

Rice Policy and Rice Consumption in Korea

Toshiyuki Kako

Masahiko Gemma

Shoichi Ito

Rice Policy and Rice Consumption in Korea

Toshiyuki KAKO, Masahiko GEMMA, Shoichi ITO

1. Rice Policy

(1) History of Rice Policy

Rice policy in Korea can be divided into two periods, before and after the end of the 1960s. Rice policy before the end of the 1960s is characterized as exploiting the rice sector. The major objective of the rice policy was to keep rice prices low in order to maintain the low wage rate for enhancing industrialization. While it shifted to protecting the rice sector in order to achieve the food security towards the end of the 1960s.

1) Rice policy before the end of 1960s

Korea suffered from a food shortage for a long time. Food shortage was the most severe during the second World War and the Korean War. The baby boom in the 1950s and 1960s as well as stagnant food production made the food problem a chronic one. Food aid from foreign countries contributed to mitigate the food shortage during the 1950s and 1960s (Koh Young-Kon, 1993). Especially, the food grain import from the United States under the 1955 U.S. Foreign Surplus Importation Agreement helped to maintain low food price level (Kim Young-Wook, Koo Won-Whe, Yang Seung-Ryong, 1992).

Rice imports increased in the latter half of the 1960s mainly due to the increase in rice consumption induced by the rapid increase in per capita income and stagnant domestic rice production. In the beginning payment for the imported grains was made with Korean currency, but it was changed to U.S. currency in 1968. As a consequence of the lack of U.S. dollars, the Korean Government started to implement the agricultural policy to increase domestic rice production in the 1960s. Investment in reclamation and tidal land development were increased. Paddy field consolidation projects and small-scale irrigation projects were initiated in the mid-1960s.

2) Rice Policy Since the End of 1960's

Faced with the world food crisis of 1973-74, policy makers recognized the importance of food security. Since then, the primary goal of the Korean Government has been to achieve self-sufficiency in rice, which is the staple food of Korean people. The Government promoted various measures such as land consolidation, land reclamation, investment in large-scale irrigation projects. The Government also stimulated agricultural mechanization, and carried out rice breeding programs. The rice sector also has been protected by measures such as rice price support and border protection.

The Korean Government introduced an anti-consumption campaign in the early 1970s and enforced the restriction of rice consumption in order to ease the rice shortage (Kim Myung-Hwan, 1993). Restaurants had to serve a mixture of 75 percent rice and 25 percent barley, and also served wheat noodles and other cereal foods on Wednesdays and Saturdays. School lunch programs followed a similar diet pattern (Kim Young-Wook,

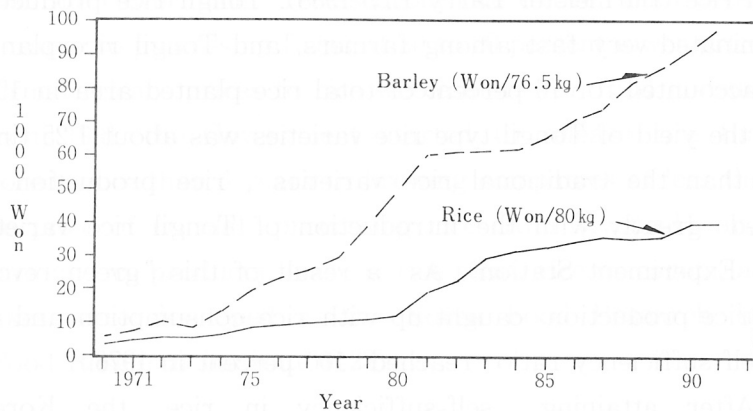


Figure 1 Trends in Wholesale Price of Rice and Barley

Source : Korean National Agricultural Cooperative Federation,
"Agricultural Cooperative Yearbook".

Koo Won-Whe, Yang Seung-Ryong, 1992). The Government prohibited rice use in processed food such as rice cake, rice wine, glutinous rice jelly, and also took measures to encourage consumers to substitute non-rice staples for rice in their diets. Wheat and barley prices were maintained at relatively lower levels compared with rice prices in order to promote consumption of wheat and barley (Figure 1).

Among various measures to increase self-sufficiency in rice, development of high-yield varieties contributed most to increase rice production. A hybridization program between Indica- and Japonica-type varieties was implemented in the mid 1960s with close cooperation between Korea and the IRRI. A semi-dwarf high-yield variety "Tongil" was developed in 1971. It was followed by the development of a series of Tongil-type rice varieties. The Government pushed Tongil rice production by mobilizing the dense agrobureaucracy as well as becoming the purchaser of

Tongil rice (Burmeister Larry L., 1988). Tongil rice production disseminated very fast among farmers, and Tongil rice planted area accounted for 76 percent of total rice planted area in 1978. Since the yield of Tongil-type rice varieties was about 1.25 times more than the traditional rice varieties, rice production increased greatly with the introduction of Tongil rice varieties (Crop Experiment Station). As a result of this "green revolution" rice production caught up with rice consumption and the rice self-sufficiency ratio reached 100 percent in 1976.

After attaining self-sufficiency in rice, the Korean Government terminated the anti-consumption campaign, and also relaxed the prohibition of rice processing in 1977. Because of the termination of the anti-consumption campaign rice consumption increased very rapidly, and the proportion of rice consumption for processing started to increase gradually.

Until 1989 the level of the year end rice stocks was slightly over one MMT. It was close to the optimum rice stock level which in Korea is considered to be two months' rice consumption, or about 860 thousand tons. Rice stocks started to increase in 1990, partly because of the bumper crop of 1988, and partly because of the declining rice consumption. Year end rice stocks in 1992 were equivalent to more than 4 month's rice consumption. Korea entered into a rice surplus phase at the end of the 1980s, and now faces problems of surplus rice management.

