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Dr. Michael V. Martin

The Korean gross national product has been growing at an average annual rate of 10 percent since the early 1960's. High growth rates of labor-intensive industry have been the source of this prosperity as policy followed the prescriptions of neoclassical international trade theory. The late 1960's saw a major change in policy with greater emphasis being given to attaining self-sufficiency in foodgrains (rice, barley and wheat) and raising the quality of life in the rural areas.

This thesis evaluates the effectiveness of price policy in achieving its primary objectives. Secondly, the implications of this for consumer and producer surplus, program costs, foreign exchange requirements and seasonal price stability (secondary objectives) are analyzed. The methodology adopted extends that used in previous studies on price policy in less developed countries by allowing

for the effects of changes in the price of substitutes in production and consumption and the impact of transport costs between the farm and domestic market.

Data on prices, production and consumption were obtained for the two periods 1965-67 and 1976-78 as reflecting the pre and post policy shift situations. The effect of price policy over free trade in each of the two periods as well as the policy shift were evaluated. Elasticities of supply and net farm income were estimated while elasticities of demand were choosen from those estimated in a number of earlier studies.

The results show that price policy in the first period (1965-67) decreased rice self-sufficiency by 0.12 but increased it by 0.31, and farm income by 22.6 percent in 1976-78. Self-sufficiency in barley and wheat fell below free trade levels in the short run after 1970 as producers shifted into and consumers out of rice. The change in policy resulted in an increase in self-sufficiency of 0.37 for rice, -0.31 for barley and -0.37 for wheat. Farm income rose by over 25 percent as higher returns per unit offset lower production levels of wheat and barley.

The impact of price policy on secondary objectives shows a similar pattern. Rice producers were the major beneficiaries after 1970 while heavy losses were suffered by rice consumers and program costs were high. Both barley and wheat producers lost as a result of the change in policy as the effects of substituting rice for winter grains offset the impact of higher prices. The net social loss from the change in policy amounted to 1.09 percent of GNP. Foreign

exchange earnings rose by 123b won, with heavy losses amounting to 94b won being made in barley and wheat. This offset much of the gians made by rice of 217b won. Finally, seasonal price stability increased for rice but fell for barley; however, overall price stability was not significantly affected as other factors increased price instability.

This study shows that attainment of self-sufficiency in more than one grain is likely to be very difficult to achieve as well as expensive due to substitutions in production and consumption. The standard hypothesis, that higher prices raise self-sufficiency, discriminate against consumers and save foreign exchange, must be qualified if Korea is to have an effective price policy. The dominance of rice determines to a large extent what happens in the foodgrain market as a whole and the objective of price policy with respect to wheat and barley needs to take this into account.

FOODGRAIN POLICY IN THE REPUBLIC OF KOREA: THE ECONOMIC COSTS OF SELF-SUFFICIENCY

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John A. MacDonald

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Redacted for Privacy

Associate Professor, Agricultural and Resource Economics, in charge of major

Redacted for Privacy

Head of Department of Agricultural and Resource Economics

Redacted for Privacy

Dean of Graduate School

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Typed by Mary Adelman for John A. MacDonald

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CHAPTER I

INTRODUCTION

The Korean economy has been growing at an average annual rate of 10 percent since the early 1960's. Rapid growth rates of labor-intensive industries (textiles, shoes, etc.) resulted in manufacturing sector's share rising from 12.8 percent of GNP in 1956 to 30.7 percent in 1980. During the same period, agriculture's share fell from 40.2 percent to 16.9 percent of GNP. The share accounted for by services remained fairly steady during the 1960's but rose to over 50 percent of GNP by 1980. Higher manufacturing growth rates compared to those in agriculture and the sectoral shift (Table 1) have been the source of Korea's economic prosperity.

International trade theory argues that a country should specialize in the sector which uses its relatively abundant resource intensively. Accordingly, Korea, which is labor-rich and land-poor relative to her major trading partners (Table 2), should specialize in labor-intensive manufacturing (Anderson, 1980). Korean development policy during the 1960's exploited this comparative advantage and, as theory predicts, reaped the benefits. The early 1970's saw a significant shift in policy with more emphasis being placed on self-sufficiency in foodgrains and improving the quality of life in the rural areas. This change in policy can be traced to four factors:

Table 1. Sectoral Shares and Growth Rates, 1956-1980

Year	Growth Rates (% p.a.)				Sectoral Shares (% GNP)		
	Real GNP	Agric	Manu	Services	Agric	Manu	Services
1956	1.2	5.3	17.0	4.4	44.2	12.8	43.0
1957	8.8	8.6	12.5	7.9	44.1	13.2	42.7
1958	5.5	6.8	7.7	3.6	44.6	13.5	41.9
1959	4.4	-1.1	9.3	8.6	42.3	14.1	43.6
1960	2.3	0.1	9.2	2.2	41.4	15.1	43.5
1961	4.2	10.1	3.2	-1.1	43.8	14.9	41.3
1962	3.5	-6.0	15.7	9.1	39.7	16.7	43.6
1963	9.1	7.2	16.5	8.1	39.0	17.8	43.2
1964	8.3	16.2	5.4	2.3	41.9	17.3	40.8
1965	7.4	-0.9	21.5	10.1	38.7	19.5	41.8
1966	13.4	11.0	17.2	14.8	36.1	19.6	44.3
1967	8.9	-5.5	17.7	15.4	31.8	20.0	48.2
1968	13.3	1.2	21.0	15.9	28.8	21.1	50.1
1969	15.0	12.5	19.9	14.6	28.7	21.5	49.5
1970	7.9	-0.9	18.2	8.9	28.0	22.8	49.2
1971	9.2	3.3	16.9	8.9	28.9	22.8	48.3
1972	7.0	1.7	15.0	5.8	28.3	24.4	47.3
1973	14.9	6.3	28.6	13.6	25.0	26.0	46.9
1974	8.0	6.7	15.2	5.0	24.8	27.3	47.9
1975	7.1	5.3	12.6	5.1	24.9	28.0	47.1
1976	15.1	10.7	21.5	13.7	23.8	28.8	47.4
1977	10.3	2.1	14.3	11.9	23.0	28.4	48.4
1978	11.6	-4.0	20.0	13.5	21.9	28.4	49.7
1979	7.1	5.2	10.0	5.6	20.6	28.5	40.9
1980	-5.7	-22.0	-1.2	-2.2	16.9	30.7	52.4

Source: Korea Statistics Yearbooks 1960-1981. National Bureau of Statistics, Republic of Korea.

Table 2. Land-Labor Ratios For Korea and Selected Trading Partners (ha/capita)

	Total	Arable	Pasture	Forest
Korea	.27	.06	.00	.18
Japan	.33	.04	.00	.22
Thailand	1.16	.36	.01	4.82
Australia	54.54	3.17	31.96	7.59
United States	4.25	.84	1.09	1.32

Source: World Bank Indicators, 1979, reported in Anderson, K (1980).

(a) due to emerging structural imbalances, doubts have been voiced about Korea's ability to maintain high growth rates. Between 1970 and 1975 the industrial wage rate increased at an annual rate of 8.5 percent compared to 1.5 percent in agriculture. This, coupled with employment opportunities in labor-intensive manufacturing and noneconomic factors, resulted in significant rural urban migration as the rural population fell by 22 percent between 1965 and 1977 (Huh, 1980);

(b) greater instability in both export and import markets during the 1970's, increased costs of food imports due to the phasing out of U.S. concessionary grain sales under PL 480, and higher petroleum prices raised the cost of relying on food imports and placed heavy demands on scarce foreign exchange (Martin et. al., 1982);

(c) higher awareness of economic disparity between urban and rural areas led to the launching of Saemaul Undong in 1971.[1/] This by itself will not be enough and increased rural employment

1/ The Saemaul Undong program covers a range of projects aimed at raising the quality of life in the rural areas.

opportunities are needed. Given the importance of agriculture in the rural areas its potential for raising rural employment and incomes is great; and

(d) ability to afford noneconomic objectives is a direct result of Korea's growth. Self-sufficiency in foodgrains has always been an objective of Korean policy, but the factors discussed above and the increased resources available to the government have allowed greater emphasis to be placed on self-sufficiency.

Problem Statement

In the 1950's and early 1960's development was synonomous with economic growth. Maximization of GNP, it was argued, would maximize welfare. Recently this view has been heavily criticized. Welfare is seen as a much broader concept involving social, economic and political factors. Development, as a goal, is more a function of each country's social, institutional, historical and geographic characteristics than the single all-embracing objective of economic growth. Todaro (1981) sums this up when he asserts that:

> "economic development during the 1970's was redefined in terms of the reduction or elimination of poverty, inequality and unemployment within the context of a growing economy...Development must be conceived of as a multi-dimensional process involving major change in social attitudes, and national institutions, as well as [economic development]" (p. 68-70).

Korea is no exception to this pattern. Government policy following the Korean War was to develop labor-intensive industry and to rely on world markets for agricultural goods. The shift in

foodgrain policy at the end of the 1960's was consistent with the change in development goals of the government as greater emphasis was given to social and political objectives. It is, however, inconsistent with the prescriptions of trade theory. Since free trade under neoclassical assumptions maximizes welfare, any divergence from free trade will be reflected in lower welfare levels. The economic costs of political objectives can, therefore, be determined as the difference between the expected welfare level under free trade and the actual level. Similarly, the costs of the change in objectives between 1968 and 1970 can be estimated by comparing welfare levels before (1965-67) and after (1976-78) the policy shift.

