IMPACT OF TRADE LIBERALIZATION

ON THE KOREAN RICE MARKET

by

Young W. Kim

Won W. Koo

Seung-Ryong Yang

Department of Agricultural Economics
Agricultural Experiment Station
North Dakota State University
Fargo, North Dakota 58105

ACKNOWLEDGMENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

HIGHLIGHTS

The Korean rice market has been protected by price-support and border protection policies. Recent developments of the GATT and bilateral negotiations emphasize removal of trade policies that affect trade flows of agricultural products. This study evaluates the impact of trade liberalization on the Korean rice economy.

A system of simultaneous equations is specified on the basis of partial equilibrium and dynamic response models. Two varieties of rice in the market, the high-yield and traditional varieties, are differentiated in the system. The equations of rice demand, supply, and import are estimated by the three-stage least squares (3SLS) using data from 1973 through 1989. The model is simulated over eight years from 1989 to 1996, under five alternative scenarios of trade liberalization.

The following conclusions emerge from our simulations:

First, under current policies of the two-price system and import ban, production of the high-yield variety decreases dramatically, and demand for the variety becomes zero in 1996.

Second, 5 and 10 percent import quotas do not affect production and prices significantly. However, the self-sufficiency rate would drop to some 90 percent compared to over 100 percent under current policies.

Third, trade liberalization with tariffs affects production and price substantially. Due to price competitiveness, imports were projected to take 27 percent of total consumption in 1989 and 85 percent in 1996. As a result, domestic production decreases significantly. The self-sufficiency rate is projected to be 73 percent in 1989 and only 14 percent in 1996.

Fourth, consumption patterns change. Demand for the traditional variety grows while demand for the high-yield variety falls to zero in 1996. These results imply that consumers switch demand to high-quality rice as a result of changes in relative prices and increases in income.

Fifth, Korean production of the high-yield variety disappears under liberalization with tariffs. Results indicate that the domestic rice sector, particularly high-yield variety production, relies heavily on the government subsidy and is not competitive in international trade.

IMPACT OF TRADE LIBERALIZATION ON THE KOREAN RICE MARKET

Young W. Kim, Won W. Koo, and Seung-Ryong Yang*

Introduction

Rice has been and would continue to be the most important crop in Korean food economics. Although other agricultural commodities, such as livestock, fruits, and vegetables, have become important in production and consumption, rice still is a dominant staple in the Korean diet and accounts for a substantial portion of the country's total grain production and farm income (Table 1).

An important feature of the Korean rice policy has been self-sufficiency. The experience of food shortage during the Korean War motivated the rice self-sufficiency policy. The Korean government has subsidized and protected the rice industry to encourage production through various policy mechanisms.

The rice self-sufficiency policy, though successful in meeting the policy goal, has led to an inefficient resource distribution. Price supports, together with quantitative restrictions or import ban, have kept domestic prices above international levels. The consumer price was about three times higher than the world price, on average, in the 1980s.

As long as consumers and taxpayers in Korea are willing to endure welfare losses due to the self-sufficiency policy, inefficiency in production, accumulating operational costs of the price support system, and inefficient resource allocation would be domestic matters. However, internal supports tend to distort trade flows, and consequently are a subject of discussion in the Uruguay Round of the GATT negotiations.

Through the Uruguay Round of the GATT negotiations, some agricultural exporting countries, including the United States, are demanding removal of all domestic policies that distort agricultural trade flows. Regardless of the success of the GATT round, major exporting countries will challenge agricultural protection through bilateral negotiations. Japan recently agreed to open all of its agricultural markets, except rice.

Rice producers in Korea have been selling their crop above the market price. Over 80 percent of Korea's farm income is from rice production. Carryover stocks have accumulated due to increasing production and decreasing per capita consumption (Table 1). Trade liberalization may have a tremendous impact on the Korean rice industry and lead to drastic changes in the Korean agricultural sector.

The objective of this study is to determine the impact of trade liberalization on domestic rice production, consumption, imports, and prices in Korea. This study uses a partial equilibrium model to simulate the impact under alternative scenarios.

*Young W. Kim is Director of Trade Cooperation Division(II), Ministry of Agriculture, Forestry, and Fisheries in Korea, Won W. Koo and Seung-Ryong Yang are a Professor and a Research Scientist in the Department of Agricultural Economics, North Dakota State University, respectively.

TABLE 1. ANNUAL PER CAPITA CONSUMPTIONS AND PRODUCTIONS OF SELECTED FOODS, 1965-1989

	1965	1970	1980	1989
	-----------------Kilogram---------------			
Consumption				
Grains	188.8	219.4	195.1	172.0
Rice	121.8	136.4	132.4	121.4
Wheat	13.8	26.1	29.4	32.2
Barley	36.8	37.3	13.8	1.8
Others	16.4	19.6	19.5	16.6
Meats	3.4	5.2	11.3	18.2
Milk	0.3	1.6	10.8	38.7
Vegetables	45.5	59.9	120.6	117.3
Fruits	11.3	13.1	21.8	45.3
	-------------------000MT---------------			
Production				
Grains				
Rice	3954	4090	5136	6023
Wheat	184	219	92	2
Barley	1459	1591	811	484
Others	1267	1197	1009	684
Fruit				2108
Vegetables				5980

Source: Korean Ministry of Agriculture, Forestry, and Fisheries. *Major Agricultural Statistics*. Seoul, 1990.

