JOURNAL OF ECONOMIC DEVELOPMENT
Volume 14, Number 1, June 1989

Evaluation of Rice Market Intervention and Its Rationale in Korea*

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This paper analyzes the effects of price intervention using the partial equilibrium approach.*** The application of the partial equilibrium model suggests that total producer gains from intervention could be in the order of US$19.5 billion for the period 1970 to 1985, with consumers recording a corresponding loss. The possible saving in foreign exchange resulting from intervention is estimated at US$1.3 billion for the same period. Although large net social efficiency losses are apparent, employment, foreign exchange, and socio-political security considerations must be take into account in a full evaluation. Analysis of the employment effects, for example, shows that some 660,000 farm workers would have been displaced from the rural labor market between 1970 and 1985, under the no-intervention scenario.

I. Introduction

Korea is a peninsula which has about 99,000 square kilometers of total land area, around 67 percent of this being mountains. Only 23 percent of the land is cultivated, the remainder being occupied by cities, industrial facilities, roads, etc. Compared with its small land area, Korea has a large population-nearly 41 million in 1986. Population density in 1986 was one of the world's highest. The average farm size is slightly over one hectare. Land therefore is one of the main constraints to the expansion of food production in Korea.

Rice is the major crop grown in Korea, comprising about 35.8 percent

* This paper is based upon part of the author's paper "Evaluation of Government Rice Market Intervention system in Korea," Evaluating Rice Market Intervention Policies-some Asian Examples published by the Asian Development Bank in 1988.

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*** The same partial equilibrium approach is applied to every five different Asian countries for cross-country comparisons purpose.

Table 1

RICE VOLUME OF PRODUCTION AND PER CAPITA CONSUMPTION, 1970-85, KOREA

Rice Year	Production (1,000 M/T)	Per Capita Consumption (kg)
1970	4,090	136.4
1971	3,939	134.8
1972	3,997	134.5
1973	3,957	129.4
1974	4,212	127.8
1975	4,445	123.6
1976	4,669	120.1
1977	5,215	126.4
1978	6,006	134.7
1979	5,797	135.6
1980	5,136	132.7
1981	3,550	131.4
1982	5,063	130.2
1983	5,175	129.5
1984	5,404	130.1
1985	5,682	128.1

Sources: Ministry of Agriculture and Fisheries, *Agricultural Statistics Yearbook*, various issues.

_____, *Report on the Results of Food Grain Consumption Survey*, various issues.

local assembler or rice miller, consignment trader or wholesaler, retailer and consumer. The government channel which is utilizing the NACF channel as a sub-channel follows the stages of producer to government NACF marketing center to NACF appointed retailer or ordinary retailer to consumer. The NACF channel utilizes the same steps as the government channel except the local agricultural cooperative receives rice from producer directly. The three channels are illustrated in Figure 1.

The volume and proportion of rice marketed through the various channels are presented in Table 2. In Korea, the largest rice marketing channel is the free market channel. In 1965, 83.9 percent of total marketed rice went through the free market channel and almost all of the rest, 15.6 percent, went through the government channel. The share of rice market between free market and government channels varied over time mainly depending upon government rice acquisition program. In

Table 2

VOLUME OF RICE MARKETED THROUGH VARIOUS CHANNELS, 1965-1985

(1,000 M/T (%))