The Government has introduced various measures to increase rice consumption rather than enacting production control measures. The Government increased the subsidy for research and development of processed rice products, and supplied rice for processing use at discounted prices. Starting in

1986, the Government released old rice (more than 2-years in storage) to processing firms at 20 to 30 percent lower prices than normal release prices to rice wholesalers for food consumption. From 1991, the Government started to release rice that was stored more than 3-years to brewing companies at less than half the price of normal processing rice (Kim Myong-Hwan, 1993). Various rice products such as rice meat, rice macaroni, and rice cakes were developed at the Korea Food Research Institute (Food Research Institute P.23).

(2) Food Grain Management System

In Korea staple food is mainly managed by the Food Grain Control Act legislated in 1950. The Food grain management system established under this Act is characterized as a partial management system. This Act allowed the Government to purchase rice and barley from farmers and distribute them to consumers. The Government objectives for the food grain management system are to balance the supply and demand of rice and barley, as well as stabilizing prices through intervention into the market¹⁾.

The rice market is a dual system, composed of free and government-controlled markets. Rice is classified into two categories, free market rice and government-controlled rice. The proportion of free market rice is about 70 to 80 percent of the total rice marketed since the 1970s. The majority of free market rice consists of traditional Japonica varieties marketed through wholesale markets. There used to be a big seasonal fluctuation in the free market rice price. The free market rice price tended to hit bottom in November and December when there was an

ample supply of newly harvested rice, and increased gradually, with the highest prices recorded from June through August when rice tended to be in short supply. The Government therefore intervened in the rice market, purchasing rice right after harvest, and releasing it when market prices are at high levels. The objectives of government-controlled rice are, first, to stimulate rice production and support farm income, and secondly, to reduce the seasonal fluctuation of rice price and maintain food security. The seasonal price fluctuation was 18.3 percent in 1985. However, as the excess supply of rice increased the seasonal price fluctuation started to decrease and was 4.6 percent in 1991. With the decrease of seasonal rice price fluctuation, the amount of rice released by the Government declined and was 250 thousand tons in 1991.

The Government set no difference in procurement price among rice varieties. Hence, high-quality Japonica rice and unpreferable tasting Tongil rice were purchased by the Government at the same price. Farmers responded to this policy by selling high-yield Tongil rice to the Government, and selling Japonica rice in the free rice market where they could receive higher prices. As a result, the majority of the government-controlled rice consisted of Tongil rice, especially for the period 1972-89.

Starting in 1992 the Government therefore decided to purchase only Japonica rice. But, because there is no difference in the Government procurement price among Japonica rice varieties, it is likely that farmers will sell high-yield, low-quality Japonica rice varieties to the Government, and sell high-quality rice varieties in the free market.

2. Rice Price Policy and Nominal Rate of Protection

(1) Two Price System

A two price system for rice was introduced under the Food Grain Control Act in 1969. The major objectives of the two price system are to stimulate rice production by setting the government procurement price at around the production cost, and to stabilize the household budget by releasing government rice below market price, thus holding consumer prices down (Figure 2). Government procurement prices were consistently higher than the government sale prices. Differences between procurement and sale prices vary over time as shown in Figure 3.

The two price system stimulated Tongil rice production by

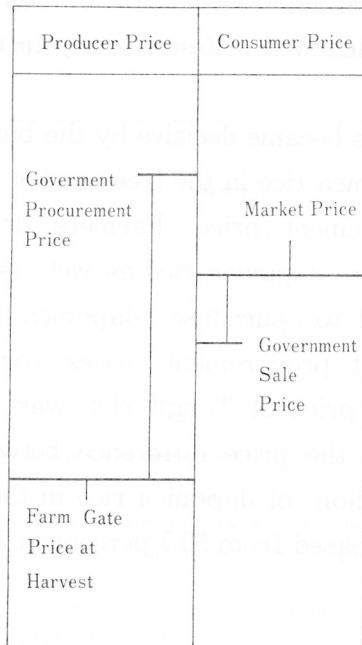


Figure 2 Two-price System of Rice Market

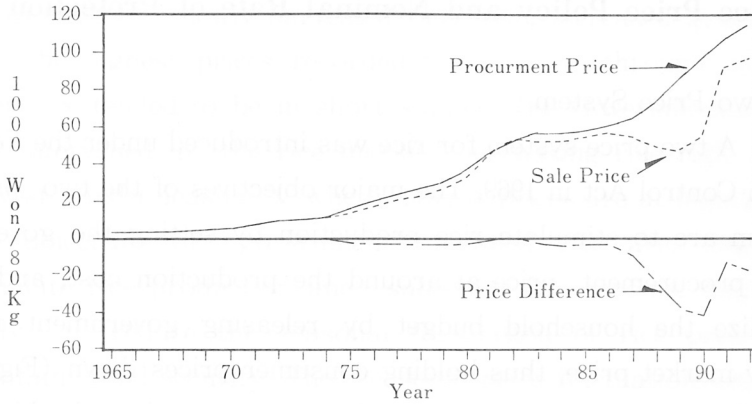


Figure 3 Government Procurement and Sale Price of Rice

Source : Korean National Agricultural Cooperative Federation,
"Agricultural Cooperative Yearbook".

setting the Government purchasing price above the market price. Because of the rapid expansion of high-yield Tongil rice production, Korea achieved self-sufficiency in rice for the period 1976~78.

The rice surplus became decisive by the bumper crop of 1988, and prices of Japonica rice in the free market dropped below the government procurement price. Farmers demanded that the Government purchase Japonica rice as well as Tongil rice²⁾. The Government started to purchase Japonica rice in 1989, and introduced different procurement prices for Tongil rice and Japonica rice. The price of Tongil rice was set below that of Japonica rice, and the price difference between them widened yearly. The proportion of Japonica rice in the total government purchased rice increased from 50.7 percent in 1989 to 84.6 percent in 1991.

(2) Nominal Rate of Protection

The Korean rice market has been protected by price support programs and border protection. The Government imposed a 5 percent tariff on rice imports, and put a tight restrictions on imports, and there has been no rice imports since 1984. Domestic rice prices have been raised relative to world prices throughout the past two decades. Price difference between domestic and world prices has been increasing over time, and recently domestic prices reached about 5 times of the world price in 1991.

