity of substitution between imported and domestically produced grain is low, medium, or high. Thus, domestic rice prices always go down and consumption always rises when the tariff is eliminated

To maintain general economic equilibrium, a rise in one sector's net imports must be matched by reduced imports or increased exports in other parts of the economy. As reported in Table 1, the main consequence of higher imports of rice is to raise foreign sales of other crops and agribusiness products, in which the Dominican Republic holds a comparative advantage. Even with intermediate trade elasticities, these sectors' exports increase by approximately 1 percent and about 3 percent, respectively. Imports of other crops go up slightly and agribusiness imports decline by a little less than 1 percent.

With domestic output of rice falling and production of other crops and agribusiness products going up mainly due to increased foreign sales, factors of production are reallocated. In the rice sector, a decline of 7 to 8 percent occurs in the use of water, labor, and capital-land. There are very small

changes in factor employment in manufacturing and services (Table 2). Most of the reallocated capital-land, labor, and water ends up in the other crops and agribusiness sectors.

As indicated in Table 3, the changes in production and reallocation of productive inputs that occur in response to tariff elimination are generally efficient, as indicated by the modest increase in real GDP. The Dominican exchange rate depreciates slightly, showing up as an increase in the exchange rate. This depreciation occurs largely because of increased rice imports. The reduction in the tariff rate for rice results in a decline in overall tariff revenues of nearly 8 percent (Table 3). To balance the government budget, the enterprise tax rate rises from 2.3 percent to 2.7 percent of enterprise income

The primary beneficiaries of freer trade are poorer households, especially middle- and low-income families in the countryside. As emphasized in the introduction, rice is the Dominican Republic's staple food and, as its price falls, food insecurity is alleviated. The gains accruing to poor and nearly poor households in rural areas as a result of cheaper food outweigh whatever they lose because of the decline in domestic rice production. For the rural middle-income group, real consumption grows by nearly 1 percent. For rural low-income households, which consume staples that are cheaper than rice, the gain in real consumption is more modest. Changes, both positive and negative, experienced by other groups are positive but also small (Table 4).

Effects of Diminished Water Subsidies. The other policy reform investigated in this paper is elimination of the subsidy for the operation and maintenance of irrigation and other public water systems. The nearly 300 percent increase in the price of water that such a reform entails raises production costs, especially in sectors that use the resource intensively. The resulting changes in domestic output and consumption depend on Armington elasticities of substitution between that output and imports.

Given their intensive use of water, rice growers are affected more than any other group of producers. The price they receive rises by a little more than 25 percent and the quantity they produce goes down by a little less than 10 percent if the elasticity of trade substitution is low. For the intermediate (base-case) elasticity, the price increase is slightly smaller and output falls by more than 13 percent. With high elasticity, the internal price goes up by a little less than 24 percent and domestic output falls by more than 21 percent (Table 5).

Since imported rice can be substituted (albeit imperfectly) for the domestic product, relative changes in the price paid by consumers and the quantity they purchase are not as large. If the elasticity of trade substitution is low, the consumer price goes up by 16 percent and absorption declines by a little less than 6 percent. For intermediate and high elasticities, the price rises by 15 percent and 14 percent, respectively, and absorption goes down by approximately 6 percent (Table 5). The increase in imports ranges from under 2 percent for the low elasticity scenario, to 9 percent for the intermediate scenario, to nearly 24 percent if the elasticity of substitution between imports and the domestic product is high (Table 5).

In the rest of the economy, the effects of subsidy elimination are more modest. Regardless of elasticities of trade substitution, the prices paid by consumers and received by domestic producers of other crops, agro-industrial products, manufactured goods, and services all increase by less than 3 percent. As a rule, relative changes in domestic production as well as absorption in each of these four sectors are even smaller than the relative changes in prices (Table 5). Larger adjustments take place in the water distribution sector, which collects less per unit of output if operations and maintenance are no longer subsidized by the government.

As with tariff elimination, quadrupling the price of water, which causes imports of rice to be substituted for domestically produced grain, leads to a change in the mix of imports and exports. Since production costs go up proportionally more in agro-industry and other crops than in manufacturing and services, the former two sectors experience declining exports as well as increased competition from imports. Imports of industrial goods and services change very slightly. In the face of a deteriorating balance of trade in farm and agro-industrial products, the overall trade balance is maintained primarily by increased exports from the manufacturing and service sectors (Table 5).