Rice Year	Production (A)	Volume (B), (B/A)	Government Channel (C), (C/B)	NACF Channel (D), (D/B)	Free Market Channel (E), (E/B)
1965	3,954	1,936 (49.0)	302 (15.6)	9 (0.5)	1,625 (83.9)
1970	4,090	1,918 (46.9)	351 (18.3)	54 (2.8)	1,513 (78.9)
1975	4,445	2,140 (48.1)	735 (34.3)	94 (4.4)	1,311 (61.3)
1976	4,669	2,248 (48.1)	790 (35.2)	84 (3.7)	1,374 (61.1)
1977	5,215	2,675 (51.3)	1,043 (40.0)	67 (2.5)	1,565 (58.5)
1978	6,006	3,243 (54.0)	1,403 (43.3)	29 (0.9)	1,811 (55.8)
1979	5,797	3,154 (54.4)	1,355 (43.0)	36 (1.1)	1,763 (55.9)
1980	5,565	2,691 (48.4)	1,301 (48.3)	32 (1.2)	1,358 (50.5)
1981	3,550	1,519 (42.8)	546 (35.9)	36 (2.4)	937 (61.7)
1982	5,063	2,653 (52.4)	915 (34.5)	45 (1.7)	1,693 (63.8)
1983	5,175	2,815 (54.4)	1,091 (38.7)	47 (1.7)	1,677 (59.6)
1984	5,404	2,934 (54.3)	1,219 (41.6)	63 (2.1)	1,652 (56.3)
1985	5,682	3,205 (56.4)	1,217 (38.0)	149 (4.6)	1,839 (57.4)

Sources: MAFF, *Yearbook of Agriculture and Fisheries Statistics,* various issues.
NACF.

Table 3

QUANTITY OF PRODUCTION AND GOVERNMENT PURCHASE OF POLISHED RICE, 1970-1984

(1,000 M/T)

Year	Production[a] (A)	Purchase (B)	B/A (%)
1970	3,939	351	8.9
1975	4,669	690	16.9
1976	5,215	1,043	20.0
1977	6,006	1,403	23.4
1978	5,797	1,355	23.4
1979	5,565	1,301	23.4
1980	3,550	546	15.4
1981	5,063	915	18.1
1982	5,175	1,091	21.1
1983	5,404	1,219	22.6
1984	5,682	1,215	21.4

[a] Quantity harvested in that particular year
Source: MAFF, *Food Grain Policy Bureau.*

The polishing of government purchased paddy rice goes three essentially the same steps as those of the purchasing of rice. First, the director of MAFF Bureau of Food Grain Policy assigns the quantity of paddy rice to be processed to each provinces. Then the responsible official of the province reassigns the quantity to each city or county, and then, from city or county to the government-appointed rice mills within the jurisdiction of each administrative district. After the paddy rice is being polished, the agents from the National Agricultural Product Inspection Office inspect the quality of polished paddy rice. The inspection criteria of polished rice have been changed a little depending upon domestic food situation. At present, the milling ratio reaches 72 to 73 percent of rough rice including 15 percent broken rice.

In accordance with the release plan set by Food Grain Policy Department of provincial government under MAFF directions, the rice is shipped to the NACF marketing center through which rice is distributed to NACF appointed retailers or ordinary retailers then on to consumers.

To obtain border prices of output (rice) and input (fertilizer), the f.o.b. export prices were used for those years in which Korea exported rice and input (after subtracting transport costs to major ports to get the producer-price equivalent), and the c.i.f. import prices for those years in which Korea imported rice or fertilizer or both. For years in which Korea

Table 4

EXCHANGE RATE, CONSUMER AND PRODUCER PRICES OF RICE, 1970-1984

(₩/1,000 M/T)

Year	Exchange Rate[a] (Won/US$)	Producer Prices[b] (A)	Consumer Prices[c] (B)	B/A
1970	316.7	76.3	73.4	0.96
1971	373.3	95.9	91.4	0.95
1972	398.9	121.8	124.1	1.02
1973	397.5	126.9	122.6	0.97
1974	484.0	180.0	170.5	0.95
1975	484.0	226.2	221.7	0.98
1976	484.0	269.9	265.4	0.98
1977	484.0	300.5	295.4	0.98
1978	484.0	340.4	337.7	0.99
1979	484.0	396.5	435.1	1.10
1980	659.9	515.9	532.7	1.03
1981	700.5	634.7	686.4	1.08
1982	748.8	699.9	746.7	1.07
1983	795.5	722.3	745.4	1.03
1984	827.4	733.8	750.7	1.02