This paper is organized as follows: Government policies on rice are briefly reviewed in the second section. The third section develops econometric models for policy simulation. Results and interpretation are presented at the fourth section. Implications and conclusions are summarized in the last section.

Rice Policies in Korea

This section reviews and discusses the historical context and evolution of government policies related to rice at different stages of economic development in Korea. The major programs include price supports, infrastructure development, input subsidy, border protection, and marketing regulations.

Policies During the 1948-60 Period

During the late 1940s and early 1950s, Korea experienced poverty, social turmoil, and political instability due to the Korean War (1950-53), following World War II and the formation of a new government (1948). Farm production was low and food shortages were widespread. The memory of chronic hunger was profound, and the principal goal of agricultural policy was to secure staple food supplies and maintain low food prices.

The key policy during this period was direct control of food grains enforced by the Food Grain Control Act of 1950. The act allowed the government to purchase rice from domestic farmers and distribute it to consumers. The grain market was a dual system, composed of free and government-controlled markets. Farmers had to sell grain to the government at prices well below what would have prevailed in a free market.

Until the 1940s, agriculture in Korea had been characterized by the landlord-tenant system with a tinge of feudalism. Transferring the ownership of farmland to those who cultivate was critical to improving agricultural productivity. This land reform was activated under the Farmland Reform Act in 1949. The act imposed an upper limit of 3 hectares on ownership by farm households and provided a basis for the small-scale farm system.

The 1955 U.S. Farm Surplus Importation Agreement changed Korean food policy. Imports under PL 480 represented about 10 percent of total grain consumption and 90 percent of all grain imports in the 1950s (Anderson 1989). This food aid helped to maintain low price levels and relieved chronic food shortages.

Policies in 1960s and 1970s

The 1960 - 1980 period is generally regarded as the era of rapid economic development in Korea. The military coup in 1961 substantially changed the economic environment for agriculture. The primary goal of food policy was self-sufficiency, as hunger and malnutrition became a national issue in the early 1960s. Government investment in agriculture rose from less than 10 percent of total government investment in the 1950s to over 20 percent in the early 1960s.

Reclamation and tidal land development projects were introduced during the 1960s. In addition, converting upland to paddy fields was initiated to concentrate on rice cultivation. To increase land productivity with limited land resources, small-scale irrigation projects were developed. In the early 1970s the emphasis shifted to large-scale, integrated regional development projects. To develop major river basins, dams and electric power plants were constructed. Paddy field consolidation projects were initiated to increase farming efficiency in the mid-1960s. With rapid emigration of the farm labor force due to economic development and rising farm wages, the Korean government introduced agricultural mechanization. Efforts through these programs increased productivity and reduced yield variability substantially.

Research and extension introduced high-yield rice during 1970s, increasing rice productivity. The high-yield varieties (HV) produced approximately 1.25 times more than traditional rice varieties (TV). The expanded acreage for high-yield varieties increased rice production by 25 percent from 1974 to 1979 (Table 2).

Introduction of a two-price system under the Food Grain Control Act in 1967 was the most rigorous effort for self-sufficiency. This policy was designed to stimulate rice production and to support farm income. Figure 1 illustrates the mechanism of the two-price system. The government purchases rice at a predetermined price right after harvest. The price is above the market price to cover average production costs. The procured rice is released below market price to hold consumer prices down. Government cost for this policy is the storage cost plus the difference between the purchasing price and release price. The price support increased production to the point where it satisfied domestic demand in the 1976-78 period.

4

TABLE 2. COMPARISON OF ACREAGE PLANTED, YIELD, AND
   PRODUCTION BETWEEN HIGH-YIELDING AND TRADITIONAL
   VARIETIES OF RICE, 1974, 1976, AND 1979

	1974	1976	1979
Areas planted (1,000 ha)			
HV	181	533	744
TV	1,008	663	480
Yield per hectare (tons)			
HV	473	479	463
TV	353	396	437
Production (1,000 tons)			
HV	856	2,553	3,449
TV	3,561	2,626	2,097