With production falling markedly in the rice sector, less so in other crops and agro-industry, and rising in manufacturing and services, a reallocation of factors occurs. Rice farmers' employment of capital-land and labor declines by more than 10 percent, as does their use of water. Use of each of these inputs is also reduced, albeit more modestly, in the agro-industrial sector. Producers of other crops cut back on capital-land and instead use more labor and water. In contrast, factor employment increases in manufacturing and services, the two non-rural parts of the economy (Table 6). Just as tariff elimination is efficient, the reallocation of factors of production and the changes in output and foreign trade resulting from the reduction of water subsidies cause GDP to go up by a small amount. A modest appreciation of the national currency occurs. A difference between the first policy reform and this one is that, instead of declining, tariff revenues go up by nearly 2 percent (Table 7). This is because imports of rice, other crops, agro-industrial products, manufactured goods, and services all increase – except for the high-elasticity scenario, in which a small decrease in service imports occurs (Table 5).

A more important distinction between the two policy reforms has to do with beneficiaries. Given the increase in manufacturing and services as well as factor employment by these two sectors,

real consumption grows for all urban households – wealthy, middle-income, and poor. A contraction in agriculture and agro-industry, resulting from a cut in water subsidies, causes all rural households to be worse off (Table 8). Without the policy change, water subsidies have the effect of redistributing income from urban to rural households. With elimination of the water subsidy, the returns to irrigated land decline, thereby lowering rural incomes.

Effects of Combined Policy Reform. If implementation of either of the two policy reforms this paper addresses is efficient, as our analysis suggests, the impacts of simultaneously undertaking both reforms on GDP and its distribution merit consideration.

As is to be expected, the burden of lowering the tariff on imported rice while simultaneously cutting water subsidies is absorbed almost entirely by the rice sector. Even if the elasticity of substitution between imports and domestically produced grain is low, Dominican rice production falls by 11 percent and imports go up by one-fifth (Table 9). If the elasticity is high, the decline in domestic output of rice approaches 40 percent and imports nearly double. Changes in production, consumption, and foreign trade in all other sectors are much smaller. Similarly, proportionate factor changes in other crops, agro-industry, manufacturing, and services are much smaller than the relative changes in the use of water, labor, and capital-land occurring in the rice sector, where use of all three factors declines (Table 10). The increase in GDP that happens if both policy reforms are implemented (Table 11) exceeds the increase occurring if either reform is implemented separately (Tables 3 and 7). Likewise, there is a larger currency devaluation (Table 11). This encourages production and exports by those parts of the Dominican economy that possess comparative advantage (Table 9).

Due to the expansion of manufacturing and services, the benefits of combined policy reform are

captured almost entirely by urban households. Meanwhile, farming and agro-industry either contract or expand very modestly (Table 9), which causes rural households to experience declines in real consumption (Table 12). However, the declines for rural middle- and low-income households are much worse (Table 8) if elimination of the water subsidy is not matched by trade liberalization, which lowers what these groups pay for the rice that comprises the mainstay of their diet.

Conclusions

Where overall economic performance is affected in various ways by state intervention and where assorted policies affect various groups in different ways, the economy-wide impacts of reform merit analysis. In this paper, two policy changes in the Dominican Republic are examined – elimination of the tariff on imported rice, which is the country's staple grain, and raising water prices enough to cover the costs of operating and maintaining irrigation and potable water systems.

As is to be expected, enacting either of these reforms separately causes GDP to rise. Even more efficient is implementing both policy changes together. However, distributional consequences vary. Freer trade in rice, which causes its domestic market value to decline, is especially beneficial for the poor, who spend a significant share of their food budgets on that commodity or close substitutes. In contrast, paring water subsidies diminishes rural incomes since these subsidies affect the returns to irrigated land, which is an important household asset in the countryside. Significantly, losses in rural well-being are mostly contained if trade barriers and water subsidies are eliminated simultaneously.

Our static CGE model furnishes alternative "snap-shots" of an economy, in the sense that each model run identifies the general equilibrium emerging in the long run under a specific set of policies and

market realities. A direction that could be taken in future research would be to identify the path-dependency of dynamic adjustment from one equilibrium to another. Something else to pursue is the modeling of environmental impacts. As emphasized throughout this paper, growing rice requires large amounts of water, which is quite scarce in the Dominican Republic. What we have not examined in detail are the linkages between greater efficiency of water use, which is a likely outcome of higher prices, and the quality of land resources. No doubt, these linkages are important. Evidence exists that degradation of the latter resources creates major costs in the Dominican Republic (Veloz *et al*., 1985; World Bank, 1994). Clearly, future CGE modeling in the country needs to address not just changes in GDP and distributional impacts, but the environment as well.