The central questions asked are, what has been the effect of price policy and, in particular, the policy shift in increasing self-sufficiency and raising farm incomes? Secondly, how has this affected other sectors of society (consumers) and the economy (program costs, foreign exchange requirements, and price stability)?

The need for such a study is well documented. Moon (1973), in his analysis of foodgrain markets in Korea, implies that the inter-relationships of international trade and price policy have been ignored when he concludes that "the overall assessment of the effect of imported wheat and that of low price policy requires an extensive research" (p. 125). Kim (1979) goes even further when he states that:

> "International trade policies on agricultural products should be carefully planned in harmony with domestic farm production and income policies...adequate attention should be paid to the appropriate use of marginal farm resources and the sociopolitical goals of the nation in addition to consideration of comparative advantages in the international perspectives" (p. 37).

Objectives

This thesis evaluates Korean foodgrain policy within an international framework. Specifically it aims to:

(a) determine the extent to which Korean government price policy has influenced free market prices of rice, barley and wheat, and the magnitude of the policy shift between 1968 and 1970;

(b) evaluate the success of price policy in achieving self-sufficiency and raising producer's incomes over free trade levels;

(c) analyze the effect of the change in government policy on self-sufficiency and producer's incomes; and

(d) measure the costs and benefits associated with price policy on consumers, producers, program costs, foreign exchange and stability of prices.

Importance Of Foodgrains

Rice, barley and wheat accounted for just over half of value added in agriculture in 1980 and about nine percent of GNP. Despite this small percentage, fluctuations in foodgrain production can have a significant impact at the macro as well as the individual level. At the national level, declining foodgrain production could have a negative impact in three ways. First, as already argued, increased demand for foodgrains which outstrips domestic production would place heavy demand on foreign exchange, thus limiting imports of raw materials required for industrial growth. Alternatively, limits on

food imports would force up food prices and may lead to political unrest. Secondly, the urban population has increased due to rural urban migration. This has placed heavy demands on food supplies and foreign exchange requirements. Thirdly, the desire to be self-sufficient is a direct result of Korea's turbulent history. As such, Korea may be willing to pay a high price for foodgrain self-sufficiency.

At the individual level, foodgrains play a vital role. While farm population as a percentage of total population has been declining (54 percent in 1966 to 38 percent in 1978), these people are generally in the lower income quartiles and rely heavily on farm income. Table 3 shows farm income as a percentage of total income by farm size. Given that foodgrains account for over 50 percent of agricultural income, it is clear that some households derive as much as half their income from rice, barley and wheat production.

Table 3. Farm Income As Percentage Of Total Income For Farm Households, 1961-1980

		Farm Size (cheongbo)				
Year	Average	<0.5	0.5-1.0	1.0-1.5	1.5-2.0	>2.0
1961	80.2	64.3	79.5	86.4	89.4	90.2
1965	79.2	57.4	78.8	84.9	86.9	87.3
1970	78.3	52.4	75.9	85.9	85.9	88.4
1975	82.5	58.4	79.8	87.7	91.3	91.9
1980	69.1	38.6	64.7	74.8	80.9	86.6

Source: Korean Statistical Yearbooks, 1962-1981.

Finally, foodgrains are an important part of the Korean diet. Thodey (1977) states that foodgrains account for 53 percent of the Korean diet by weight. Many Koreans view their diet as nutritionally

superior to western alternatives (Martin et al, 1982) and policy-makers are clearly concerned about the effect of cheaper imports on the traditional diet.

Supply and Utilization Of Grains

Table 4 shows the supply and utilization of rice, barley and wheat for selected years, 1961 through 1980, and predicted total demand for 1990. Self-sufficiency ratios for all foodgrains fell from 1961 until the mid-1970's, but near self-sufficiency has been attained since then in barley and rice in most years. This is due as much to leveling off in demand as to increases in supply.

Self-sufficiency ratios of wheat have declined rapidly since 1961 to less than five percent of requirements, mainly due to falling wheat acreage.

Demand for foodgrains is, according to theory, affected by the commodity's own price, prices of substitutes and the level of income. A number of studies have attempted to estimate these elasticities, some of which are discussed in Thodey et al. (1977). The results vary widely so that most estimates are subject to a large degree of error. Thodey et al. (1977) conclude that "all of the elasticities calculated...should be used with caution. At most, they should be regarded as an indication of the magnitude of the real elasticity.... In many cases, however, they should be completely ignored" (p. 123). Moon (1973) has highlighted the simultaneous nature of the foodgrain

Table 4. Supply and Utilization Of Rice, Barley and Wheat ('000 MT)

	Year	Supply: Production	Supply: Ex Stocks	Supply: Net Imports	Utilization: Human	Utilization: Other	Self-Sufficiency Ratio (%)
	1961	3,047	37	-22	3,062		99.5
	1966	3,501	62	31	3,314	280	97.4
R	1971	3,939	-69	907	4,462	315	82.5
I	1974	4,212	223	206	4,310	331	90.8
C	1976	4,669	-288	157	4,339	199	102.8
E	1978	6,006	-240	-80	5,014	672	105.6
	1980	5,136	70	580	5,057	729	88.8
	1990				5,857		
	1961	1,478	66	123	1,535		96.3
B	1966	2,018	-144	--	1,532	342	107.7
A	1971	1,858	134	--	1,669	323	93.3
R	1974	1,705	84	299	1,868	220	81.7
L	1976	1,759	46	--	1,411	302	102.6
E	1978	1,348	362	--	1,397	313	78.8
Y	1980	811	596	--	1,407		57.6
	1990				2,324		
	1961	280	-12	348	616		45.5
	1966	315	-2	461	663	111	40.9
W	1971	322	100	1,532	1,738	216	16.5
H	1974	136	-174	1,592	1,409	145	8.8
E	1976	82	26	1,711	1,352	467	4.5
A	1978	36	68	1,587	1,412	279	2.1
T	1980	92	20	1,810	1,922		4.8
	1990				2,510		

Sources: 1961-74 Thodey, R. (1977)
1976-80 Korean Statistical Yearbooks, 1962-81
1990 Hansen and Rao (1979)

market and concludes that partial estimates are subject to simultaneous bias. Taking these factors into account, estimates of reasonable magnitude which emerge from the various studies are given in Table 5.[2/]

2/ See chapter IV for more detailed discussion of demand elasticities.

Table 5. Estimates Of Price and Income Elasticities Of Demand For Foodgrains In Korea

Commodity	Income Elasticity	Price Elasticities		
		Rice	Barley	Wheat
Rice	0.2	-0.3	0.3	0.0
Barley	-0.25	0.6	-1.0	0.3
Wheat	0.04	1.3	0.3	-0.7

Source: Various studies as discussed in chapter IV.

Foodgrain demand is not expected to increase greatly. Table 4. gives estimates of total demand in 1990. These are based on the low income elasticities of demand and experience in other Pacific Rim countries. The increase in wheat consumption despite its negligible income elasticity of demand is due to increases from industrial and processing sources.

Supply increases are mainly the result of spectacular increases in yields. Rice yields in Korea at 6-7,000 kg per hectare are among the highest in the world while only Japan, of the Pacific Rim countries, has higher barley yields than Korea's 2,400 kg per hectare. Wheat yields at 2,000 kg per hectare are high in comparison with other less-developed countries but low in relation to North America and Western Europe. Four factors have influenced Korean yields. Most important is the introduction of new varieties of rice seeds such as IR 667, which are now planted on 70 percent of paddy land. Secondly, subsidies on inputs such as fertilizer and land improvement programs have increased yields. Third, increased mechanization has lowered labor costs and increased yields. Finally, higher producer prices have been a major incentive. A number of estimates of price response

are available (AERI, 1973; Moon, 1973). Estimates of price elasticity of supply for rice vary between 0.15 and 0.3, with higher response to long run prices. For barley and wheat, the estimates are higher. For the purposes of this thesis, long and short run price elasticities were obtained for the years 1963-78 using a Nerlovian price adaptation model. The results which are given in Table 14 show that farmers do respond to changes in price.

Future increases in supply are severely limited by land availability. Rice, which is planted in June and harvested in October/November, accounts for 59 percent of the 2.22 m hectares of cultivated land. Barley and wheat are winter crops. Barley, planted on 23 percent of land (0.5 m ha), is often grown as a second crop to rice in the South. Wheat acreage has fallen rapidly since 1974, mainly due to the change in government policy, and accounts for only 4.5 percent of cultivated land. Attempts to increase the supply of land through reclamation schemes have been largely frustrated by urban growth and erosion so that increases in production must come from yields or new technology which will permit multiple cropping. In addition, labor supply at peak demand periods is cited as a constraint (Hansen and Rao, 1979). While increased mechanization may alleviate this, demands due to multiple cropping will require improvements in labor availability. These two constraints mean that significant increases in supply are unlikely.

Historical Overview Of Foodgrain Policy

Korean foodgrain policy has had a major impact on supply and demand of rice, barley and wheat. The historical developments have been covered in detail elsewhere (Moon, 1975) and only a brief overview will be given here. Measures to influence foodgrain supply and demand date back to the Japanese occupation of Korea (1910-1945), with the objective of exporting rice to Japan. Dislocation caused by the Second World War meant that targets were not met. Compulsory purchases and the closure of the free market were resorted to in 1943. The U.S. Military Government's rule saw farmers trying to minimize sales to the government as a result of Japanese policies. The return to a free market (Ordanance I, 1945) resulted in rapid inflation as prices rose by 600 percent between 1945 and 1947. Attempts to improve the situation through the imposition of price ceilings led to black market prices and the 1946 Rice Collection Decree met with little success.