Source: Korean Ministry of Agriculture, Forestry, and
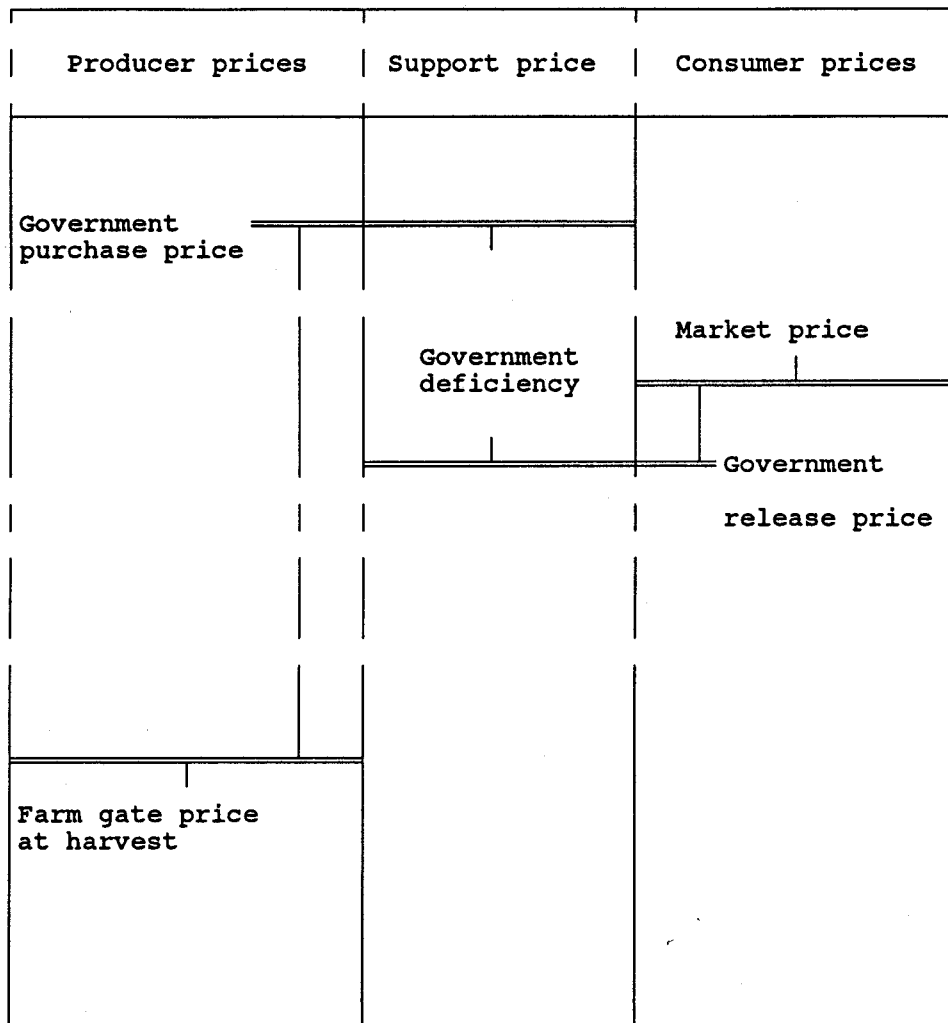Fisheries. Major Agricultural Statistics. Seoul, 1990.

Figure 1. The Two-price System in the Rice Market.

Together with price support, border protection restricted imports. Tight restrictions on imports were required to support the high domestic prices for producers. In addition, the government imposed a 5 percent tariff.

Prices of wheat and barley have been maintained at a relatively low level compared to that of rice to reduce rice consumption. The government took various measures to encourage consumers to substitute non-rice staples for rice in their diets. Restaurants had to serve a mixture of 75 percent rice and 25 percent barley. Restaurants served wheat noodles and other cereal foods on Wednesdays and Saturdays. School lunch programs followed a similar diet pattern. Domestic food consumption programs were an integral part of the agricultural policy during the 1960s and 1970s and succeeded to some extent.

Policies in the 1980s

Korea was in the midst of economic uncertainty in the 1980s. Real output declined in part because of the worldwide oil shock and a severe crop failure. Also, the inflation rate soared in the early 1980s. Food security issues were revisited because of the short supply and high food prices. During the first half of the 1980s, low levels of price supports for rice were maintained to reduce the inflation rate. In particular, the support price was frozen in 1983 and 1984.

After the mid-1980s, however, the policy environment changed, mainly because of economic recovery. The support price level for rice increased along with the difference between the procurement and release prices. Rice self-sufficiency was achieved during this period (Table 3) and government stocks increased substantially (Table 4) at the expense of taxpayers.

TABLE 3. SELF-SUFFICIENCY RATIOS OF SELECTED CROPS, 1965-1989

	1965	1970	1980	1989
	---------------Percent---------------			
Total cereals	93.9	80.5	56.0	42.9
Rice	100.7	93.1	95.1	108.1
Wheat	27.0	15.4	4.8	0.1
Soybeans	100.1	86.1	35.1	19.4
Corn	36.1	18.9	5.9	1.8

Source: Korean Ministry of Agriculture, Forestry, and Fisheries. Major Agricultural Statistics. Seoul, 1990.

TABLE 4. SUPPLY, CONSUMPTION, AND INVENTORY OF RICE, 1975-1989

	1975	1980	1985	1989
	-----------Thousand tons-----------			
Supply	5,414	6,468	6,929	7,174
Consumption	4,699	5,402	5,501	5,602
Carryover stock	715	1,066	1,428	1,572

Source: Korean Ministry of Agriculture, Forestry, and Fisheries. Major Agricultural Statistics. Seoul, 1990.

One of the toughest challenges that Korean agriculture faced in the 1980s was pressure to open agricultural markets. Bilateral trade negotiations, particularly with the United States, reduced trade restrictions on farm products. Korea liberalized imports of 234 agricultural commodities in 1991. As a result, the ratio of imports to consumption of farm products was 86.2 percent in 1991 compared to 64.6 percent in 1979 and 79.3 percent in 1989.