[a] Bank of Korea standard concentration rate.
[b] (RTV×FT + HYV×PP) / (RTV + HYV)
[c] (SPM×WP + SGP×RP) / (SPM + SGP)
RTV: Rice of traditional variety
HYV: Rice of high yield variety
SPM: Share of private market
SGP: Share of Government purchase
FP: Farmers received price of rice
PP: Government purchasing price of rice
WP: Wholesale price of rice
RP: Government release price of rice

Sources: Ministry of Agriculture and Fisheries, *Agricultural Statistics Yearbook*, various issues.
FAO, *Trade Yearbook*, various issues.
BOK, *Economic Statistics Yearbook*, various issues.

Table 6

NOMINAL PROTECTION COEFFICIENTS ON OUTPUT AND INPUT, 1970-1984

Year	NPCOC[a]	NPCOP[b]	NPCI
1970	0.140	0.187	0.179
1971	0.527	0.603	0.070
1972	1.108	1.069	–0.108
1973	0.144	0.185	–0.284
1974	–0.231	–0.188	–0.019
1975	0.055	0.077	0.351
1976	0.942	0.975	0.934
1977	1.592	1.636	0.570
1978	0.979	0.995	0.352
1979	1.909	1.651	0.054
1980	1.056	0.991	–0.152
1981	1.170	1.007	0.152
1982	1.176	1.040	0.538
1983	0.895	0.837	0.608
1984	0.715	0.677	0.396

[a] $\frac{\text{Domestic Consumer Price of Rice}}{\text{Border Price of Rice}} - 1$

[b] $\frac{\text{Domestic Producer Price of Rice}}{\text{Border Price of Rice}} - 1$

Sources: MAF, *Statistical Yearbook of Agriculture Forestry and Fisheries,* various issues.
NACF, *Rural Price and Wage Survey,* various issues.
FAO, *Trade Yearbook,* various issues.

Also the nominal protection coefficients on output for rice producers (NPCOP), the norminal protection coefficients on output for rice consumers (NPCOC) and the nominal protection coefficient for fertilizer (NPCI) are in Table 6.

B. The Supply and Demand Elasticities of Rice

1. The Elasticity of Supply of Rice

The elasticity of supply of rice with respect to the various relative prices enables one to estimate the effect of the government interventions on the output of rice. In measuring the supply elasticity, the Nerlovian lagged supply function was fitted to the observed data in order to obtain

For decades rice demand analysis as well as analysis for demand for other farm-food products in Korea have been made extensively by planning officials in the government as well as by agricultural economists because detailed information on the future demand for farm-food products is essential for planning agricultural development programs. Most of previous attempts can be characterized by two features: (1) the use of a single demand equation specified intuitively and estimately by commodity using national per capita consumption of farm-food products to obtain price and income elasticities and (2) the assumption that the obtained elasticities are constant over the predicting period. In these attempts, therefore demand for individual farm products are determined independently of each other and change proportionally according to the increase in income without upper limit. In addition, demand for farm products, for example, the demand for wheat is ought to be determined as a function of its own price and income despite the fact that, strictly speaking, the demand for wheat is not determined by its own utility, and price but derived from the consumer's demand for foods made from wheat flour — breads, noodles, and cake, etc. As a result, internal consistency is not maintained, violating the budget constraint as well as the biological limitation particularly in the long-term prediction.

In this analysis, therefore, the rice demand elasticities are obtained not by itself but as a component of all food system. Speciically, the demand function is strictly specified in the framework of classical demand theory and estimated using household budget data. As a functional form of the demand function, Almost Ideal Demand System proposed by Deaton and Muellbauer was adopted. This model assumes that Engel curve is nonlinear and income and price elasticities vary according to the level of income and price.