The year 1948 marked the beginning of a more structured policy with the establishment of the Food Administration Bureau. The need to stimulate supply through raising producer prices and the desire to keep consumer prices low failed due to inadequate financial allocations. In July 1949, temporary emergency measures involving rationing and a return to the free market were introduced. The dual market system that exists today began with the Grain Management Law, 1950, under which the government was charged with formulating annual foodgrain plans and was given the power to purchase a proportion of production. Inadequate funds, as agriculture took second place to overcoming the

dislocations of the Korean war and developing the manufacturing sector, meant that high producer prices were sacrificed for low consumer prices. In 1955 the final block that was to become the foundation of policy in the 1960's was laid with the beginning of shipments of grain under Public Law 480.

The PL 480 program covers a number of titles who govern the terms under which food aid can be given. These are generally concessionary or extended credit terms and enabled Korea to obtain foodgrains at prices below world levels. (It is also referred to as the "Food For Peace" program.)

The basis for present day policy was embodied in two acts: Agricultural Prices Stabilization Act, 1961 and the Grain Management Act, 1963. While the Students (1960) and Military (1961) revolts had been important events for Korea, they had done little to alter the direction that foodgrain policy was moving in. The responsibilities and powers granted under Laws 636 and 1381 were essentially extensions of the earlier Grain Management Law, 1950, and throughout the 1960's agriculture was accorded a low priority. The availability of low cost, and often subsidized, barley and wheat on the world markets led to policies which encouraged substitution of barley and wheat for rice. As has already been discussed, the 1970's saw a major shift in policy as emphasized both in the Third and Fourth National Development Plans and by greater financial commitments to agriculture. It is the purpose of this thesis to determine the economic costs and benefits to Korea of the change in policy.

Thesis Outline

This thesis is divided into five sections. Chapter II gives a brief review of the theoretical arguments for and against free trade and discusses their applicability to Korea. Chapter III provides the methodology and theoretical framework adopted. The methodology is divided into three sections. First, a means to determine the extent of the policy shift is given. Secondly, the framework used to evaluate the impact of price policy on self-sufficiency and farm incomes is outlined. Finally, the model adopted to estimate the effect of price policy on producer and consumer surplus, program costs, foreign exchange requirements and seasonal price stability is discussed. Chapter IV gives the data used, including estimates of supply and demand elasticities. The results are presented in Chapter V and conclusions drawn in Chapter VI.

CHAPTER II

INTERNATIONAL TRADE THEORY AND POLICY IMPLICATIONS

Patterns Of Trade

Under neoclassical trade theory assumptions of a two-country world (RoK, RoW), two sectors (food, F, and textiles, T) two homogenous factors of production (labor, L, and land, D), no transport costs, perfect competition and perfect substitutability, RoK should export T and import F if:

$$\left(\frac{P_F}{P_T}\right)_{RoK} > \left(\frac{P_F}{P_T}\right)_{RoW} \quad (1)$$

where: P_j is the autarkic (closed economy) price of the i^{th} commodity

Thus, the pattern of trade is determined by the autarkic price ratios. These depend on the effectiveness of factors of production, factor endowments and preference patterns of the two countries.

Early trade theories concerned themselves with the influence of factors of production on trade and have been formalized as the theory of comparative costs. Adam Smith showed that, with one factor of production (L), if the labor output ratio for good 1 in country A (a_1) was less than that of country B (b_1) and the reverse held for good 2, then world and individual welfare would be increased if A (B) exported (imported) good 1 and vice versa for good 2. Ricardo argued that trade would benefit both countries if the relative costs of producing

two commodities differed even if one country had an absolute advantage in the production of both commodities.

Further developments resulted in the theory of comparative costs. Prices are expressed as the opportunity cost of producing one good in terms of the other. This enables the terms of trade to be determined based on the strength of reciprocal demands. The theory of comparative costs, assuming similar preference patterns, makes factor endowments irrelevant in determining the direction of trade. It predicts that RoK will export T and import F if:

$$\left(\frac{C_F}{C_T}\right)_{RoK} > \left(\frac{C_F}{C_T}\right)_{RoW} \qquad (2)$$

where: C_i is the opportunity cost of producing the i^{th} good

Patterns of trade are predicted by equation (2), but the theory does little to explain it. Differences in the quality of factors of production, production functions or luck are all incorporated into Ricardo's phrase "peculiar powers bestowed by nature." It was in response to this question that the Heckscher-Ohlin theorem, explaining trade on the basis of differences in factor endowments, was developed. The theory predicts that a country will export the good which uses its more abundant factor of production intensively. Two alternative definitions of factor abundance are referred to in the literature (Bhagwatti, 1964). The price definition predicts that RoK is labor-intensive if:

$$\left(\frac{w}{d}\right)_{RoK} < \left(\frac{w}{d}\right)_{RoW} \qquad (3)$$

where: w is return to labor
d is return to land

Using this definition, if T is labor-intensive and F is land-intensive, RoK will export T and import F. The second definition is the physical one. In this case RoK is labor-intensive and, thus, exports T if:

$$\left(\frac{L}{D}\right)_{RoK} > \left(\frac{L}{D}\right)_{RoW} \quad (4)$$

If the assumptions of identical preference patterns and production functions are valid, then the two definitions give the same results. If this is not the case using (4), which more accurately reflects factor endowments, may yield predictions which are not born out by empirical results.

The third factor, preference patterns, has received less emphasis. The literature has generally focused on the reversal of trade patterns from those predicted using cost or factor endownment differences. Thus, even when (2) holds, if the demand for F in RoW is such that the inequality in (1) is reversed, the predicted pattern of trade would be reversed.

A good deal of work has gone into testing the hypotheses advanced as well as extending the theoretical arguments (Bhagwatti, 1964 and Stern, 1975). The early tests of the Ricardian model used labor productivity as a proxy for comparative costs, assuming that the differences would be reflected in export prices. Bhagwatti (1964) has criticized both the narrow focus on labor and the export price assumption. Later studies have looked at inter-country differences in efficiency, but variations in methodology, failure to systematically link the results to trade theory and not isolating the

causes in the differences in efficiency leads Bhagwatti to conclude that the Ricardian model still needs to be tested.

Empirical results from studies testing the H-O theory have met with even less success. Leontief's famous paradox was followed by a spate of studies as well as attempts to defend the H-O theorem. Problems include defining factors of production, role of natural resources, implications of factor-intensity reversals, the effect of trade distortions and a lack of sufficient variation in factor input ratios which can make imports and exports statistically indistinguishable (Stern, 1975). The inconclusive nature of the results is not surprising given the wide range of factors that affect trade and the resulting failure of the ceteris paribus assumption. Smith and Toye (1975) argue that because of this the H-O theorem is untestable. All that can really be said is that differences in labor efficiency and factor endowments may help to determine patterns of trade.

The literature on Korea's comparative advantage is almost unanimous in its conclusion that Korea has a comparative advantage in labor-intensive manufacturing and a comparative disadvantage in agriculture. Anderson (1980) extends a model developed by Jones (1979) to analyze comparative advantage in the Pacific Rim countries. Three factors of production are used to produce two commodities: land is specific to agriculture, capital to manufacturing while labor is mobile. The model consists of two sets of equilibrium equations: full employment conditions through which factor endowments can be traced and competitive profit relations which form the basis for factor price equalization. Comparative advantage is determined by the

relative endowments of land and capital. Anderson concludes that Korea is labor abundant and should specialize in labor-intensive manufacturing.

Comparative advantage is likely to move even further against agriculture and, in particular, against foodgrains. There are three reasons for this:

(a) physical constraints such as limited supplies of land preclude large increases in supply;

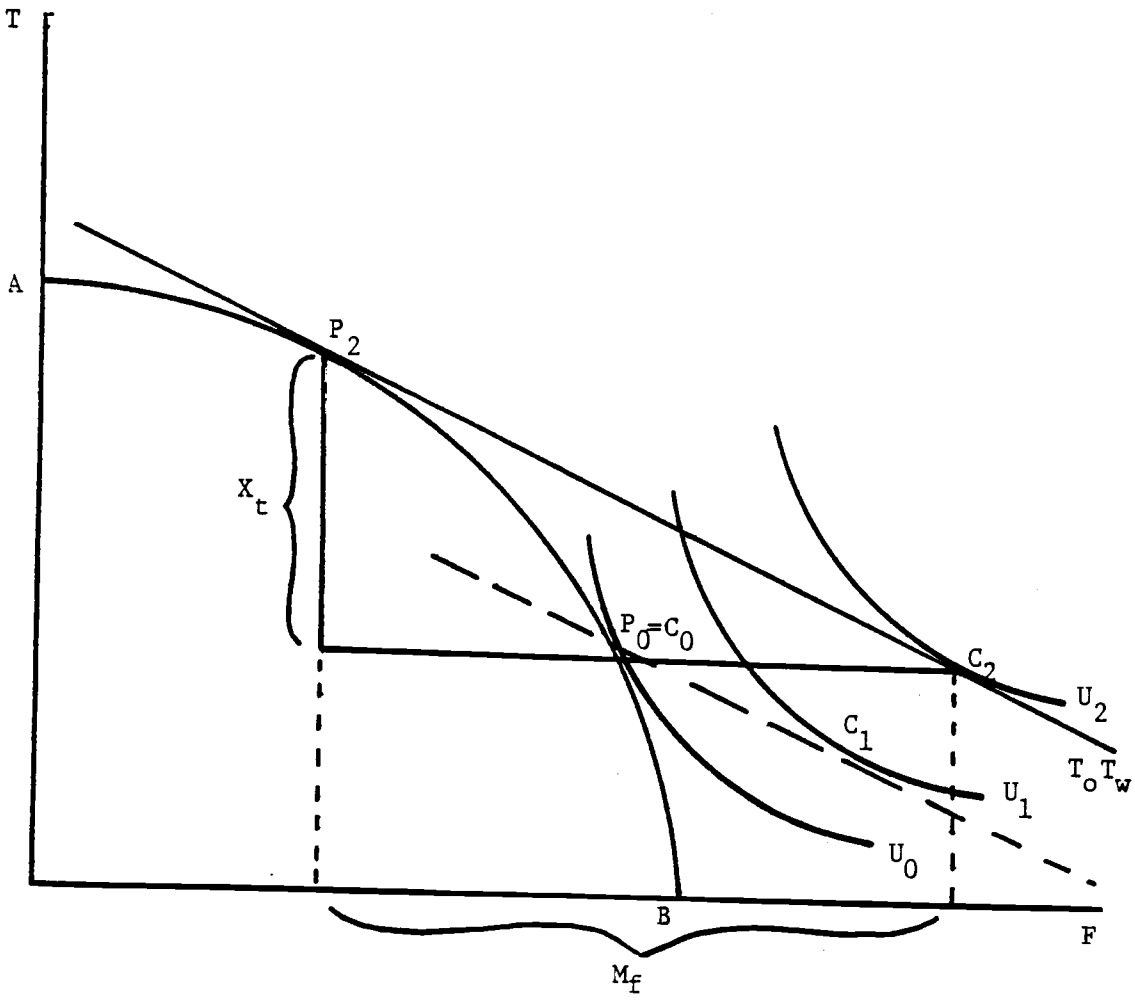
(b) low income elasticities of demand for foodgrains (0.2 for rice, -0.25 for barley and 0.04 for wheat) relative to other goods (0.44 to 1.21 for fruit, 1.02 for meat and 0.96 for milk and eggs) means that price of foodgrain will increase relatively less than other products; and