To compensate farmers' losses due to trade liberalization, the government adopted a direct payment program. Under the program, the government provides three kinds of subsidies: 1) Farmers who produce soybeans and corn are subsidized the difference between a guaranteed internal price and the import price to maintain adequate levels of production; 2) grape and peach producers are subsidized if they reduce acreage planted; and 3) favorable credits are provided to farmers producing crops that face import competition when they convert the cropland to other farm uses.

However, the government decided to protect staple crops, especially rice, that represent a major portion of farm income. Food security is another cause of protective agricultural policies. Policymakers believe that once the market is open, the Korean rice industry will not be able to compete with the major exporters, and eventually will go out of business. Dependence of rice on the foreign market may be critical to the Korean economy, especially when monopoly or oligopoly in the international rice market is possible.

Nonetheless, trade liberalization in the agricultural sector may be irresistible through either the GATT negotiation or bilateral negotiations. Rice may not be an exception.

Model Development and Procedures

To determine the impact of trade liberalization, this study uses a partial equilibrium model, including consumer, producer and import behaviors. Empirical estimates are used to simulate the impact of policies on prices, consumption, production, and imports.

Koreans consume two different varieties of rice. One is a traditional high-quality variety Japonica rice (TV), and the other is a low-quality but high-yield variety (HV), which is a hybrid of Japonica and Indica. Since they are not perfect substitutes in consumption, the demand schedule for each differs. In production, they compete for limited land.

The representative consumer maximizes utility, given a fixed income. The demand schedule is derived by maximizing utility. This study assumes that the per capita demand for variety i is a linear function of income and prices of goods in the consumption bundle as follows:

$$D_{it} = a_0 + a_1 Y_t + a_2 P_{it} + \Sigma_j b_j P_{jt} + \varepsilon_{it}, \quad i = TV, HV, \tag{1}$$

where Y is per capita disposable income, P_i is the price of the ith variety, P_j is the price of substitute, and εj is assumed independent, identically distributed normal variate. Income and prices are deflated by the Consumer Price Index to meet the homogeneity condition.

It is further assumed that demand does not adjust instantaneously to changes in real characteristics of the economy such as taste. To incorporate dynamic adjustment in consumption, we introduce the partial adjustment model (Nerlove) such that

$$D_{it}^* = a_0 + a_1 Y_t + a_2 P_{it} + \Sigma_j b_j P_{jt} + \varepsilon_{it}, \text{ and} \tag{2}$$
$$D_{it} - D_{it-1} = \delta(D_{it}^* - D_{it-1}), \quad 0 < \delta < 1,$$

where D* is the equilibrium quantity determined by the static utility maximization condition, and δ is an adjustment coefficient. The adjustment is partial because of some frictions such as habit formation or lack of information. The reduced form of the partial adjustment model after simplification is (Phlips)

$$D_{it} = \alpha_0 + \alpha_1 Y_t + \alpha_2 P_{it} + \Sigma_j \beta_j P_{jt} + \alpha_3 D_{it-1} + v_{it}. \tag{3}$$

This model is used to estimate domestic demands for the two varieties. TV and HV are substitutes for each other. Other commodities included in the demand models are barley and wheat. Barley has been a close substitute of rice throughout Korean history, while wheat became a substitute since 1970s.

The supply schedule can be derived through producer's profit maximization as

$$S_i = f(P, W), \quad i=TV \text{ and } HV, \tag{4}$$

where P is a price vector of output including substitutes and W is the vector of input prices. The two-price system is only applied to HV, i.e., only HV is subsidized. Thus, the government procurement price is used for HV, while the farm price is used for TV. Technically, no other crop is competing with the production of rice in Korea. Thus, P in equation (4) includes only the prices of TV and HV.

Since farm prices of rice are not known at planting time, farmers are assumed to make planting decisions based on the previous year's price (naive expectation). Similarly, the previous year's production costs form an information set at planting time.

Supply does not response instantaneously to innovation or policy changes. A dynamic model can capture the friction in adjustment. Dynamics in supply response are introduced, using the partial adjustment process. Consequently, supply response functions to be estimated are

$$S_{it} = \beta_0 + \beta_1 FP_{t-1} + \beta_2 G_{t-1} + \beta_3 W_{t-1} + \beta_4 S_{it-1} + e_{it}, \quad i=TV, HV, \tag{5}$$

where P_{t-1} is the price of TV received by farmers at time t-1, G_{t-1} is the government procurement price for HV at time t-1, W_{t-1} is the farm input price index at time t-1, and e is i.i.d. normal.

An import demand model for a commodity can be expressed as a function of the domestic and international prices of the commodity. A greater difference between the two prices would bring more import, assuming traders maximize profit. Equilibrium in trade is made where no arbitrage opportunity exists. Since rice is the basic staple in the diet, income would not affect the import decision. Thus, a linear import demand equation is specified as follows:

$$M_t = \gamma_0 + \gamma_1 P_{tvt} + \gamma_2 P_{hvt} + \gamma_3 WP_t + \mu_t, \tag{6}$$

where WP is the world price, and μ_t is the disturbance term.