Nominal rate of protection is a measure of the rate of protection given to rice producers, and is calculated by dividing the price difference between the domestic price and the world price by the world price. Nominal rate of protection for Korean rice is calculated using both Bangkok long-grain fob price and California medium-grain fob price, and calculation result is

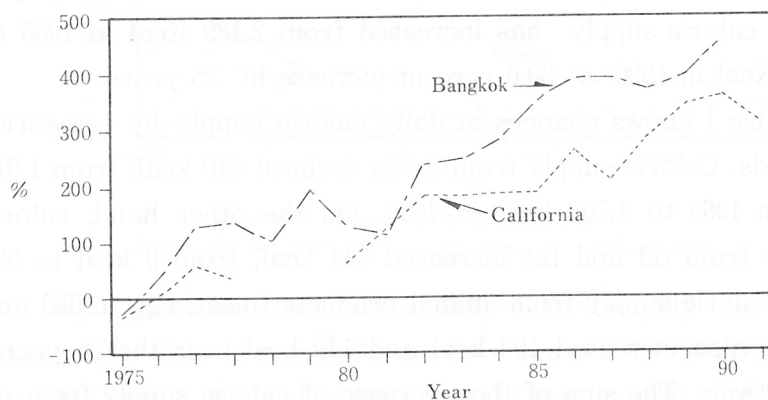


Figure 4 Nominal Rate of Protection

Source : Sheldy, H. Holder, Jr. et al "U.S. Rice Industry," USDA Agricultural Economic Report, No.433. USDA, "Rice Situation and Outlook Report."

Note : Prices are fob 5% broken milled Bangkok, and medium grain fob milled U.S. No. 1, California.

shown in Figure 4³⁾. NRP was about zero in the middle of the 1970's, and thereafter it increased gradually. The NRP's rate of increase accelerated in the latter half of the 1980s, and in 1990 it was 462 percent compared with Bangkok price, and 360 percent compared with California medium-grain price.

3. Trends in Food Consumption

(1) Trends in Calorie Supply

Real GNP in Korea grew at annual rates of 8 to 10 percent since 1960. Nominal per capita GNP increased from 248 dollars in 1970 to 6,498 dollars in 1991. With the dramatic increase of income, food consumption has increased rapidly and also diversified. The food consumption pattern has changed; consumption of oil and fat, animal products, and sugar have increased, while grain consumption has decreased. Daily per capita calorie supply has increased from 2,189 Kcal in 1965 to 2,858 Kcal in 1990, a 30.6 percent increase in 25 years.

Table 1 shows changes in daily calorie supply by categories of foods. Calorie supply from grain declined 210 kcal, from 1,910 kcal in 1965 to 1,700 kcal in 1990. On the other hand, calorie supply from oil and fat increased 344 kcal, from 9 kcal to 353 kcal. Calorie supply from animal products (meat, egg, milk) and sugar also increased 193 kcal and 149 kcal over the 25 years, respectively. The sum of the increase of calorie supply from oil and fat, animal products, and sugar was 686 kcal, and it was a little more than the total increase in calorie supply over the 25 years. This implies that the major source of the increase in calorie supply was from these three categories of foods.

Table 1 Daily Per Capita Calorie Supply

Year	1965	1990	Difference A-B Kcal
	A Kcal	B Kcal	
Grain	1910	1700	-210
Animal Products	52	245	193
Oil and Fat	9	353	344
Suger	14	163	149
Vegitables	46	117	71
Fruit	12	34	20
Fish and Shellfish	43	92	49
Pulses	66	113	47
Others	37	41	4
Total	2189	2858	669

Source : Korea Rural Economic Institute
"Food Balance Sheet".

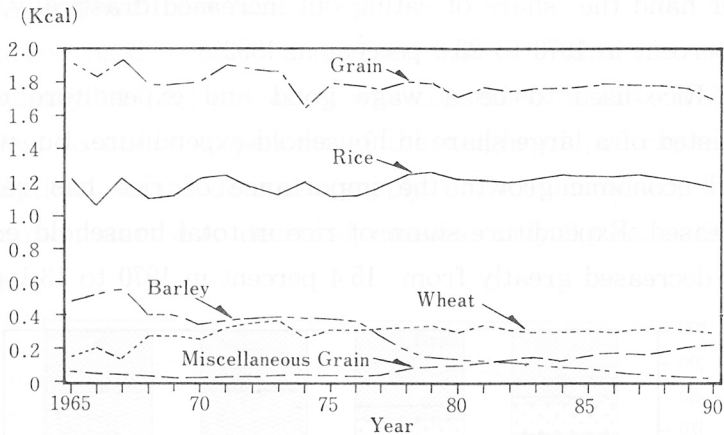


Figure 5 Per Capita Calorie Intake

Source : Korean Rural Economic Institute, "Food Balance Sheet".

Figure 5 shows the trend of daily calorie supply per capita from grain. Calorie supply from rice decreased by 48 kcal or 3.9 percent, from 1,225 kcal in 1965 to 1,177 kcal in 1990, and that of barley also decreased by 460 kcal or 95.4 percent, from 482 kcal to 22 kcal. On the other hand, calorie intake from wheat increase by 140 kcal. Thus, the decrease of calorie intake from grain over the 25 years was mainly caused by the reduction of barley

consumption.

(2) Expenditure Shares on Categories of Foods

Figure 6 shows the trend of composition of expenditures on foods and beverages in urban households. Expenditure share of rice was 38.6 percent in 1970, decreasing gradually to 12.7 percent in 1992. On the other hand, expenditure share of animal products increased from 11.8 percent in 1970 to 16.7, and exceeded that of rice in 1992. Expenditure share of vegetables and fruits, and fish and shellfish were stable over the years. On the other hand the share of eating out increased drastically, from 2.1 percent in 1970 to 23.6 percent in 1992.