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Table 1: Output, Absorption, and Trade Changes Due to Elimination of Rice Import Tariff

Elasticities and Sectors	*Output (% D)*		*Absorption (% D)*		*Imports (% D)*		*Exports (% D)*	
	Qty.	*Price*	*Qty.*	*Price*	*Qty.*	*Domestic Price*	*Qty.*	*Domestic Price*
Low Trade Elasticities								
Rice	-1.29	-0.43	5.03	-11.08	18.22	-28.28	--	--
Other Crops	0.23	0.33	0.25	0.34	0.21	0.40	0.28	0.40
Agro-Industry	0.61	-0.49	0.41	-0.32	-0.13	0.40	1.29	0.40
Manufacturing	-0.02	0.35	-0.13	0.36	-0.17	0.40	0.03	0.40
Services	-0.10	0.34	-0.21	0.33	-0.26	0.40	-0.05	0.40
Water	0.0	0.34	0.0	0.34	--	--	--	--
Intermeditate Trade Elasticities								
Rice	-7.44	-0.72	5.37	-11.82	32.17	-28.24	--	--
Other Crops	0.58	0.08	0.58	0.16	0.18	0.47	1.17	0.47
Agro-Industry	1.03	-0.57	0.56	-0.36	-0.69	0.47	2.62	0.47
Manufacturing	-0.05	0.44	-0.18	0.44	-0.24	0.47	0.00	0.47
Services	-0.10	0.43	-0.25	0.43	-0.31	0.47	-0.04	0.47
Water	0.0	-0.06	0.0	-0.06	--	--	--	--
High Trade Elasticities								
Rice	-20.00	-1.21	6.13	-13.21	60.76	-28.14	--	--
Other Crops	1.48	-0.34	1.32	-0.11	-0.56	0.61	4.40	0.61
Agro-Industry	2.07	-0.70	0.86	-0.43	-2.23	0.61	6.14	0.61
Manufacturing	-0.31	0.61	-0.36	0.59	-0.41	0.61	-0.33	0.61
Services	-0.11	0.61	-0.35	0.60	-0.37	0.61	-0.12	0.61
Water	0.0	-0.76	0.0	-0.76	--	--	--	--

Table 2: Economy-Wide Impacts of Rice Tariff Elimination (Percentage Changes)

Factor usage	*Rice*	*Other Crops*	*Agro-Industry*	*Manu-facturing*	*Services*
Water use	-7.17	1.39	1.03	-0.05	-0.10
Labor use	-7.12	0.99	1.01	-0.07	-0.12
Capital-land use	-7.71	0.35	1.04	-0.04	-0.08

Table 3: Aggregate Results of Rice Tariff Elimination

Indicator	Percentage Change
Real gross domestic product	0.06
Exchange rate	-0.47
Tariff revenue from all sources	-7.74

Table 4: Real Consumption by Household Following Rice Tariff Elimination

Household	*Percentage Change*
Urban high income	-0.04
Urban middle income	-0.02
Urban low income	0.06
Rural high income	0.00
Rural middle income	0.82
Rural low income	0.13

Table 5: Output, Absorption, and Trade Changes Due to Water Subsidy Elimination

Elasticities and Sectors	*Output (% D)*		*Absorption (% D)*		*Imports (% D)*		*Exports (% D)*	
	Qty.	*Price*	*Qty.*	*Price*	*Qty.*	*Domestic Price*	*Qty.*	*Domestic Price*
LowTrade Elasticities								
Rice	-9.65	25.11	-5.88	15.94	1.73	0.66	--	--
Other Crops	-0.94	2.71	-0.92	2.15	0.03	0.66	-2.43	0.66
Agro-Industry	-1.00	2.28	-0.67	1.88	0.23	0.66	-2.18	0.66
Manufacturing	0.74	0.52	0.45	0.56	0.35	0.66	0.88	0.66
Services	0.38	0.40	0.54	0.41	0.35	0.66	0.57	0.66
Water	0.0	-1.71	0.0	283.93	--	--	--	--
Intermediate Trade Elasticities								
Rice	-13.56	24.65	-5.99	15.34	9.13	0.70	--	--
Other Crops	-1.02	2.34	-0.92	1.89	0.59	0.70	-3.39	0.70
Agro-Industry	-1.20	2.16	-0.60	1.80	1.02	0.70	-3.30	0.70
Manufacturing	1.10	0.57	0.56	0.61	0.37	0.70	1.36	0.70
Services	0.42	0.45	0.53	0.46	0.17	0.70	0.80	0.70
Water	0.0	-2.13	0.0	282.29	--	--	--	--
High Trade Elasticities								
Rice	-21.22	23.86	-6.17	14.27	23.73	0.77	--	--
Other Crops	-1.01	1.74	-0.87	1.45	0.88	0.77	-3.82	0.77
Agro-Industry	-1.44	1.94	-0.46	1.64	2.16	0.77	-4.82	0.77
Manufacturing	1.61	0.66	0.70	0.68	0.36	0.77	2.04	0.77
Services	0.49	0.54	0.51	0.55	-0.14	0.77	1.17	0.77
Water	0.0	-2.84	0.0	279.53	--	--	--	--