Along with the five behavioral equations, two identity equations were specified:

$$S_{tv} + M = D_{tv} \tag{7}$$

$$S_{hv} + ST_{-1} = D_{hv} + ST, \tag{8}$$

where ST (ST$_{-1}$) is the ending stock (previous year's). The first identity reflects that imported rice only enters into the TV market because they are similar in quality. This equation also indicates that rice is imported only when supply is in short of demand for TV. Insignificant HV price in the import demand equation [6] would confirm this relation. The second identity reflects accumulating HV stocks. There is no stock for TV.

The above simultaneous equation system was estimated by the three-stage least squares (3SLS) estimator. Past studies similar to this analysis usually used OLS (e.g., Moon and Kang). The results in this study do not suffer from the simultaneity problem. Moreover, if errors are correlated across equations, i.e., contemporaneously correlated, the estimates obtained by this method are asymptotically more efficient.

The impact of trade liberalization on the rice industry is simulated under the following five alternative scenarios:

(1) Model 1 assumes that the existing two-price system and border protection will continue. The results of this base model are compared to those of alternative scenarios.

(2) Model 2 assumes that the domestic rice market is partially liberalized with import quotas under the two-price system. The import quota is assumed to be 5 percent of total domestic consumption. This scenario is a plausible first step for Korea to take under trade liberalization.

(3) Model 3 assumes a 10 percent import quota in Model 2.

(4) Model 4 considers a more practical scenario. This mode assumes that the price support system is removed, and the quota restriction is converted into tariffs. A 20 percent tariff is assumed in this model, partly reflecting the proposals discussed in GATT negotiations.

(5) Model 5 assumes a 5 percent tariff, but is otherwise the same as Model 4. Hence, the domestic rice market is liberalized with only a modest degree of protection by eliminating other protectionist measures that apply to rice. A complete elimination of all trade restrictions is not likely.

The impact of trade liberalization is simulated over eight years from 1989 to 1996. This analysis assumes that real disposable income increases at 5 percent annually, which is projected for the seventh five-year economic development plan (1992-1996). Production cost and government purchase price are assumed to increase at 1.5 and 1 percent, respectively. These numbers are based on the annual rates of increase for the 1985 to 1989 period. Import price is assumed to be constant at the 1988-89 level.

Data Description

Annual data from 1975 to 1989 are used to estimate the model. Table 5 shows definitions of variables in empirical models. Data for personal disposable income were obtained from the Bank of Korea, and the Consumer Price Index is from the Korean Economic Planning Board. Data for rice consumption are taken from the Korean Ministry of Agriculture, Forestry, and Fisheries (KMAFF).

Data for the government procurement price, production cost index, and rice production are obtained from KMAFF. Data for farm prices are taken from the Korean National Agricultural Cooperative Federation.

Data for consumer prices by variety and import price are obtained from the Food and Agriculture Organization and KMAFF. Consumer prices and import prices are deflated by CPI and exchange rate, respectively. Import prices for milled rice are converted to a polished basis by multiplying by the official conversion rate of 0.929. Prices of imported rice are determined by adding transport and handling costs after imposing a 5 percent tariff per c.i.f. unit import value.

Because rice has not been imported since 1984, the sample data for import demand model were from 1975 through 1983. The maintained assumption is that the import behavior has not changed since then.

TABLE 5. ENDOGENOUS AND EXOGENOUS VARIABLES FOR THE MODELS

Variable	Description
Endogenous Variables	
D_{TV}	Consumption of traditional varieties
D_{HV}	Consumption of high-yielding varieties
P_{TV}	Consumer price of traditional varieties
P_{HV}	Consumer price of government-controlled high-yielding varieties
S_{TV}	Production of traditional varieties
S_{HV}	Production of high-yielding varieties
M	Quantity of imported rice
Exogenous Variables	
PDI	Per capita disposable income
Pb	Consumer price of barley
Pw	Consumer price of wheat
FP_{-1}	Farm price of traditional variety at t-1
G_{-1}	Government purchase price for high-yielding variety at t-1
W_{-1}	Farm Input costs at t-1
WP	Border price of import rice
ST	Ending Stock
Lagged Variables	
LD_{TV}	Previous year's D_{TV}
LD_{HV}	Previous year's D_{HV}
LS_{TV}	Previous year's S_{TV}
LS_{HV}	Previous year's S_{HV}
ST_{-1}	Previous year's ST

Table 6 summarizes sample statistics. The price of TV is higher than that of HV, reflecting the quality difference. Prices of barley and wheat are below those for the two varieties of rice. The difference between the HV consumer price (P_{hv}) and procurement price (G) indicates government subsidy for HV production. The government purchased HV at 7.63 won/kg and released it at an average 6.49 won/kg. Import price adjusted to transferring cost and tariff is about half of the TV consumer price, indicating price incompetitiveness of the Korean rice industry. Quantities of TV consumed and produced are about 70 percent higher than those of HV during the sample period. The average import is about 343,000 MT or 0.06 percent of total domestic production.