Rice used to be a wage good and expenditure on rice consisted of a large share in household expenditure. But with the rapid economic growth the importance of rice has relatively decreased. Expenditure share of rice in total household expenditure decreased greatly from 15.4 percent in 1970 to 13.1 percent

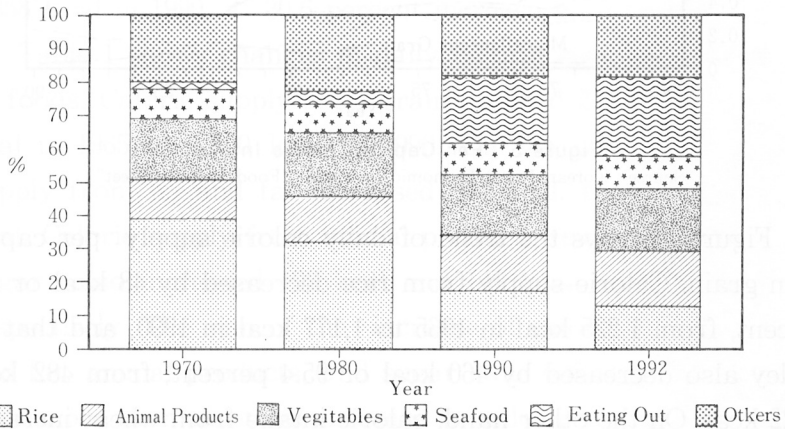


Figure 6 Composition of Expenditure on Food and Beverages

in 1980, and only 3.5 percent in 1992. While the expenditure share for rice in farm households was 18.8 percent in 1981 and 8.7 percent in 1990.

(3) Trends in Annual Per Capita Grain Consumption

Figure 7 shows trends of annual per capita grain consumption (disappearance) in physical weight. It was 204.3 kg in 1965, and reached a peak of 212.5 kg in 1971, then turned to decrease, and was 175.8 kg in 1990. Rice is the most important grain among food grain, and more than half of the calorie intake from food grain is supplied from rice.

Barley used to be cooked mixed with rice when rice was in short supply. 51.7 kg of barley was consumed in 1965, which is equivalent to about 40 percent of the weight of per capita rice consumption. As the domestic supply of rice increased, barley consumption started to decrease, and was only 2.4 kg in 1990.

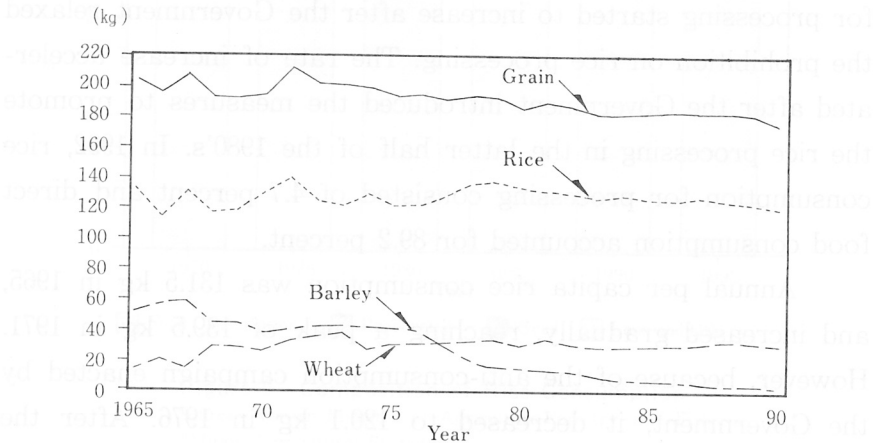


Figure 7 Annual Per Capita Grain Consumption

Source : Korean Rural Economic Institute, "Food Balance Sheet".

Wheat is a substitute for rice, and per capita consumption was 14.9 kg in 1960 and kept increasing, reaching a peak of 36.6 kg in 1973. Thereafter, the level of wheat consumption has been stable at around 30 kg.

(4) Trends in Rice Consumption

Total rice consumption was about 4 MMT in the latter half of the 1960's, and thereafter started to increase reaching a record high of 6.76 MMT in 1979 as shown in Figure 8. Rice consumption declined by more than 1 MMT after 1979, and thereafter the level of rice consumption stabilized in the range of 5.3~5.8 MMT.

Figure 9 shows composition of rice consumption by use. In 1970 direct food consumption consisted of 96.0 percent of total rice consumption, and rice processing and seed accounted for only 0.4 percent and 0.8 percent, respectively. Rice consumption for processing started to increase after the Government relaxed the prohibition on rice processing. The rate of increase accelerated after the Government introduced the measures to promote the rice processing in the latter half of the 1980's. In 1992, rice consumption for processing consisted of 4.7 percent and direct food consumption accounted for 89.2 percent.

Annual per capita rice consumption was 131.5 kg in 1965, and increased gradually, reaching a peak of 139.5 kg in 1971. However, because of the anti-consumption campaign enacted by the Government, it decreased to 120.1 kg in 1976. After the abolition of the anti-consumption campaign rice consumption increased and reached 135.6 kg in 1979. Thereafter, rice became an inferior good and rice consumption started to decline and

(Million Tons)