To estimate elasticities of farm-food products as well as rice, commodities are classified into eight food groups and one non-food group: the food groups are cereals and potatoes, livestock products and fish, vegetables, condiments, confectionaries and soft drink, alcoholic drink, other food and restaurant meals. Rice with barley, beans, miscellaneous cereals, wheat products and potatoes were included in the cereals and potatoes group. The demand system includes altogether twenty-two food commodities and one non-food aggregate. Annual household time series and/or cross sectional budget data by income class for the 1960-85 period were used for parameter estimation.

The results of own price elasticities for 1970-1984 by the Almost Ideal Demand System method are presented in Table 7. As can be seen in Table 7 the elasticity for each year changes through time. However, rather

point of view over the study period (1970-1985). They are following:

Case I (1972, 1979-1985) $P > P_c > P_f > P_w^c > P_w^f$

Case II (1976-1987) $P > P_f > P_c > P_w^c > P_w^f$

Case III (1970, 1973, 1975) $P_w^c > P_w^f > P > P_f > P_c$

Case IV (1974) $P_w^c > P_w^f > P_f > P > P_c$

Case V (1971) $P > P_f > P_w^c > P_c > P_f^c$

where P is the equilibrium price (D = S)
P_c is the consumer price
P_f is the producer price
P_w^c is the broder price to the domestic consumer
P_w^f is the border price to the domestic producer
Q_w^s is the quantity supplied at the border price to the producer
Q_f^s is the quantity supplied at the producer price
Q is the equilibrium quantity
Q_c^d is the quantity demanded at the consumer price
Q_w^d is the quantity demanded at the border price to the consumer

The results of the partial analyses are shown in Table 8. The effects of the price interventions on four different aspects such as welfare trade-off between consumer and producer, changes in government revenue and expenditure, consequential net social efficiency losses due to the distorted market and the changes in the balance of foreign exchange were analyzed guantitatively by borrowing the previously estimated NPCOs and elasticities. With given price elasticity of demand and supply for rice, the welfare trade-off depends upon the difference between domestic prices and border prices of rice. Comparison of domestic prices to border prices of rice in Korea, revealed that the domestic consumer's prices as well as prodcuer's prices of rice were always higher than border prices of rice except for 1970-1971 and 1973-1975. The nominal protection coefficient on output was the highest in 1985 which means that the price difference between domestic and world gas the largest. For the year 1985 the producer's welfare loss was equivalent to 3,945.2 million dollars whereas the government revenue increased by 25.6 million dollars due to the rice market interventions. The net social welfare losses, i.e., the deadweight efficiency losses, amounted to 418.4 million dollars.

On the other hand, for 1974, when the border price of rice was higher than the domestic price, producer's welfare losses was equivalent to 1,245.7 million dollars while consumer welfare gain was equivalent to 1,310.7

Table 8 (continued)