TABLE 7. ESTIMATED PARAMETERS OF RICE DEMAND, SUPPLY, AND IMPORT MODEL (t-VALUES IN PARENTHESES)

	Demand		Supply		Import
	D_{TV}	D_{HV}	S_{TV}	S_{HV}	
Intercept	-8397.339 (-2.364)	16926 (3.300)	-31.417 (-0.034)	2674.035 (4.022)	-7468.057 (-2.537)
PDI	214.988 (1.001)	-275.384 (-0.985)			
P_{TV}	-103.156 -0.167)	281.146 (0.337)			564.024 (2.380)
P_{HV}	608.131 (1.154)	-725.810 (-1.035)			249.255 (0.764)
Pb	367.256 (1.422)	-604.261 (-1.655)			
Pw	1775.651 (1.212)	-3572.04 (-1.827)			
LD_{TV}	0.297 (1.790)				
LD_{HV}		0.224 (1.371)			
WP					168.151 (0.645)
FP_{-1}			986.374 (2.339)	-619.840 (-2.282)	
G_{-1}			-510.455 (-1.359)	834.612 (3.406)	
W_{-1}			-468.935 (-1.477)	-683.877 (-3.374)	
LS_{TV}			0.587 (4.350)		
LS_{HV}				0.686 (8.587)	

TABLE 8. OWN-PRICE, CROSS-PRICE, AND INCOME ELASTICITIES OF DEMAND AT THE MEANS

		Demand
	TV	HV
Demand:		
Price of		
TV	-0.254	1.274
HV	1.114	-2.444
Barley	0.407	-1.230
Wheat	1.018	-3.767
Income	0.741	-1.747
Supply:		
Price of		
TV	2.377	-2.374
HV	-1.200	3.118

Policy Simulations

Protection Under Current Policies

Table 9 shows simulated results under the current price support and import ban. Domestic supply of HV gradually decreases while demand for HV falls sharply and eventually becomes nil in 1996. As a result, domestic supply of HV is projected to exceed demand for HV. However, domestic supply of TV is projected to increase by 10 percent between 1989 and 1996, while demand for TV increases by 25 percent. The domestic supply of TV would fall short of demand for TV. The results imply that under current policies, the rice self-sufficiency ratio would be over 100 percent with a surplus of HV and a shortage of TV.

TABLE 9. PROJECTIONS OF CONTINUING PROTECTION POLICIES (SCENARIO 1)

Year	Demand		Supply		Consumer Price	
	TV	HV	TV	HV	TV	HV
	------------ 1,000 tons ----------				----won/kg----	
1989	4,680	91	4,475	987	10.38	5.73
1990	4,823	747	4,587	864	10.38	5.52
1991	4,930	617	4,702	756	10.39	5.28
1992	5,010	520	4,819	661	10.44	5.03
1993	5,074	439	4,940	579	10.48	4.76
1994	5,124	369	5,063	506	10.50	4.48
1995	5,328	111	5,190	443	10.52	4.45
1996	5,597	0	5,320	388	10.53	4.45

Impacts of Liberalization With Quotas

Models under 5 and 10 percent import quotas provide results similar to the results of Model 1 as shown in Table 10. Compared to the results of Model 1, allowing import with quantitative restrictions would decrease production, increase demand, and decrease the prices of both varieties.

TABLE 10. PROJECTIONS OF RICE IMPORTS

Year	Demand		Supply		Import	Consumer Price	
	TV	HV	TV	HV		TV	HV
	---------- 1,000 tons ----------					----won/kg----	

5 Percent Import Quota (Scenario 2):

Year	TV	HV	TV	HV	Import	TV	HV
1989	4,906	863	4,453	846	281	10.37	5.50
1990	5,397	647	4,542	635	288	10.37	5.37
1991	5,031	486	4,633	476	302	10.37	5.17
1992	4,960	364	4,726	367	276	10.37	4.89
1993	5,020	273	4,820	268	266	10.37	4.68
1994	5,144	205	4,917	201	265	10.37	4.51
1995	5,350	34	5,015	151	267	10.37	4.45
1996	5,618	0	5,115	112	269	10.37	4.45

10 Percent Import Quota (Scenario 3):

Year	TV	HV	TV	HV	Import	TV	HV
1989	5,129	806	4,410	846	561	10.18	5.39
1990	4,900	564	4,454	635	593	10.18	5.39
1991	5,071	356	4,498	476	546	9.88	5.39
1992	5,151	249	4,543	357	543	9.88	5.10
1993	5,217	163	4,589	268	540	9.88	4.83
1994	5,291	61	4,635	201	538	9.88	4.57
1995	5,444	0	4,681	151	535	9.88	4.45
1996	5,680	0	4,728	113	544	9.88	4.45

With a 5 percent quota, the domestic supply of TV is projected to decrease by 8 percent in 1989 and by 4 percent in 1996, compared to that of Model 1. Production of HV is projected to fall by 30 percent in 1989 and by 70 percent in 1996. However, demand for TV is projected to increase by 10 percent in 1989 and by 0.4 percent in 1996. The demand for HV is projected to drop to zero in 1996. This results in a lower self-sufficiency ratio. Since imports take a small portion of consumption, imports hardly affect the domestic price.