(c) world foodgrain prices have fallen in real terms over the last two decades. Martin and Brokken (1982), in a study of wheat and corn prices since 1866, argue that this is part of a long run historical trend. If this trend continues, Korean farmers will be at a greater disadvantage.

Trade Gains and Policy Implications

The costs of self-sufficiency, or gains from trade, are shown in Figure 1. AP_oB, the production possibility curve, is assumed to be concave to the origin. Social indifference curves (U_i) are convex to

Figure 1. Gains From Trade



Explanation: Trade lowers production of food and raises that of textiles from P_0 to P_2. Consumption is C_2 so that M_f is imported and X_t exported. Welfare increases from U_0 to U_2.

the origin and ordinarily rank society's welfare.[3/] Before trade, the country produces and consumes at P_o. Trade at world prices (ToT_w) shifts production to P_2 and consumption to C_2, resulting in a welfare gain of $U_2 - U_0$. This consists of two components: C_0 to C_1 is the trade gain with production staying at P_0; C_1 to C_2 is the specialization gain.[4/] The equilibrium conditions are given by:

$$MRT = MRS = ToT \quad (5)$$

where: MRT is the marginal rate of transformation in production
MRS is the marginal rate of substitution in consumption
ToT are terms of trade

Equation (5) gives the first order conditions for maximizing welfare with the second order conditions being assured by the concavity and convexity assumptions concerning the production function and social indifference curves (Bhagwatti and Srinivasan, 1969).

The argument that free trade maximizes welfare and is, therefore, the optimal policy has been widely criticized. Smith and Toye (1979) state that:

> "...there is the danger that in joining the chorus of praise for the theory of comparative advantage...one is persuaded to overlook its severe limitations both as an explanation of how comparative advantages arise, are lost or taken away, and as a policy guide..." (p. 3)

3/ The model requires the assumption that society's tastes can be represented as indifference curves much as an individual's can. In practice, the problems with summing individual indifference curves and the need to adopt Pareto compensation principal to escape distributional impacts of trade raise concerns about the validity of the conclusions (Cacholiades, 1981).

4/ Myint (1958) gives a third source of gain. Here trade enables previously unutilized resources to be employed (vent for surplus). Such a gain would be shown by a move from the actual production point inside AP_oB to P_o.

In general, modifications of the free trade argument involve one of five issues: domestic distortions in factor and commodity markets (Hagan, 1958, Johnson, 1965), imperfect international markets (Caves, 1979, Schmitz, et. al., 1981), the static nature of the argument (Myint, 1968 and 1969, Smith and Toye, 1979), uncertainty (Jabara and Thompson, 1980, Pomery, 1979) and nonenconomic objectives (Bhagwatti and Srinivasan, 1969). As Viner (1953) points out, in an imperfect world the choice facing policymakers ceases to be no trade versus free trade but, rather, what is the optimal level of trade (and protection) in the presence of various distortions?[5/]

The effect of imperfections in domestic markets has been analyzed by Hagan (1958) and Johnson (1965). Factor immobility causes production to remain at P_o in Figure 1 so that gains are limited to trade gains (C_0 to C_1). The optimum policy is free trade since equality between MRT and ToT can only be attained at the cost of destroying the MRS and ToT equality.

Hagan (1958) analyzed policy prescriptions with domestic distortions. In particular, he argued that manufacturing wages exceed that of agriculture by more than was accounted for by the higher cost of urban living. There are two effects of distorted factor prices. First, the PPC is pulled in towards the origin and, secondly, the equality between MRT and ToT does not hold. The optimal policy is not as argued by Hagan (1958), a prohibitive tariff. Bhagwatti and Ramaswami (1963) have shown that free trade may increase welfare even in the

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5/ Protection here is meant in the wider sense of any government action affecting the market and not simply tariffs and quotas.

presence of domestic distortions. A tariff policy also leaves the economy on the inner PPC. A tax or subsidy on the factor will shift the PPC out and enables (5) to be satisfied.[6/]

Distortions in commodity markets also influence policy conclusions. These may be due to external economies or market structure imperfections. Caves (1979) argues that a country will gain from trade if competition is introduced into the monopolistic sector. Cacholiades (1981) shows that if the distortion continues, the welfare effect of trade may be negative if the country specializes in the wrong commodity. Optimal policy in the presence of commodity price distortion is the imposition of a subsidy-cum-tax on output (Johnson, 1965). This would equate MRT and ToT without affecting the relationship between ToT and MRS.

Analysis of imperfections in international markets has centered on the potential for foodgrain cartels and the implications for exporters (Schmitz, et al., 1981). Less attention has been given to effects on importers. The actual effects on importers may include higher prices, increased foreign exchange needs and greater price and political risk. The policy implications for importers depend on the nature of the market and size of the country. Carter and Schmitz (1979) have argued that some countries, e.g. Japan and EEC exert monopoly power by applying an optimum tariff. Small countries do not have this luxury. They must either accept the terms of trade or adopt

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6/ Johnson (1965) also analyzes the effect of factor price rigidities. Production occurs inside the PPC and the optimal policy is a tax or subsidy on the factor.

protective measures and increase domestic production. For them the world terms of trade represent the opportunity cost of trading regardless of distortions from a global viewpoint.

The free trade argument has been criticized as being too static and the infant industry argument used by many countries to justify import substitution policies. Johnson (1965) argues that the optimal policy is not protection but a tax or subsidy which equates social with private rates of return and cost of capital. Doubts have also been expressed as to the practicality of the policy; in particular, the timing and extent of protection is difficult to determine and implement.

Marxian theory offers a more dynamic approach. Unequal exchange results in the center dominating trade and underdeveloping the periphery. Myrdal (1957) has extended this arguing that there is a cumulative causation effect in that concentration of productive resources in the center generates agglomeration economies which encourage further concentration. The policy implications here are to restrict trade--a prescription almost totally opposite to that of traditional trade theory.

Uncertainty due to tastes, prices or technology also affect policy conclusions. Models involving uncertainty are discussed in Pomery (1979). Most of the work is very theoretical and only Jabara and Thompson (1980) have done any empirical work. Two categories of uncertainty models are identified in the literature. In ex post models the production decision is made before, and the trading decision after, the resolution of uncertainty. The second is where trade decisions are taken before the resolution of uncertainty

(ex ante trade). The solution to the problem involves the identifcation of a market which bears the risk. Assuming risk averseness, it can be shown that a country should specialize less in the presence of risk than under conditions of complete certainty. This last result is born out in a study by Jabara and Thompson (1980). They develop a linear programming model for Senegal and conclude that, with international price uncertainty Senegal should specialize less in the production of peanuts (rely less on foodgrain imports) than pure theory would prescribe.

Finally, the free trade argument has been criticized for ignoring noneconomic objectives. Bhagwatti and Srinivasan (1969) analyzed four situations: (1) specified output level, (2) self-sufficiency, (3) specified factor employment level and (4) domestic availability of certain goods. The optimal policy is determined by adding an additional constraint reflecting the noneconomic objective and solving for first order conditions. The solution involves the imposition of a subsidy or tariff equal to the shadow price of the additional constraint. For objectives (1) and (4), this involves a producer subsidy, for (2), a tariff and for (3), a factor subsidy.