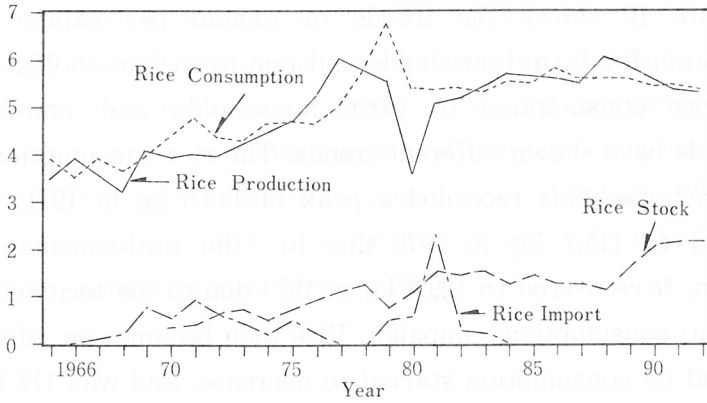


Figure 8 Rice Production, Rice Consumption, Year End Rice Stock, Rice Import

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

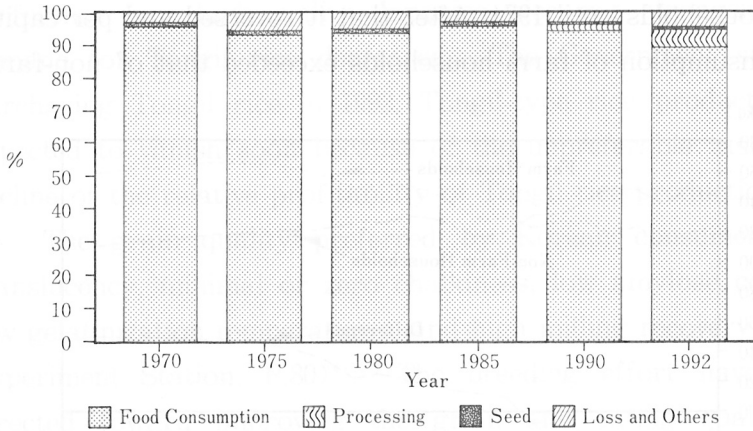


Figure 9 Composition of Rice Consumption

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

was 113.5 kg in 1992.

Figure 10 shows the trends of annual per capita rice consumption for farm households and non-farm households. Per capita rice consumption of farm households and non-farm households have shown different trends. The rice consumption of non-farm households recorded a peak of 148.5 kg in 1971, and decreased to 115.7 kg in 1976 due to the anti-consumption campaign. It recovered to 129.4 kg in 1979 due to the termination of the anti-consumption campaign. Rice then became an inferior good and its consumption started to decrease, and was 112.1 kg in 1990. This is in contrast with per capita rice consumption of farm households which kept increasing until it reached a peak of 165.1 kg in 1986, and then began to decrease gradually. Per capita rice consumption of non-farm households exceeded that of farm households until 1974. After that it reversed and per capita rice consumption of farm households exceeded that of non-farm

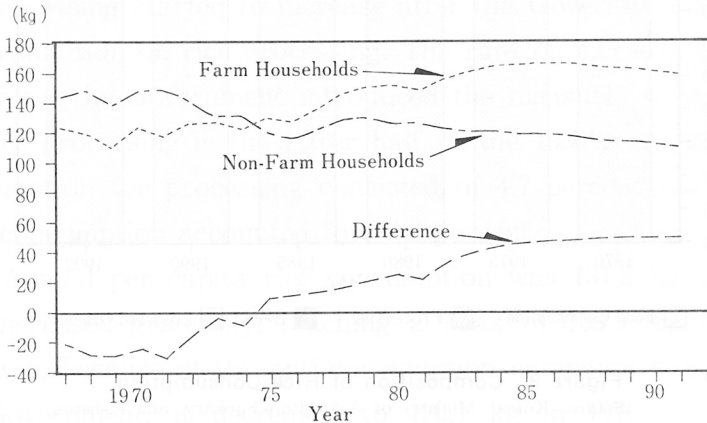


Figure10 Per Capita Rice Consumption

Source : Korean Ministry of Agriculture, Forestry, and Fisheries, "Annual Report on the Farm Household Economy Survey",

households and the difference of rice consumption between them expanded and was 49.6 kg in 1988. After that the difference remained at about the same level as shown in Figure 8.

From the above observation it can be pointed out that annual per capita rice consumption of non-farm households was depressed strongly by the anti-consumption campaign. While per capita rice consumption of farm households was affected less, and kept increasing even during the anti-consumption campaign period.

(5) Demand Increase in High-quality Rice

As income increases, consumers tend to pay more attention to rice quality than price. Korean consumers prefer short and round, translucent and sticky rice. Consumers preference for high-quality Japonica rice got stronger and demand for Tongil rice decreased. The Government stopped purchasing Tongil rice in 1992. Tongil-type rice production is expected to vanish soon because of the unpreferable taste and decline of the relative profitability of Tongil rice production.

The grain quality preferred by Korean consumers are translucency, minimal or zero chalkiness, low amylose content, low gelatinization temperatures, and high milling recovery (Crop Experiment Station, P.80)⁴⁾. The breeding effort have been directed toward improving the grain and eating quality of Japonica rice, and high quality Japonica rice varieties have been developed since the end of the 1970s. They are almost zero in chalkiness, low amylose content of 17.7 ~ 20.3 percent. Such Japonica varieties as Akibare and Tongjin are most popular among Korean consumers.

4. Model Development and Data for Rice Demand Projection

(1) Rice consumption function

In this study, partial equilibrium model will be used to carry out the medium- and long-term rice demand projection. The time trends of per capita rice consumption for farm households and non-farm households are quite different as shown in Figure 8. Therefore, rice demand function for farm households and non-farm households will be estimated separately.

It is assumed that the representative consumer maximizes utility, given a fixed income. The demand schedule for rice is derived by maximizing consumer's utility. This study assumes that per capita demand for rice is a function of income, rice price, and prices of substitutes and complements of rice. It is also assumed that rice demand function can be specified as follows:

$$\ln C_t = a_0 + a_1(1/Y_t) + a_2 \ln Y_t + a_3 \ln P_r + a_4 \ln P_b + e_t \quad \dots\dots(1)$$

where C is annual per capita rice consumption, Y is per capita income, P_r is farm gate rice price in the case of farm households, and P_b is price of wheat and barley. Income and prices are deflated by the consumer price index (1985=100) in the case of non-farm households and purchasing price index of household goods in the case of farm households. e is disturbance term and is assumed independent, identically distributed normal variate.