		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Total
	Supply (1,000MT)	4,178	4,264	4,391	4,570	4,923	4,933	5,384	6,121	7,082	7,015	5,888	4,616	6,558	6,598	6,922	6,929	
Inter-	Demand (1,000MT)	4,719	5,171	4,975	5,007	5,129	5,414	5,552	6,121	7,082	7,516	6,468	6,861	6,827	6,814	6,922	6,929	
vention	Imports (1,000MT)	541	907	584	437	206	481	168	—	—	501	580	2,245	269	216	—	—	
No	Supply (1,000MT)	4,266	4,119	4,037	4,955	5,692	5,107	4,998	5,570	6,512	6,386	5,471	4,305	5,929	5,896	6,148	6,022	
Inter-	Demand (1,000MT)	4,135	5,127	5,535	3,725	2,795	4,811	5,941	6,745	7,701	8,547	6,702	7,145	7,251	7,260	7,417	7,483	
vention	Imports (1,000MT)	−131	1,008	1,498	−1,230	−2,897	−296	943	1,175	1,189	2,161	1,231	2,842	1,322	1,364	1,269	1,461	
Producer Gain ($ million)		−56.6	105.7	347.7	−484.8	−1,245.7	−269.5	839.4	1,405.3	1,632.0	1,925.0	1,255.7	1,261.9	2,689.7	2,974.9	3,341.6	3,807.6	19,529.9
Consumer Gain ($ million)		190.8	17.0	−346.3	708.6	1,310.7	597.2	−622.9	−1,195.9	−1,337.1	−2,392.6	−1,176.1	−1,918.4	−3,007.8	−3,158.9	−3,370.4	−3,945.2	19,647.3
Gov't Expenditure ($ million)		47.5	36.7	−57.4	111.1	148.8	88.8	24.3	56.9	34.7	−585.5	−229.0	−908.9	−482.1	−276.5	−135.0	−25.6	−2,151.2
(Sub-Total)		86.7	86.0	58.6	112.7	−83.8	238.9	192.2	152.5	260.2	117.9	308.6	252.4	164.0	92.5	106.2	−112.0	2,033.8
Foreign Exchange Cost ($ million)		110.1	−26.6	−130.6	590.5	1,693.0	300.9	−241.0	−364.1	−442.4	−586.5	−284.5	−297.1	−429.0	−428.9	−345.1	−442.4	−1,323.7
Efficiency Loss in Production ($ million)		0.6	1.8	14.6	19.6	90.2	4.7	31.2	66.2	68.4	90.4	46.1	44.0	135.5	167.1	126.3	266.7	1,173.4
Efficiency Loss in Consumption ($ million)		12.6	0.1	18.5	104.0	386.0	35.2	21.1	58.0	56.0	153.6	20.9	39.2	90.6	100.1	116.3	151.7	1,363.9
Total Deadweight Loss ($ million)		13.2	1.9	33.1	123.6	476.2	39.9	52.3	124.2	124.4	244.0	67.0	83.2	226.1	267.2	242.6	418.4	2,537.3

Table 9

RICE PRODUCTION UNDER NO INTERVENTION

Year	Actual Production (1,000 M/T)	Without Intervention		
		Production (1,000 M/T)	Self-Sufficiency (%)	Additional Import[a] (Million $)
1970	3,939	4,272	103.3	-150.3
1971	3,997	4,303	83.9	-49.3
1972	3,957	4,010	72.4	72.5
1973	4,212	3,876	104.1	-335.1
1974	4,445	4,646	166.2	-1383.1
1975	4,669	5,660	117.6	-617.4
1976	5,214	6,140	103.3	-167.0
1977	6,006	6,206	92.0	131.4
1978	5,797	5,311	69.0	411.2
1979	5,564	4,732	55.4	658.2
1980	3,550	2,818	42.0	422.1
1981	5,062	3,969	55.5	686.3
1982	5,175	3,992	55.1	654.7
1983	5,404	3,925	54.1	719.2
1984	5,682	3,896	52.5	787.9
1985	5,626	3,665	49.0	761.5

[a] Border prices (changes in production + changes in consumption)

the study period. This might have led to a serious foreign exchange problem because the Korean economy already borrowed large foreign debt.

It may be asserted that under the scinario of opening the rice market non-farm sector would have grown at a higher rate than the actual and export would have risen so much as to cover the additional foreign exchange requirement for rice import. However, it is also true that the additional growth of non-farm sector would have increased the demands for foreign exchange and foreign debt altogether, as the economic growth in Korea was heavily relied upon foreign capital. The remarkable decrease in rice price and production, as a second aspect of opening the rice market, would have extended large decline in total agricultural production in value-added terms which have caused a serious employment problem. Since rice production could be substituted into other crops and livestock under low rice price situation, the total agricultural production should be compensated as much. Supply equations of livestock and other crops were estimated with the national income account of the Bank of Korea from

Table 10

CHANGES IN AGRICULTURAL PRODUCTION UNDER NO INTERVENTION

(10 billion ₩)