Theoretical and Historical Considerations In Korean Foodgrain Policy

Policies aimed at influencing the supply and demand of foodgrains have been implemented by a number of countries with a variety of objectives. These include distributing income to consumers or producers, stabilizing prices, raising government revenue or minimizing

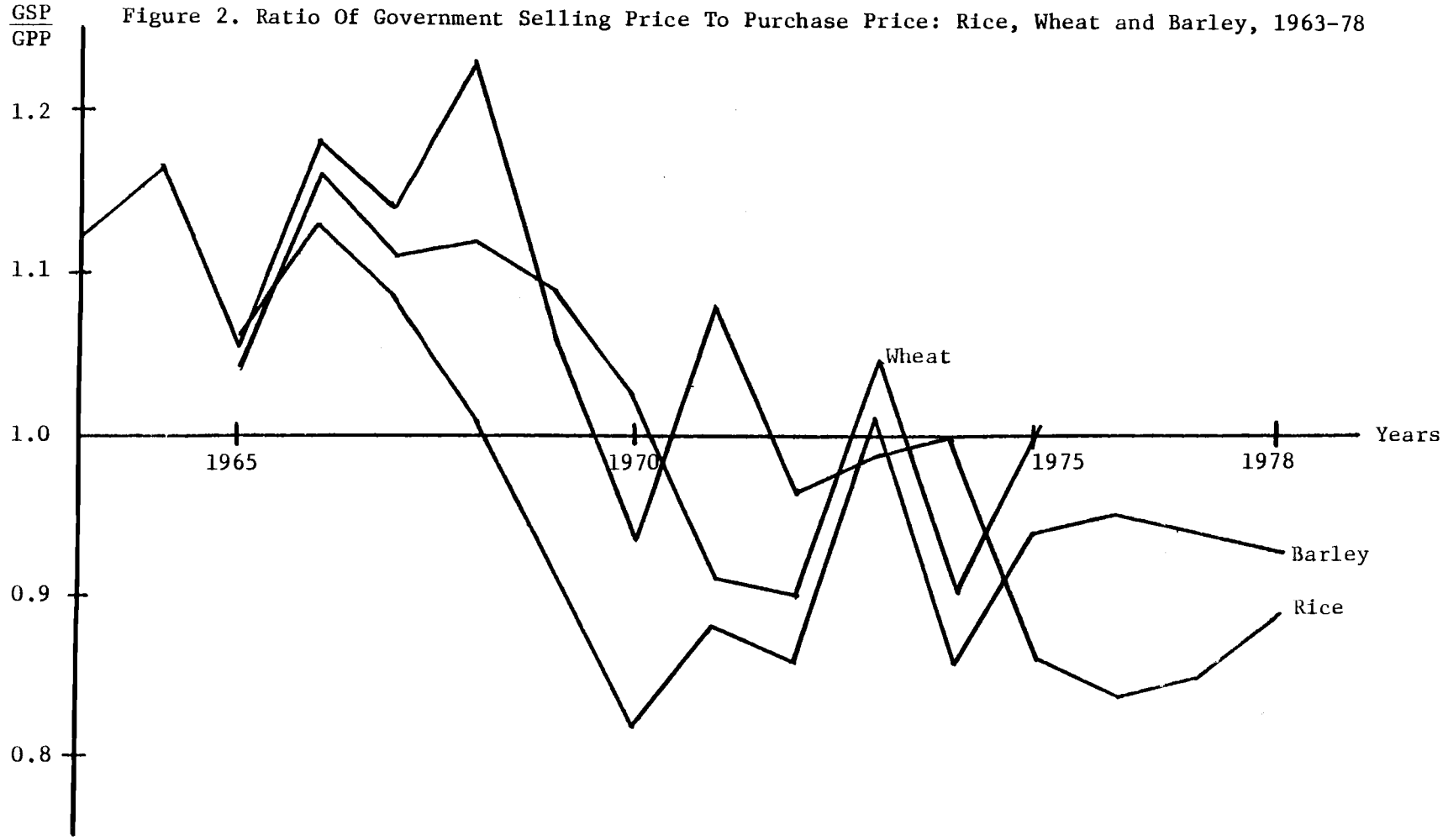
program costs, earning foreign exchange or minimizing demands on foreign exchange and achieving self-sufficiency. Korea has at one time or another embraced most of these objectives. Two periods can be distinguished since 1955.

From 1955 to 1968, government aimed at achieving low and stable consumer prices. The rationale was to generate a cheap supply of labor to the industrial sector. Secondly, the policy aimed at minimizing program costs in line with the lower priority given to agriculture. In particular, throughout this period the foodgrain program was charged with covering its costs. The third objective was to minimize demands on foreign exchange. A fourth goal of the government as stated in the First and Second National Development Plan was self-sufficiency. This was consistent with the third objective but conflicted with the first two. PL 480 shipments gave Korea a way of avoiding this dilemma by providing foodgrains, and in particular wheat, at prices below world levels. As such, PL 480 can be said to have underwritten Korea's industrial development.

The second period from the early 1970's until today coincided with the broader shift in Korea's development policy. Self-sufficiency, raising agricultural incomes and improving the "quality of life in the rural areas" became the main focus of foodgrain policy.

The shift can be seen in Figure 2. During the 1960's, government selling prices (GSP) exceeded purchase prices (GPP). Between 1968 and 1970 this trend was reversed. This is particularly marked for rice and barley.

Figure 2. Ratio Of Government Selling Price To Purchase Price: Rice, Wheat and Barley, 1963-78



Source: Korean Agricultural Cooperative Yearbooks, 1964-79

Output price policy is not the only method of achieving the above objectives. Input subsidies, infrastructural development and tariffs can also have an effect. While Korea subsidizes fertilizer and has implemented land reclamation schemes (Huh, 1980 and Kim, 1979), output subsidies are seen as the main strategy.

The extent to which Korean government policy has affected market incentives between sectors can be obtained by looking at effective protection and subsidy rates. Westphal and Kim (1977) concluded that, in 1968 these rates were higher for agricultural domestic sales than for other industry groups. The opposite holds for exports (Table 6). Kim (1974) provides evidence that the nominal rates of protection for primary products have been increasing relative to other sectors. These results indicate that Korea has followed her comparative advantage in labor-intensive manufacturing but less reliance has been placed on agricultural imports than trade theory would argue for.

Table 6. Effective Protection and Subsidy Rates, 1968 (%)

	Effective Protection		Effective Subsidy	
	Exports	Domestic Sales	Exports	Domestic Sales
Primary	-7.0	17.9	-2.4	20.7
Agriculture, Food and Fisheries	-15.3	17.9	-9.4	21.7
Mining	-0.9	3.5	2.7	4.5
Manufacturing	2.2	-1.1	8.9	-6.5

Source: Westphal and Kim (1977)

Three arguments can be advanced to reconcile trade theory and Korean price policy both in the past and the move towards a more protectionist agricultural policy since 1970:

(a) world foodgrain markets are characterized by a few major exporters and many importers. This is particularly true in the case of wheat and barley, though not for rice (Table 7). The low proportion of rice traded, some 3 percent of production, and the existence of the EEC as a large buyer and seller of barley reduces the oligopoly power in these markets. The wheat market has been characterized as one dominated by large multinational companies (Morgan, 1979); an oligopoly with implicit collusion (Alaouze, et. al, 1979) and as one in which state and private traders play a major role (Martin, 1979, Schmitz, et. al, 1981). In such a situation the action of a few large companies or governments can have a major effect on price as a result of collusion or domestic policy actions.

This oligopoly power is unlikely to decrease. The U.S. is, and has been, emerging as an increasingly important supplier of wheat and other foodgrains, thus increasing concentration in supply. Fast rates of population growth will force a number of countries to continue importing and lower buyers' market power.[7/] A further change in market structure has occurred with the entry of the USSR as a major importer. The potential entry of China presents a situation in with the world market will be dominated by a few large buyers and sellers. Such a situation would leave Korea vulnerable to external disturbancs;

7/ Carter and Schmitz (1979) argue that large countries exert monopsony power by applying an optimum tariff. Korea and most developing countries are probably not large enough importers to do this.

Table 7. Average Production, Exports and Imports Of Rice, Barley and Wheat By Geographical Area, 1978-80 (million MT)

	Production			Imports			Exports		
	Rice	Barley	Wheat	Rice	Barley	Wheat	Rice	Barley	Wheat
World	387.4	167.6	440.6	11.6	15.0	88.5	11.5	15.0	88.8
Africa	8.2	4.2	8.8	2.1	0.7	14.0	0.1	0.0	0.2
N.C. America	8.3	19.1	78.8	0.5	0.4	3.3	2.6	4.4	50.8
S. America	12.8	1.0	12.3	0.5	0.3	7.8	0.6	0.0	3.6
Asia	353.3	17.5	130.5	6.1	3.1	32.8	6.9	0.3	2.2
Europe	1.8	70.5	92.2	1.7	8.7	18.5	0.9	8.2	18.3
Oceania	0.7	3.8	15.2	0.2	0.1	0.2	0.4	2.1	11.0
USSR	2.3	51.5	102.8	0.6	1.5	12.0	0.0	0.0	2.7
Largest 5 (MT)				2.8	10.0	43.6	8.1	14.0	78.6
%				24.1	66.7	49.3	70.4	93.3	88.5

Source: FAO Production and Trade Yearbook 1981

(b) risks of relying on the world wheat markets have increased. In addition to changes in market structure, Schmitz et al. (1981, pp. 7-8) gives five reasons for this: higher petroleum prices, fall in the level of stocks relative to annual utilization, failure to reach international trade agreements, use of food as a counter to OPEC and the potential use of food as a political weapon. Table 8. gives world prices of rice, wheat and barley between 1965 and 1978. It is fairly clear that there has been a significant increase in price instability since 1970; and

(c) the noneconomic objective of self-sufficiency is a direct result of Korea's history. Martin et al. (1982) sum this up:

> "Even the most casual observer in Korea is struck by the intensity with which national security is pursued. There is a clear sense that Korea sees itself as an island in a potentially hostile neighborhood. To the north is the 40-year enemy of Communist North Korea. To the west is the giant People's Republic of China. To the east is Japan, an economic ally, but also a nation whose heavy-handed 35-year occupation of Korea has left a legacy of animosity and distrust."