It is further assumed that consumers do not adjust rice demand instantaneously to changes in prices and income. To

incorporate dynamic adjustment in rice consumption, the partial adjustment model developed by M. Nerlove is employed.

$$\ln C_t - \ln C_{t-1} = r (\ln C_t^* - \ln C_{t-1}) \quad 0 < r < 1 \quad \dots\dots(2)$$

where C^* is the long-run equilibrium quantity determined by the utility maximization condition, and r is a constant of proportionality which may be called as the elasticity of adjustment. Adjustment in demand due to changing economic condition is usually partial because of friction such as habit formation or lack of information (Koo Won-Whe, Yang Seung-Ryon, Kim Young-Wook, 1992). By substituting (2) into (1), the reduced form of the partial adjustment model can be written as

$$\ln C_t = ra_0 + ra_1(1/Y_t) + ra_2 \ln Y_t + ra_3 \ln P_{rt} + ra_4 \ln P_{bt} + (1-r)\ln C_{t-1} + re_t \quad \dots\dots(3)$$

This model is used to estimate rice consumption functions of both farm households and non-farm households.

(2) Data Description

1) Per Capita Income

Data for household income was obtained from the "Annual Report on the Family Income and Expenditure Survey" of the Korean Statistical Association, and "Major Agricultural Statistics" of the Korean Ministry of Agriculture, Forestry, and Fisheries (KMAFF).

Farm household income have tended to lag behind non-farm household income, partly due to the small farm scale, and partly because of the limited amount of off-farm income. In contrast with Japanese experience, the increase in off-farm income of farm households was small because off-farm job opportunities are limited in rural areas since most of the factories are located

in or around large cities.

Per capita income of farm households increased from 18 thousand won in 1965 to 3,681 million won in 1991. On the other hand, per capita income of salary and wage earners' households increased from 20 thousand won in 1965 to 4,096 thousand won in 1991 (Figure 11). Figure 12 shows trends in the ratio of per capita income and household income of farm households and salary and wage earners' households. Per capita income of farm households was about 87.0 percent of that of the salary and wage earners' households in 1965. The ratio decreased to 52.5 percent in 1967, then it turned to increase, and was 96.4 percent in 1974. It again fluctuated and was 89.9 percent in 1991.

2) Price Index

The consumer price index appearing in the "Annual Report on the Price Survey" of the Korean Economic Planning Board was utilized. Data on rice consumption were obtained from

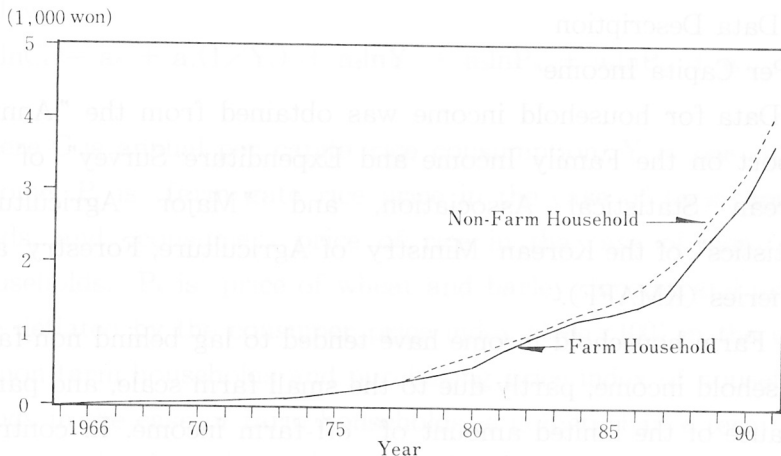


Figure 11 Per Capita Income

Source : Korean Statistical Association, "Annual Report on the Family Income and Expenditure Survey".

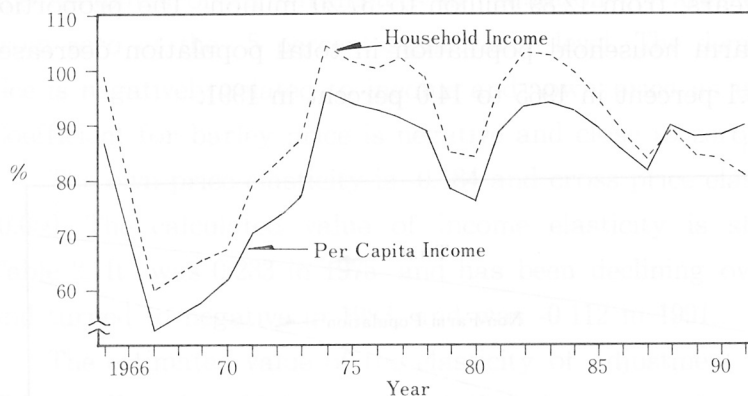


Figure 12 Ratio of Farm Household Income to Non-Farm Household income

Source : Korean Statistical Association, "Annual Report on the Family Income and Expenditure Survey".

"Major Agricultural Statistics" of Korean Ministry of Agriculture, Forestry, and Fisheries. Data for farm prices such as the farm gate rice price index, the farm gate barley price index were taken from the "Agricultural Cooperative Yearbook" of the Korean National Agricultural Cooperative Federation. Data for the consumer price index was taken from the "Korean Statistical Yearbook" of the Korean Economic Planning Board.

3) Population

The population of Korea increased by 14.56 million over the 26 years, from 28.71 million in 1965 to 43.27 million in 1991, as shown in Figure 13. Average annual growth rate of population over the 26 years was 1.58 percent.

Because of the rapid outmigration of the rural population the proportion of farm households population decreased by 61.6 percent, from 15.81 million in 1965 to 6.04 million in 1991. While non-farm household population increased by 188.6 percent over

the 26 years, from 12.89 million to 37.20 million. The proportion of the farm household population in total population decreased from 55.1 percent in 1965 to 14.0 percent in 1991.