Year	Rice	Livestock	Other Crops	Total
1970	51.4	-35.4	-13.3	2.7 (0.4)[a]
1975	409.7	-226.3	-104.1	79.3 (3.4)
1976	-771.7	225.0	118.2	-428.5 (-9.4)
1980	-939.5	635.1	124.7	-179.7 (-3.6)
1981	-2251.6	316.7	145.8	-1789.1 (-24.2)
1985	-3185.2	354.9	276.7	-2553.6 (-28.2)

[a] Figures in parentheses are percentage changes in total agricultural production.

market would have been greater than the actual by 0.4 percent in 1970 and 3.4 percent in 1975.

On the contrary, since the domestic rice price was much higher than the border price after 1976, opening the rice market would have increased non-rice production. However, the increase in non-rice production was much less than the decrease in rice production in value terms, and thus the total agricultural value-added production could have declined to a great extend, that is, 24.2 percent in 1983 and 28.2 percent in 1985. The possible employment changes in the farm sector, caused by the decline in agricultural prodution are presented Table 11. There would have been

Table 11

CHANGES IN WAGE RATE AND EMPLOYMENT

	Non-Farm Wage Rate (1,000₩/year)			Changes in Employment (1,000 persons)		
Year	Actual (A)	Without Intervention(B)	B/A	Non-Farm Sector	Farm Sector	Total
1970	171.6	174.0	1.01	-40.4	19.3	-20.7
1975	460.5	474.0	1.03	-92.9	174.2	81.3
1978	1,114.9	1,055.0	0.95	242.1	-462.5	-220.4
1979	1,434.2	1,357.1	0.95	257.3	-552.4	-295.1
1983	2,721.5	2,554.0	0.94	348.1	-978.6	-630.5
1985	3,235.8	3,035.0	0.94	387.4	-998.7	-661.3

cent while the death rate dropped rapidly. The average annual growth rate of population was over three percent around 1960 and sustained very high level afterward. The babies born in that period had begun to join job market since mid-1970s. As a result supplies of labor forces in Korea increased about three percent per year from mid-1970s to early 1980s.[3] Compared to Japan which market less than two percent increases in labor force during her initial stage of industrialization, the three percent increase in labor force should be perceived to be very high level. The rapid increase in labor supply could be well reflected on the fact that the number of farm workers increased continuously until 1976 even though the number jobs made available by the non-farm sector showed a remarkable increase of over 10 percent per year during 1960 and 1970s. Under the pressure of the large increase in total labor supplies, the Korean government had already chosen its high economic growth pilicy by borrowing a huge amount of foreign capital. However, since the Korean economy was already under heavy foreign debt pressure, the borrowing more foreign capital at the international financial market was very limited. Therefore it is a very unlikely that the Korean economy, which needed already the additional 2.6 billion U.S. dollars for rice import due to the free trade, could have accelerated the growth of the non-farm sector without creating foreign exchange crisis. In addition even if some additional growth were possible in the non-farm sector, it is very doubtful whether workers from farm sector could find proper jobs because migration from farm sector should be extended to more aged and less educated farmers than before. Consequently, unemployment problem might have been still serious even if the number of jobs made available in the non-agricultural sector were large enough.

Secondly, the possibility to lower the non-farm wage rate should be investigated as an alternative to place the people from farm sector through stimulating substitution from capital into the unskilled labor. One of the peculiar characteristics of the Korean labor market was that the skilled labor was in excess demand while the unskilled labor was in excess supply. The unbalance of labor demand and supply in Korea can be proved by comparing wage rates among the different skilled labor groups: wage rate for unskilled labor was 105 thousand won (US$172) per month, skilled labor 245 thousand won (US$403) per month and, specialist 597 thousand (US$982) per month in 1980, respectively.[4] From the above comparison we can see that not only the wage gaps among the different skilled labor groups are very big but also the wage rate of the unskilled labor is

[3] KDI (1985).
[4] Park and Park (1984).

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