In Korea, as in many developing countries, food is seen as a strategic commodity. Whatever the force of the economic arguments against self-sufficiency, failure to appreciate political objectives will severely limit the usefulness of the analysis.

Table 8. World Prices Of Rice, Wheat and Barley, 1965-78 and (U.S. dollar per MT)

		RICE (5% broken white) f.o.b. Bangkok	WHEAT (unmilled) f.a.s. U.S.	BARLEY (unmilled) f.a.s. U.S.
	1965	137.50	72.12	56.11
	1966	165.80	68.30	63.80
	1967	223.70	63.79	71.00
	1968	203.30	58.69	59.70
	1969	185.50	57.79	58.44
	1970	143.00	55.74	32.66
	1971	129.10	60.59	60.31
	1972	150.70	68.10	60.32
	1973	368.10	138.85	85.77
	1974	542.10	199.30	146.92
	1975	364.20	169.32	141.50
	1976	241.80	136.93	150.00
	1977	272.30	112.31	96.81
	1978	368.20	128.56	130.60
standard deviation ÷ mean	1965-71	21.11	9.60	21.04
	1972-78	40.83	30.50	30.19

Source: U.S. Foreign Agricultural Trade Statistical Report, 1966-1979. Food and Agricultural Organization, Rice Report, 1966-1975. U.N. Monthly Bulletin of Statistics, May 1979, reported in Tolley et. al. (1981).

The increasing risk in relying on imports is largest in wheat where the change in degree of world price instability and extent of market power is largest. This would suggest that Korea should put the greatest emphasis on self-sufficiency in wheat. Three

factors indicate that the higher priority given to rice and barley may not be so irrational. First, the noneconomic objective is far stronger in the case of a traditional food such as rice. Secondly, agricultural advantages such as higher yields, the ability to practice multiple cropping and farmers' familiarity with the production of rice and barley would mitigate against wheat. Finally, substitution in consumption and consumer preferences for rice would favor higher rice price supports.

Bhagwatti and Srinivasan (1969) argue that the optimum policy for self-sufficiency is the imposition of a tariff equal to the shadow price of the self-sufficiency constraint. Korea has adopted a policy of producer price supports which is nonoptimal. However, the consideration of other objectives alter the theoretical policy conclusions. In particular, a tariff will raise consumer prices and increase the urban cost of living and industrial wages. This conflicts with the need to maintain a supply of low cost labor. The imposition of a tariff would also invite retaliation against Korean exports. Finally, the second main objective of raising rural incomes would be best served through higher producer prices.

CHAPTER III

THEORETICAL FRAMEWORK AND METHODOLOGY

Introduction

The previous chapters outlined the theoretical arguments for and against free trade. Assuming that unrestricted trade maximizes welfare, the costs of deviating from economic policy perscriptions can be measured in terms of welfare gains and losses to different sections of society. Korean foodgrain policy prior to 1970 was largely based on the doctrine of comparative advantage, incentives to producers were small, and government investment was concentrated in the industrial sector. Policy after 1970 showed a sharp reversal as noneconomic goals were given more emphasis. A comparison of the effects of price policy in the periods before and after 1970 enables an estimate of the economic costs of political goals to be obtained.

The analysis consists of three parts. First, the hypothesis that there was a significant policy shift between 1968-70 is tested. Secondly, the effects of policy on self-sufficiency and producer incomes (primary objectives) in each of the two periods are determined and a comparison between the two periods is made. Thirdly, the economic costs of achieving the primary objectives for producer and consumer surplus, foreign exchange requirements and government revenue (secondary objectives) are estimated. The analysis is done for a number of price scenarios in order to determine the effect of both changes in the price of the good itself and of substitute prices. The scenarios evaluated are domestic prices, world prices, world

prices of the good itself with domestic substitute prices and domestic prices of the good with world substitute prices.

The methodology used extends that developed by the World Bank in a series of studies on price policy in eight less developed countries (Scandizzo and Bruce, 1980). It also incorporates aspects of a study by Tolley et. al. (1981) of price policy in four developing countries including Korea.

Reference Prices

The evaluation of price policy requires a set of reference prices to be determined. Border prices (P_b), defined as foreign prices converted to won at the official exchange rate, are used. In the case where the country is a small importer, as assumed here, the relevant consumer price (P_c) is the cost in full (c.i.f.) import price. This is equal to the price in the exporting country plus transport and insurance costs. The appropriate producer price (P_p') is the c.i.f. import price less internal transport costs (TC). Figure 3a shows P_c, P_p' and P_b for an importer. In the case of a small exporter, the relevant consumer price is the free on board (f.o.b.) export price defined as the price received abroad less international transport costs (ITC). Prices received by producers under free trade would be equal to the f.o.b. export prices less internal transport costs.

Under certain price scenarios, the c.i.f. import prices predict Korea to be an exporter, while f.o.b. export prices predict an importer.

Consumers could thus purchase domestic production more cheaply, while producers could get a higher price at home than abroad. No trade would occur and the relevant price is the self-sufficiency price. For the purpose of this study, the following rules are used to determine the relevant price under alternative price scenarios:

(a) if c.i.f. import prices predict an importer, then c.i.f. prices are used;

(b) if. f.o.b. export prices predict an exporter, then f.o.b. prices are used; and

(c) if c.i.f. import prices predict an exporter and f.o.b. an importer, the self-sufficiency price is used.

Policy Shift

The extent to which government price policy affects producer and consumer prices is measured by the Nominal Protection Coefficient (NPC):

$$NPC = \frac{P^i_d}{P_b{}^i} \quad (6)$$

where: P^i_d is the domestic price of i^{th} good

$P_b{}^i$ is the border price of i^{th} good

Using domestic producer and consumer prices (6) provides a simple measure of the degree to which price policy has affected market prices. On the production side, it ignores the effects of subsidies and taxes on inputs. The effects of input price distortions could be evaluated using the Effective Rate Of Protection Coefficient (EPC).[8/] In practice,

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8/ This is defined as the ratio of value added per unit of output at domestic prices to value added at world prices.

where the value of purchased input is a small proportion of value added as in many developing countries, EPC and NPC yield similar results (Scandizzo and Bruce, 1981). NPC is considerably easier to calculate and is used here.

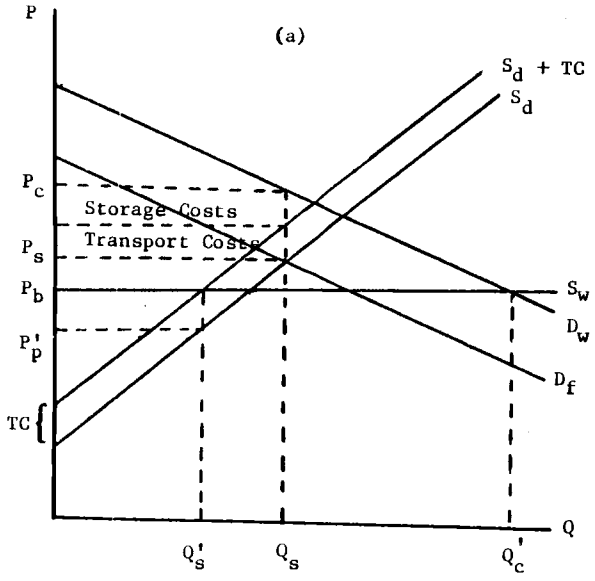
Major Objectives Of Price Policy

Figure 3a shows the model developed by Tolley et al. (1981) in a study of agricultural pricing policy in four less developed countries including Korea. The long run domestic supply curve is assumed to be positively sloped and is the marginal cost curve in the absence of external economies and diseconomies. D_f is demand at the farm level, and D_w at the wholesale level. The difference between the two is accounted for by the average cost of storage per unit plus transport costs. World supply from the point of view of the individual country is assumed to be perfectly elastic at P_b so that Korea is a price taker.

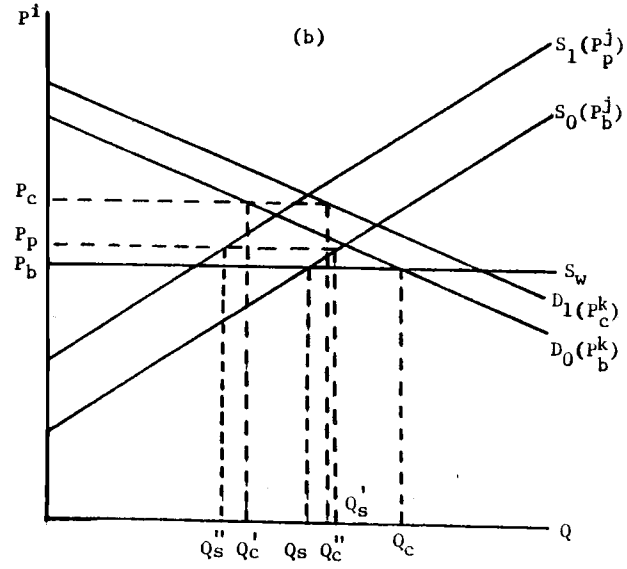
In a closed economy with no government intervention, equilibrium is attained at an output of Q_s. Producers would receive a price of P_s, consumers would pay a price P_c and $(P_c - P_s)$ is the average storage cost plus transport costs (TC). Consumer prices would rise from $P_s + TC$ at harvest time to $P_s + 2(P_c - P_s) - TC$ at the end of the year.