Increasing the quota to 10 percent reduces domestic production of TV and prices, leaving the production of HV almost the same as that of the 5 percent quota model. Rice imports increase two fold, and domestic consumers switch to the cheaper imports.

14

Impacts of Liberalization With Import Tariffs

Trade liberalization with tariffs has a significant impact on prices, production, consumption, and imports (Table 11). Consumer prices are projected to fall significantly compared to those of partial liberalization under the quota systems. Without import restrictions, the import price would prevail in the domestic market. This would affect domestic production. Production of TV decreases sharply compared to Model 1 and models under quotas, and HV is not produced. About 85 percent of consumption is supplied by import in 1996. The results of the two different tariffs are similar.

TABLE 11. PROJECTIONS OF RICE IMPORTS

Year	Demand		Supply		Import	Consumer Price	
	TV	HV	TV	HV		TV	HV
	---------- 1,000 tons -----------					---won/kg---	

20 Percent Tariffs (Scenario 4):

Year	TV	HV	TV	HV	Import	TV	HV
1989	5,417	567	4,366	0	1,618	4.01	3.74
1990	5,523	170	2,170	0	3,523	4.01	3.74
1991	5,630	0	1,973	0	3,656	4.01	3.74
1992	5,736	0	1,777	0	3,959	4.01	3.74
1993	5,842	0	1,580	0	4,262	4.01	3.74
1994	5,948	0	1,384	0	4,564	4.01	3.74
1995	5,814	0	1,188	0	4,626	4.01	3.74
1996	5,981	0	991	0	4,990	4.01	3.74

5 Percent Tariffs (Scenario 5):

Year	TV	HV	TV	HV	Import	TV	HV
1989	5,417	570	4,366	0	1,622	3.60	3.58
1990	5,523	174	2,126	0	3,571	3.60	3.58
1991	5,630	0	1,908	0	3,722	3.60	3.58
1992	5,736	0	1,690	0	4,046	3.60	3.58
1993	5,842	0	1,471	0	4,371	3.60	3.58
1994	5,948	0	1,253	0	4,695	3.60	3.58
1995	6,055	0	1,035	0	5,020	3.60	3.58
1996	5,997	0	816	0	5,180	3.60	3.58

Summary and Conclusions

A five-equation, partial equilibrium model was used to determine the impacts of trade liberalization on the rice market in Korea. A dynamic deterministic simulation was conducted under five alternative scenarios.

Table 12 summarizes the simulated results for 1989 and 1996 under alternative scenarios. The numbers for Model 1 for 1989 are actual numbers for comparison. Important findings are as follows:

First, under the current policies of the two-price system and the import ban, production of the high-yield variety would decrease dramatically, and demand for this variety would be nil in 1996.

Second, import quotas do not significantly affect production or prices. However, the self-sufficiency rate would drop to some 90 percent compared to over 100 percent under the current policies.

Third, trade liberalization with tariffs affect production and price significantly. Due to price competitiveness, imports were projected to satisfy 27 percent of total consumption in 1989 and 85 percent in 1996. As a result, domestic production decreases significantly. The self-sufficiency rate would be 73 percent in 1989 and only 14 percent in 1996.

Fourth, consumption patterns change. Demand for TV grows while demand for HV falls and becomes nil by 1996. These results imply that consumer demand switches to high-quality rice as a result of changes in relative prices and increases in income.

Fifth, production of a high-yield variety would disappear from Korean paddy fields under the liberalization with tariffs. The results indicate that the domestic rice sector, particularly HV production, relies heavily on the government subsidy and is not competitive in international trade.

TABLE 12. PROJECTIONS OF THE IMPACT OF REMOVING PROTECTION

| | Scenarios | | | | |
	1	2	3	4	5
	───────── 1,000 ton ─────────				
1989:					
Production					
TV	4,848	4,453	4,410	4,366	4,366
HV	1,206	846	846	0	0
Total	6,054	5,299	5,256	4,366	4,366
Consumption					
TV	4,456	4,906	5,129	5,417	5,417
HV	1,108	863	806	567	570
Total	5,564	5,769	5,935	5,984	5,987
Imports	0	281	562	1,618	1,622
Self-sufficiency(%)	109	92	89	73	73
Consumer price					
TV (won/kg)	10.38	10.37	10.18	4.01	3.61
HV (won/kg)	5.73	5.50	5.39	3.74	3.58
1996:					
Production					
TV	5,319	5,115	4,728	911	816
HV	388	113	113	0	0
Total	5,707	5,228	4,841	911	816
Consumption					
TV	5,596	5,618	5,680	5,981	5.997
HV	0	0	0	0	0
Total	5,596	5,618	5,680	5,981	5,997
Imports	0	269	544	4,990	5,180
Self-sufficiency(%)	102	91	85	15	14
Consumer price					
TV (won/kg)	10.53	10.37	10.06	4.01	3.61
HV (won/kg)	4.45	4.45	4.45	3.74	3.58

Suggestions for Future Studies

Not all trade restrictions were discussed in this study. In addition to price supports and border protection, input subsidies and infrastructure supports may impact the rice market after trade liberalization.