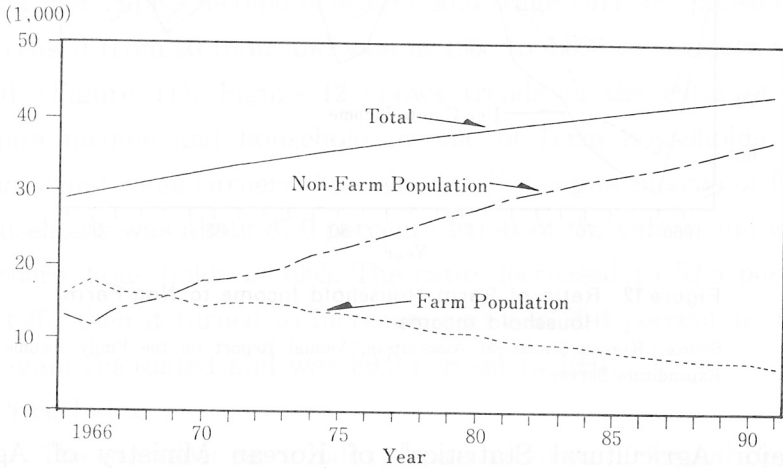


Figure 13 Population

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

5. Estimation Results of Rice Consumption Function

1) Rice Consumption Function of Non-farm Households

Rice consumption function of non-farm households was estimated by OLS using annual data from 1975 to 1991. The estimation result is

$$\begin{aligned}
 \ln C_t = & 5.745 - 219.418(1/Y_t) - 0.189 \ln Y_t - 0.184 \ln P_{tt} \\
 & (6.547) \quad (-5.508) \quad (-4.571) \quad (-2.718) \\
 & - 0.050 \ln P_{bt} + 0.343 \ln C_{t-1} \quad \dots\dots (7) \\
 & (-2.024) \quad (2.394)
 \end{aligned}$$

$$\bar{R}^2 = 0.889$$

The fit of the model is good. T-values in parentheses are large,

and estimates of all parameters in equation (7) are different from zero at the 5 percent significance level. The demand for rice is negatively related to income and own price as expected. Coefficient for barley price is negative and close to zero.

The own price elasticity is -0.184 and cross price elasticity is -0.050. The calculated value of income elasticity is shown in Table 2. It was 0.233 in 1975, and has been declining over time, and turned to negative in 1983, and was -0.112 in 1991.

The estimated value of the elasticity of adjustment is 0.657. This implies that 65.7 percent of the change in the ratio of optimum rice consumption in year t and actual rice consumption in year $t-1$ is adjusted in year t , and 34.3 percent was left for adjustment for latter years.

Table 2 Income Elasticity for Rice

Year	Farm	Non-farm
	Households	Households
1975	0.242	0.233
1976	0.185	0.167
1977	0.144	0.144
1978	0.097	0.061
1979	0.099	0.024
1980	0.126	0.031
1981	0.087	0.036
1982	0.050	0.016
1983	0.020	-0.007
1984	-0.002	-0.026
1985	-0.011	-0.037
1986	-0.021	-0.051
1987	-0.039	-0.068
1988	-0.074	-0.079
1989	-0.093	-0.095
1990	-0.106	-0.103
1991	-0.120	-0.112

2) Rice Consumption Function of Farm Households

The estimation result of per capita rice consumption of farm households using the time series data for the period 1976~1991 is as follows.

$$\begin{aligned} \ln C_t = & 3.068 - 271.435(1/Y_t) - 0.220 \ln Y_t - 0.251 \ln P_{rt} \\ & (2.200) \quad (-2.117) \quad (-2.900) \quad (-2.309) \\ & + 0.231 \ln P_{bt} + 0.768 \ln C_{t-1} \quad \dots\dots(8) \\ & (2.808) \quad (4.400) \end{aligned}$$

$$\bar{R}^2 = 0.974$$

The coefficient of determination is large, 0.974, and all of the absolute value of the t-values are large, indicating that all of the estimated parameters are different from zero at the 5 percent significance level. The demand for rice is negatively related to income and own-price as expected. Coefficient for wheat and barley prices has a positive sign, indicating that barley and wheat is the substitute for rice. The own price elasticity is -0.251 and cross price elasticity is 0.231. The value of income elasticity was 0.242 in 1975, and has been declining over time, and turned to negative in 1984, and was -0.120 in 1991 as shown in table 2 .

The estimated value of the elasticity of adjustment is 0.232. It is smaller than that of the non-farm households. This implies that it takes more time for farm household members to adjust to the changing economic conditions than non-farm household members.

3) Comparison With Previous Studies

Table 3 shows estimation results of income elasticity of rice published in articles. Although there is variation in estimation results, it can be pointed out that absolute values of income elasticity are small, and demand for rice is inelastic. Income

elasticities of the 1980's are either close to zero or negative. It can be concluded that the estimation result of the present study is in line with other studies.

Table 3 Estimates of Income Elasticity

Year	Income Elasticity	Source
1975	0.2353	Lee Jung-Hwan, Cho Duck-Rae (1984)
1976	-0.0180	Lee Sang-Won (1978)
1977	-0.0210	Ju Young-Che (1985)
1977	0.1192	Young Ho-Soup, Sung Myong Hwan (1988)
1977	0.1780	Young Ho-Soup, Sung Myong Hwan (1988)
1981	0.0190	Lee Jung-Hwan, Cho Duck-Rae (1983)
1984	-0.2259	Lee Jung-Hwan, et al (1986)
1986	0.0323	Young Ho-Soup, Sung Myong Hwan (1988)
1986	-0.6749	Young Ho-Soup, Sung Myong Hwan (1988)
1986	0.0160	Young Kwang-Shik, Sung Myong Hwan (1987)

6. Some Consideration on Projection of Rice Demand

According to the agreement of the Uruguay Round of the GATT negotiations Korea accepted the minimum access; starting from 1 percent of total rice consumption (about 60 thousand ton) in 1995 and increasing to 4 percent (about 240 thousand ton) through 2004. The Korean Government will maintain the two price system and control all the imported rice. It is reported that the Korean Government plans to release the imported rice only for processing use. If this is the case, rice consumption will decrease to some extent due to the substitution of processed rice product to rice.

In the 1980s, per capita rice consumption decreased by 1.4 kg per annum. In recent years, the rate of decrease has accelerated,

decreasing 3.4 kg per annum during 1990~92. A researcher predicted that the annual rate of decrease will be 2 to 3 percent through the 1990s. Per capita rice consumption is projected to be 86~94 kg in 2001 (Kim Myoung-Hwan p.115, 1993).