Under free trade with P_b lower than P_s, the level of imports in equilibrium would be $Q_c' - Q_s'$. Price policy moves the economy towards self-sufficiency by increasing supply and lowering demand. For instance, if producer prices were raised to P_s domestic supply increases and imports fall by $Q_s - Q_s'$. Similarly, raising consumer prices to P_c would lower imports by $Q_c' - Q_s$.

Figure 3. Effect Of Price Policy On Self-Sufficiency



Explanation: Free trade lowers consumer prices from P_c to the cost in full world price P_b and producer prices to $P'_p = P_b$-TC where TC is internal transport costs. Consumption increases to Q'_c, output falls to Q'_s and imports are $Q'_c - Q'_s$.



Explanation: Raising P^i_p and P^i_c above P^i_b lowers imports from $(Q_c - Q_s)$ to $(Q'_c - Q_s)$. Increasing substitute prices (P^j, P^k) shifts D_0 and S_0 to D_1 and S_1 resulting in imports of $Q''_c - Q''_s$. Supply curves include TC and demand is at wholesale prices.

The model in Figure 3a implicitly assumes that the supply and demand curves are not affected by price policy. However, rice, barley and wheat are substitutes in production and consumption so that changing the price of any one shifts the curve of the other two. The impact of parameter changes on self-sufficiency is shown in Figure 3b.

The effect of price policy on self-sufficiency of i^{th} good in period t is given by:

$$\Delta Q^{it} = \left[\left(\frac{P_p^{it} - P_b^{it}}{P_p^{it}} \right) e_{ii} + \sum_{j=i}^{2} \left(\frac{P_p^{jt} - P_b^{it}}{P_p^{jt}} \right) e_{ji} \right] Q^{it} \qquad (7)$$

$$\Delta C^{it} = \left[\left(\frac{P_c^{it} - P_b^{it}}{P_c^{it}} \right) n_{ii} + \sum_{k=1}^{2} \left(\frac{P_c^{kt} - P_b^{kt}}{P_c^{kt}} \right) n_{ki} \right] C^{it} \qquad (8)$$

$$SS_t^i = \frac{Q^{it}}{C^{it}} - \frac{Q^{it} - \Delta Q^{it}}{C^{it} - \Delta C^{it}} = \frac{Q^{it}}{C^{it}} - \frac{Q_w^{it}}{C_w^{it}} \qquad (9)$$

where: ΔQ^{it} is change in output due to price policy

ΔC^{it} is change in consumption due to price policy

$P_{p,c,b}^{it}$ are producer, consumer and border prices of i^{th} output in period t. For i = j substitute in production; i = k substitute in consumption

e_{ji} (n_{ki}) are elasticities of supply (demand) of i^{th} output with respect to j^{th} (k^{th}) price

$Q_{(w)}^{it}$ is production at domestic (border) prices

$C_{(w)}^{it}$ is consumption at domestic (border) prices

SS^i is effect in period t of price policy over free trade on self-sufficiency

The first term in equation (7) and (8) gives the change in quantity produced and consumed of the i^{th} good due to the divergence between world and domestic prices. The second term allows supply and demand price parameters to be analyzed. Equation (9) gives the change in self-sufficiency due to price policy.

Evaluation of the policy shift is more complex since one must also allow for changes in nonprice parameters. These include costs and income changes.[9/] The effect on quantity supplied and demanded can be analyzed using equations (10) and (11).

$$\Delta Q^i = \left[\left(\frac{P_p^{i1} - P_p^{i0}}{\frac{1}{2}(P_p^{i1} + P_p^{i0})} \right) e_{ii} + \sum_{j=1}^{2} \left(\frac{P_p^{j1} - P_p^{j0}}{\frac{1}{2}(P_p^{j1} + P_p^{j0})} \right) e_{ji} + \left(\frac{K^{i1} - K^{i0}}{\frac{1}{2}(K^{i1} + K^{i0})} \right) k_{ii} \right] \frac{Q^{i1} + Q^{i0}}{2} \quad (10)$$

$$= \Delta Q_p^i + \Delta Q_s^i + \Delta Q_k^i$$

$$\Delta C^i = \left[\left(\frac{P_c^{i1} - P_c^{i0}}{\frac{1}{2}(P_c^{i1} + P_c^{i0})} \right) n_{ii} + \sum_{s=0}^{2} \left(\frac{P_c^{s1} - P_c^{s0}}{\frac{1}{2}(P_c^{s1} + P_c^{s0})} \right) n_{si} + n_{yi}\, g \right] \frac{C^{i1} + C^{i0}}{2} \quad (11)$$

$$= \Delta C_p^i + \Delta C_s^i + \Delta C_y^i$$

$$\Delta SS_i = \frac{Q^{i1}}{C^{i1}} - \frac{Q^{i1} - \Delta Q_r^i}{C^{i1} - \Delta C_m^i} \qquad \begin{matrix} r = p,s,k \\ m = p,s,y \end{matrix} \quad (12)$$

where: e_{ji} is elasticity of supply of i^{th} output with respect to price of j^{th} good

k_{ii} is elasticity of supply of i^{th} output with respect to changes in unit cost of production

K^{it} is cost of producing one unit of i^{th} output in time t

n_{si} is elasticity of demand for i^{th} good with respect to price of s^{th} good

n_{yi} is income elasticity of demand of i^{th} good

g is growth of real G.N.P.

9/ Changes in costs of production can be seen as a proxy for changes in input prices and technology which shift the supply curve.

In equations (10) and (11), ΔQ_p^i and ΔC_p^i are the changes in production and consumption due to changes in producer and consumer prices of i^{th} good, ceteris paribus. They represent the effects of changes in the product's own price, with the supply and demand curve parameters constrained to the 1976-78 level. The remaining terms can be similarly interpreted as change in production and consumption resulting from parameter changes.[10/] Equation (12) is the increase or decrease in the self-sufficiency ratio due to price or parameter changes as defined by ΔQ_r^i and ΔQ_m^i.

In this study, equations (7) to (9) are used to determine the effect of price policy in the two periods 1965-67 and 1976-78. Equations (10) through (12) are used to evaluate the effects of the policy shift on self-sufficiency.

The second major objective of policy since 1970 is to raise producers' income. If domestic producer prices exceed world prices, then farm incomes will rise as both output and returns per unit rise. This can be seen in Figure 3a where higher domestic prices raise incomes by $(P_s - P_b)\ Q_s + (Q_s - Q_s')\ P_b$. The situation is more complex in many developing countries since farmers are both producers and consumers. Higher producer prices are likely to:

(a) increase output, assuming a positive elasticity of supply, which will increase sales at a constant proportion of output sold;

(b) increase producer income as a result of increases in sales and higher prices, which will increase consumption of a normal good and lower it for an inferior good;

10/ ΔQ_s^i and ΔC_s^i relate to changes in substitute prices; ΔQ_k^i to changes in costs and ΔC_y^i to changes in income.

(c) lower consumption as relatively cheaper goods are substituted for the more expensive good. This will raise quantity marketed as a percentage of output; and

(d) decrease consumer real income since consumer prices rise. This would lower on-farm consumption for a normal good and raise it for an inferior good.

In determining the effect of price policy, the important question is: what is the resulting change in marketed output which is determined by the net effect of the factors just discussed? In practice, the change in net farm income (F_t^i) as a result of maintaining prices above world levels can be divided into two components as given by (13):

$$F_t^i = \%\Delta Q^{it}\, Y_{pi} + \frac{(P_p^{it} - P_b^{it})\alpha Q^{it}}{NFI} \qquad (13)$$

where: Y_{pi} is elasticity of net farm income with respect to output

NFI is net farm income

α is proportion of output marketed

ΔQ^{it} is determined by (7)

The first term on the right-hand side gives the change in net farm income due to an increase in output with prices constant. The second term is the increase in income on final marketed output due to the higher price. It can be interpreted as the elasticity of net farm income with respect to price, marketed output held constant.

The effect of the shift in policy is determined in a similar fashion as given by (14):

$$F_i = \%\Delta Q^i \, Y_{pi} + \frac{(p_p^{i1} - p_p^{i0})\alpha Q^{i1}}{\frac{1}{2}(NFI^1 + NFI^0)} \qquad (14)$$

where: ΔQ^i is given by (10)

In (13) and (14) the second term will, assuming an increase in price, be positive providing some output is sold. The first term can be negative or positive, but the latter is more likely since a negative Y_{pi} means that the income effect which increases consumption must be greater than the increase in output.[11/]

Equations (13) and (14) assume that the proportion of output sold (α) remains constant. In practice, higher producer prices are likely to increase the value of α. Tolley et al. (1981) estimate the elasticity of rice marketing with respect to price as twice the elasticity of supply, indicating that the change in α may be significant for large price changes. Ideally the second term in (13) and (14) should be broken down into the effect of price policy in increasing the proportion of output marketed and the effect of higher prices in raising the per unit returns. In this study, however, the change in α is accounted for by the second term in equations (13) and (14). The reason for this is that reliable estimations of α do not exist for barley and wheat.

11/ Tolley et. al. (1981) show that the elasticity of consumption with respect to output, prices constant, is equal to Y_{pi} multiplied by elasticity of income. Even if the latter is large, the increase in consumption is unlikely to be great enough to offset the increase in production.

Indirect Effects Of Price Policy

Price policy aimed at attaining self-sufficiency and raising producer incomes will have a number of other effects on the economy. In particular, price policy will impact upon consumer and producer surpluses, program costs, foreign exchange requirements and price stability. Each of these issues are briefly discussed and a framework to analyze welfare changes given.