Table 6: Economy-Wide Impacts of Water Subsidy Elimination (Percentage Changes)

Factor usage	*Rice*	*Other Crops*	*Agro-Industry*	*Manu-facturing*	*Services*
Water use	-12.22	-3.21	-1.20	1.10	0.42
Labor use	-11.58	1.61	-1.59	0.74	0.02
Capital-land use	-15.00	-2.32	-0.99	1.35	0.63

Table 7 Aggregate Results due to Water Subsidy Elimination

Indicator	Percentage Change
Real gross domestic product	0.07
Exchange rate	-0.70
Tariff revenue from all sources	1.86

Table 8: Real Consumption by Household Following Water Subsidy Elimination

Household	*Percentage Change*
Urban high income	0.48
Urban middle income	0.50
Urban low income	0.29
Rural high income	-0.12
Rural middle income	-0.95
Rural low income	-0.22

Table 9: Output, Absorption, and Trade Changes Due to Simultaneous Elimination of Rice Tariff and Water Subsidy

Elasticities and Sectors	*Output (% D)*		*Absorption (% D)*		*Imports (% D)*		*Exports (% D)*	
	Qty.	*Price*	*Qty.*	*Price*	*Qty.*	*Domestic Price*	*Qty.*	*Domestic Price*
LowTrade Elasticities								
Rice	-11.01	24.71	-1.73	3.91	20.06	-27.81	--	--
Other Crops	-0.70	3.06	-0.65	2.50	0.27	1.07	-2.14	1.07
Agro-Industry	-0.36	1.73	-0.23	1.52	0.11	1.07	-0.85	1.07
Manufacturing	0.71	0.88	0.31	0.92	0.17	1.07	0.89	1.07
Services	0.27	0.74	0.32	0.75	0.09	1.07	0.52	1.07
Water	0.0	-1.37	0.0	285.28	--	--	--	--
Intermediate Trade Elasticities								
Rice	-20.34	23.89	-1.17	1.62	43.76	-27.71	--	--
Other Crops	-0.46	2.50	-0.34	2.12	0.84	1.20	-2.35	1.20
Agro-Industry	-0.11	1.49	0.00	1.36	0.24	1.20	-0.54	1.20
Manufacturing	1.04	1.04	0.36	1.07	0.11	1.20	1.36	1.20
Services	0.30	0.91	0.25	0.91	-0.18	1.20	0.74	1.20
Water	0.0	-2.06	0.0	282.57	--	--	--	--
High Trade Elasticities								
Rice	-39.23	22.53	0.17	-2.63	91.93	-27.55	--	--
Other Crops	0.40	1.61	0.44	1.51	0.65	1.43	-0.13	1.43
Agro-Industry	0.79	1.08	0.44	1.10	-0.54	1.43	1.85	1.43
Manufacturing	1.29	1.33	0.30	1.33	-0.11	1.43	1.72	1.43
Services	0.32	1.20	0.07	1.20	-0.62	1.43	1.02	1.43
Water	0.0	-3.19	0.0	278.15	--	--	--	--

Table 10: Economy-Wide Impacts of Simultaneous Elimination of Rice Tariff and Water Subsidy (Percentage Changes)

Factor usage	*Rice*	*Other Crops*	*Agro-Industry*	*Manu-facturing*	*Services*
Water use	-18.90	4.51	-0.11	1.04	0.30
Labor use	-18.27	2.54	-0.52	0.68	-0.11
Capital-land use	-21.85	-1.95	0.11	1.31	0.52

Table 11: Aggregate Results of Simultaneous Elimination of Rice Tariff and Water Subsidy

Indicator	Percentage Change
Real gross domestic product	0.16
Exchange rate	-1.20
Tariff revenue from all sources	-6.67

Table 12: Real Consumption by Household Following Simultaneous Elimination of Rice Tariff and Water Subsidy

Household	*Percentage Change*
Urban high income	0.40
Urban middle income	0.44
Urban low income	0.33
Rural high income	-0.13
Rural middle income	-0.13
Rural low income	-0.08