Projection of total rice demand will be carried out in the coming study as follows.

- ① Using the parameters of the estimated rice consumption function, per capita rice consumption of farm and non-farm households will be forecasted first. Then, total rice consumption for direct food use will be projected by multiplying this quantity to future population estimates.
- ② Loss of rice will be calculated as a certain percentage of total rice consumption for food use.
- ③ Rice seed will be forecasted by multiplying the quantity of seed per unit of area to the expected total rice planted area.
- ④ Rice use for processed food will be forecasted by simply extending the past trend into the future.
- ⑤ Total rice demand in the future will be projected by adding the quantity calculated in ① to ④.

It is expected that the rate of decrease in per capita rice consumption will accelerate in the future, because rice consumption of both farm households and non-farm households has been decreasing since 1986, and also because the population of farm households which consume more rice has been declining as shown in Figure 13.

NOTE

- 1) The major contents of the food grain management system are, first, the amount of rice to be procured by the Government is limited to be within one third of the total rice production due to the limited government budget size. Second, distribution of rice and barley is managed by the Government through both free market and government procurement operation. Third, import and export of rice is under the control of the Government. The Government imports rice and barley directly, releasing them when necessary.
 - 2) The Food Grain Control Act was amended in 1988. With this amendment, the purchasing operation of grain became subject to the agreement of Congress. The proportion of rice purchased by the Government doubled from 14.3 percent of total rice production in 1988 to 28.7 percent in 1990.
 - 3) The nominal rate of protection of Korean rice is calculated by using the following prices. As international price, i) fob price of long-grain milled rice (5 percent broken) in Bangkok, ii) fob price of medium-grain milled rice (U.S. No.1) in California. As for domestic price, producer price was used rather than wholesale price since prices farmers receive from the Government are higher than the price the Government sells to wholesalers.
 - 4) Rice is mostly consumed as the boiled rice in Korea. The qualified characteristics of boiled rice require a right shape, proper stickiness, natural flavor, light yellowish or whitish color, and proper tint.
 - 5) Rice consumption function was also estimated by using the pooled data of farm households and non-farm households.
- $$\begin{aligned} \ln C_t = & 3.788 - 197.820(1/Y_t) - 0.145 \ln Y_t - 0.241 \ln P_{rt} \\ & (7.408) \quad (-5.184) \quad (-4.485) \quad (-4.300) \\ & + 0.690 \ln C_{t-1} + 0.105 D \\ & (12.624) \quad (6.695) \quad \dots\dots(9) \end{aligned}$$
- $$\bar{R}^2 = 0.982$$
- D is a dummy variable ; 1 for farm households and 0 for non-farm households. T-values for wheat and barley price are small, so these variables are dropped from the explanatory variable. All of the t-values except for wheat and barley price are large and estimated parameters are different from zero at the 5 percent significance level.

The demand for rice is negatively related to income and own-price as expected. The coefficient for dummy variable has a positive sign, indicating that level of rice consumption is higher for farm household members than non-farm household members with the same income and price levels. The value of income elasticity was positive in the 1970s, and had been declining over time, and turned to negative in the early 1980s. The estimated value of the elasticity of adjustment is 0.310.

REFERENCES

- Burmeister Larry L. (1988). *Research, Realpolitik, and Development in Korea ; The state and the Green Revolution*. Westview Press.
- Chong Hwan Chu (1990). The Rice Economy In South Korea, *Journal of Agricultural Economics*, Vol.62, No.2, PP.86-94.
- Crop Experiment Station, Rural Development Administration (1990). *Rice Varietal Improvement in Korea*, p.10.
- Food Research Institute. *Food Development Research Activities in Korea*.
- Kim Myung-Hwan (1993). Structure of the Rice Market and Proposals for Rice Policy Changes in Korea, *Journal of Rural Development*, Vol.16, PP.15-40.
- Kim Young-Wook, Koo Won-Whe, Yang Seung-Ryong (1992). Impact of Trade Liberalization on the Korean Rice Market, Department of Agricultural Economics, Agricultural Experiment Station, North Dakota State University, Agricultural Economics Report No. 287.
- Koh Young-Kon (1993). Implications of Current Rice Trade Issue

for Korean Agriculture. Paper presented at the International Seminar on Recent Trends and Future Prospects of Rice Farming in Asia, May 24-30, 1993, Seoul, Korea.

Koo Won-Whe, Yang Seung-Ryong, Kim Young-Wook (1992). The Impacts of Alternative Trade Liberalization Policies on the Korean Rice Economy, *Journal of Rural Development*, Vol.15, No.1,2, PP.1-14.

Korea Rural Economic Institute (1986). *Long-run National Development Plan Toward 2000 : Agricultural Sector*.

Korean Ministry of Agriculture, Forestry, and Fisheries(1992). *The Seventh Five-Year Economic, Social Development Plan: Agricultural Sector Development Plan*.

Korean Statistical Association. *Annual Report on the Family Income and Expenditure Survey*. Various Issues.

Korean Ministry of Agriculture, Forestry, and Fisheries. *Major Agricultural Statistics*. Various Issues.

Korean Economic Planning Board. *Annual Report on the Price Survey*. Various Issues.

Korean National Agricultural Cooperative Federation. *Agricultural Cooperative Yearbook*. Various Issues.

Korean Economic Planning Board. *Korean Statistical Yearbook*. Various Issues.

Lee Jung-Hwan, Cho Duck-Rae et al(1990). Long-run Projection of Supply and Demand of Rice and Choice of Rice Policy, *Rural Economy*, Vol.13, No.2.

Acknowledgment

This article is the part of research outcome of the research project of "Projections and Policy Implications of Medium- and Long-Term Rice Supply and Demand" organized by International Rice Research Institute and International Food Policy Research Institute. The authors would like to acknowledge IRRI and IFPRI for allowing us to publish this paper.