This study does not incorporate feedback effects of the rice market to other farm sectors. The consequences of liberalizing the rice market can affect the performance of the other food markets. Finally, the maintained assumption of this study is that Korean imports do not influence the world rice market. However, in the case of medium-grain rice that Koreans consume, the import of the Korean market may not be negligible. Imports from Korea may affect the world price.

BIBLIOGRAPHY

Anderson, Kym. 1989. "Korea: A Case of Agricultural Protection." Food Price Policy in Asia. Ed. Terry Sicular. Ithaca: Cornell University Press.

Anderson, Kym, and Perter G. Warr. 1987. "General Equilibrium Effects of Agricultural Price Distortions: A Simple Model for Korea." Food Research Institute Studies 20.2:245-263.

Askari, Hossein, and John Thomas Cummings. 1977. "Estimating Agricultural Supply Response with the Nerlove Model." International Economic Review 18.2:257-292.

Carter, Colin A. 1988. "Trade Liberalization in the Grain Markets." Canadian Journal of Agricultural Economics 36: 633-641.

Childs, Nathan W., and William Lin. 1989. Rice: Background for 1990 Farm Legislation. Washington, D.C.: USDA.

Food and Agriculture Organization. Trade Yearbook. Rome, Italy, various issues.

Golden, Ian, and Odin Knudsen, eds. 1990. Agricultural Trade Liberalization: Implications For Developing Countries, Washington, D.C.: OECD.

Henneberry, Shida, and David Henneberry. 1989. "International Trade Policies." Agricultural Analysis Tools For Economic Development. Ed. Luther Tweeten. Boulder: Westview Press, 322-354.

Ito, Shoichi, E. Wesley F. Peterson, and Warren R. Grant. 1989. "Rice in Asia: Is It Becoming an Inferior Good ?" American Journal of Agricultural Economics 71.1:32-42.

Konandres, Panos, Peter Bushnell, and Richard Green. 1978. "Estimation of Export Demand Functions for U.S. Wheat." Western Journal of Agricultural Economics 3.1:39-49.

Koo, Won W. 1982. An Econometric Analysis of U.S. Wheat Acreage Response: The Impact of Changing Government Programs. Agricultural Economic Report No. 157. Fargo, North Dakota State University.

Koo, Won W., and Chang J. Park. 1988. Econometric Analysis of Livestock Products Demand in Korea and its Implications in the Korean Feed Grain Industry. Agricultural Economics Report No. 232. Fargo, North Dakota State University.

Korean Economic Planning Board. Annual Report on the Price Survey. Seoul, various issues.

Korean Ministry of Agriculture, Forestry, and Fisheries. 1990. Annual Report on Agricultural Situation. Seoul.

Korean Ministry of Agriculture, Forestry, and Fisheries. 1989-1991. Budget in Brief. Seoul.

Korean Ministry of Agriculture, Forestry, and Fisheries. 1990. Major Agricultural Statistics. Seoul.

Korean Ministry of Agriculture, Forestry, and Fisheries. Report on the Results of Production Cost Survey of Agricultural Products. Seoul, various issues.

Korean National Agricultural Cooperative Federation. 1989-1990. *Agricultural Cooperative Yearbook*. Seoul.

LaFrance, Jeffrey T., and Oscar R. Burt. 1983. "A Modified Partial Adjustment Model of Aggregate U.S. Agricultural Supply." *Western Journal of Agricultural Economics* 8.1:1-12.

Moon, Pal Yong, and Bong Soon Kang. 1989. Trade Exchange Rate, and *Agricultural Pricing Policies in the Republic of Korea*. Washington, D.C.: The World Bank.

Nerlove, Marc. 1958. *The Dynamics of Supply: Estimation of Farmers' Response to Price*. Baltimore: Johns Hopkins Press.

OECD. 1987. *National Policies and Agricultural Trade*. Paris.

Phlips, L. 1983. *Applied Consumption Analysis: Revised and Enlarged Edition*. North-Holland, NY.

Shonkwilder, J.S., and Suzanne Hinckley. 1985. "A Generalized Supply Response: Factor Demand Model and its Application to the Feeder Cattle Market." *Western Journal of Agricultural Economics* 10.2:245-253.

Tweeten, Luther, David Pyles, and Shida Henneberry. 1989. "Supply and Elasticity Estimation." *Agricultural Analysis Tools for Economic Development*. Ed. Luther Tweeten. Boulder: Westview Press, 73-95.

Unnevehr, Laurian J. 1986. "Consumer Demand for Rice Grain Quality and Returns to Research for Quality Improvement in Southeast Asia." *American Journal of Agricultural Economics* 68.3:636-641.

Vincent, David. 1989. "Domestic Effects of Agricultural Protection in Asian Countries with Special Reference to Korea." *Macroeconomic Consequences of Farm Support Policies*. Ed. Andrew B. Stoeckel, David Vincent, and Sandy Cuthbertson. Durham: Duke University Press, 150-172.