Consumer and Producer Surplus. The assumptions in demand and supply theory of diminishing marginal utility and increasing marginal costs give rise to the concept that the value placed upon a good is more for a consumer and less for a producer than the price on all but the last unit traded. If government price policy increases the price, then consumer and producer welfare or surpluses will change. Marshall argued that if the marginal utility of money was constant and remained constant for any move along the demand curve, the area under the demand curve less total expenditure measures consumer surplus. This area, referred to in the literature as the "triangle", has commonly been used in the literature as a measure of consumer surplus. Similarly, total revenue less the area under the marginal cost curve represents producer surplus.

The concept has caused considerable debate in the literature as to its precise meaning and definition (Currie et al., 1971). Under an ordinal preference map, consumer surplus is best defined as the change in income required to keep the consumer on his original indifference curve. However, using the initial or new price level and

constraining the consumer to a particular bundle gives different measures.[12] On the supply side, if the short run marginal cost curve equals the supply curve, the triangle measures return to fixed factors of production. In the long run, with no fixed factors the triangle has no economic significance. If, however, there are some fixed factors and the long run supply curve is both the marginal cost curve excluding rents and the average cost curve including rents, the triangle is the payment to fixed factors above their opportunity costs.

Ideally, compensated supply and demand curves should be used to estimate welfare changes. These can be derived in a similar manner to ordinary supply and demand curves except that the consumer or producer is constrained to the initial income or welfare level. In practice, many of the theoretical problems are ignored. One reason for this is that no workable alternative to the measurement of welfare changes has been found. As Bhagwatti (1964) states:

> "Policies are maintained or changed largely for non-economic reasons; and the (economic) 'cost' involved is a magnitude that is commonly demanded... the trade theorist...has begun to meet this need in an attempt to bring economic analysis closer to fulfilling the objective that provides its ultimate raison d'êtr̂e. The result has been a definite and significant trend, in the analysis of pure theory, towards measurement of welfare change." (p. 123)

12/ Four measures of consumer and producer surplus have been defined which depend on which set of prices are used and whether the bundle of goods is constrained to any particular level.

Secondly, while the Marshallian triangle is a biased estimate of surplus according to the sign of the income or welfare effect, lack of knowledge about the exact magnitude of the elasticities makes the bias relatively unimportant for goods with low income and welfare elasticities. For these reasons, the Marshallian triangles are taken as measures of the welfare gains and losses to consumers and producers resulting from price policy.

Program costs are a function of government purchase and selling prices, world prices, storage and transport costs, interest rates and elasticities of supply and demand. Analysis of the impact of price policy on program costs can most easily be carried out by considering the cost per unit handled and the quantity handled.

The cost per unit depends on the difference between selling and purchase prices and costs due to storage, wastage, transport and opportunity cost of capital. Tolley et al. (1981) calculate an average cost per unit due to holding and marketing costs ($P_c - P_s$ in Figure 3a) which can be taken as a constant proportion of the price of the commodity. In the situation where government handles all output, purchase and selling prices equal producer and consumer prices. This is not very realistic if government prices differ from market ones.[13/]

Quantity handled is also affected by price policy. First higher prices increase output which, given positive elasticity of marketing with respect to price, increases the volume sold. Unless government reduces

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13/ Since 1970 government purchase prices have generally exceeded producer prices while selling prices have been below retail prices.

the proportion of production purchased, it will handle a higher volume. Secondly, as discussed later, government by bearing part of the storage cost increases price stability. The effect of this is to reduce the margin between the harvest farm price, with no storage cost, and the price received by the farmer. As this margin is decreased so the incentive to hold stocks is lowered and the farmer will be more willing to sell to government (Tolley et al., 1981).[14/]

Higher prices increase self-sufficiency so that the government moves from purchasing in the world market to the domestic market. This raises purchase costs if domestic prices exceed world prices. A second effect of higher domestic production is that a greater volume must be sold. As Tolley et al. (1981) argue, if demand is inelastic, then increasing sales to the domestic market will lower revenue and increase costs. Selling the additional output on the world market will increase revenue, but costs will still rise if purchase prices exceed world prices. Finally, purchase programs transfer risk from producers to government (Zwart and Meilke, 1979). Assuming that farmers are risk averse, they would be more willing to sell to government.

In order to analyze the effects of price policy on costs, storage and transport, wastage and opportunity cost of capital are assumed to to be a constant proportion of the price. It is also assumed that the government handles all imports, exports and marketed ouput. The

---

14/ Price stabilization also increases unit costs by raising producer and lowering consumer prices. Consumption is shifted to later in the year, thus raising storage and interest costs.

estimates obtained will not, therefore, predict actual costs. They will, however, enable observations to be made about the economic relationships between price policy and program costs. Secondly, by adjusting the values by the actual proportion of sales handled by government, fairly accurate estimates can be obtained.

Foreign Exchange. Free trade policies place heavy demands on foreign exchange. Higher producer and consumer prices, by increasing supply and decreasing demand, can substantially reduce imports. The extent to which the policy is successful depends on the elasticities of supply and demand. In general, the more elastic are supply and demand, the greater the effect of raising prices.

Stability of prices can be significantly affected by prices. Tolley et. al. (1981) develop a model to analyze complete and partial price stabilization policies and the implications for program costs and producer and consumer surpluses. The model is shown in Figure 3a where producer prices, net of storage costs, are P_s. At harvest time, wholesale prices equal P_s plus transport costs (TC). Over the year they rise (to reflect storage costs) to $P_s + 2(P_c - P_s) - TC$. The condition for complete stabilization is that government must purchase all production at P_p and sell at $P_p + TC$, thus bearing all storage costs.

In practice partial price stabilization as a result of price policy is more realistic. In this case, prices rise at the beginning of the year until government begins selling its stocks. Implications for consumer and producer surplus, program costs and prices can then be determined. The relevant question in this thesis is not the impact

of a price stabilization policy on consumer and producer surpluses and program costs; rather, it is, what is the impact of increasing prices, aimed at attaining self-sufficiency and raising producer incomes, on price stabilization?

This question can be analyzed within the Tolley et al. model. In particular, as argued earlier, a higher producer price will increase the volume and proportion of output purchased by the government. If this is sold in the domestic market, then consumer prices will fall, forcing government to bear at least some of the storage costs, thus, increasing price stability. If some of the increased output is exported, then the impact on price stability depends on the proportion of the domestic market supplied by the private sector.

The ability of the government to control imports means that price stability may be increased without government incurring additional costs, providing world prices are lower than domestic levels and are more stable. In this study the effect of policy on stability of the price of rice and barley will be analyzed.

The model used to evaluate the effects of price policy on consumer and producer surpluses, program costs and foreign exchange requirements extends that employed in a World Bank study by incorporating the effects of change in supply and demand parameters (Scandizzo and Bruce, 1981). Formulas for calculating the welfare effects are given by equations (15) through (20):

Welfare Gain To Producers (G_p)

$$= P_p^{it}Q^{it} - P_b^{it}Q_w^{it} - \int_{Q_w^{it}}^{Q^{it}} S(Q) \cdot dq \qquad (15)$$

Welfare Gain To Consumers (G_c)

$$= (P_c^{it} - P_b^{it})\, C^{it} + \int_{C^{it}}^{C_w^{it}} D(Q) \cdot dq - P_b^{it}\,(C_w^{it} - C^{it}) \qquad (16)$$

Net Social Loss In Production (NSL_p)

$$= \int_{Q_w^{it}}^{Q^{it}} S(Q)\, dq \; - P_b^{it}\,(Q^{it} - Q_w^{it}) \qquad (17)$$

Net Social Loss In Consumption (NSL_c)

$$= \int_{C_w^{it}}^{C^{it}} D(Q)\, dq \; - P_b^{it}\,(C_w^{it} - C^{it}) \qquad (18)$$

Government Revenue (R)

$$= (SP^{it} - PP^{it})\, Q_m^{it} + (SP^{it} - P_b^{it})\, M^{it} + (R_b^{it} - PP^{it})\, X^{it} - \gamma V^{it} \qquad (19)$$

Change In Foreign Exchange (F)

$$= -P_b^{it}\,(Q_w^{it} - Q^{it} + C^{it} - C_w^{it}) \qquad (20)$$

where: $S(Q)$ is supply function
$D(Q)$ is demand function
$Q_{(w)}^{it}$ is production at domestic (world) prices
$C_{(w)}^{it}$ is consumption at domestic (world) prices
V^{it} is value of domestic output handled by government at producer prices
γ is handling and marketing cost as a proportion of producer prices
SP^{it}, PP^{it} are government selling and purchase prices
M^{it}, X^{it} are quantities imported and exported

The graphical areas which correspond with (15) to (20) are shown in Figure 4. The effect of raising domestic prices of substitutes is to shift the supply and demand curves to the left and right respectively. The area between the curves represents the net gain to producers and consumers due to changes in substitute prices.

In calculating, the welfare effects linear approximations of the integrals are used. There are three reasons for this. First, that in general the areas evaluated using integrals account for less than 20 percent of the change in welfare.[15/] Secondly, while demand elasticities are available, the "best" estimates are derived from a number of studies so that the exact functional forms of the demand curves are not known. Finally, linear approximations have been used in a number of studies despite the assumption of a constant elasticity being inconsistent with a linear function. In particular, a constant elasticity of supply implies that the increase in (P/Q) must be offset by a fall in ($\partial Q/\partial p$) since:

$$e_{ii} = \frac{\partial Q}{\partial p} \cdot \frac{P}{Q} = \text{constant} \quad (21)$$

The magnitude of the error introduced by this assumption is unlikely to affect the conclusions.

Net social losses in production and consumption reflect inefficient use of resources. Raising consumer price to Pc results in a loss to consumers of $C'(P_c - P_b)$, which is captured by the government, plus the net social loss in consumption which is the loss to society

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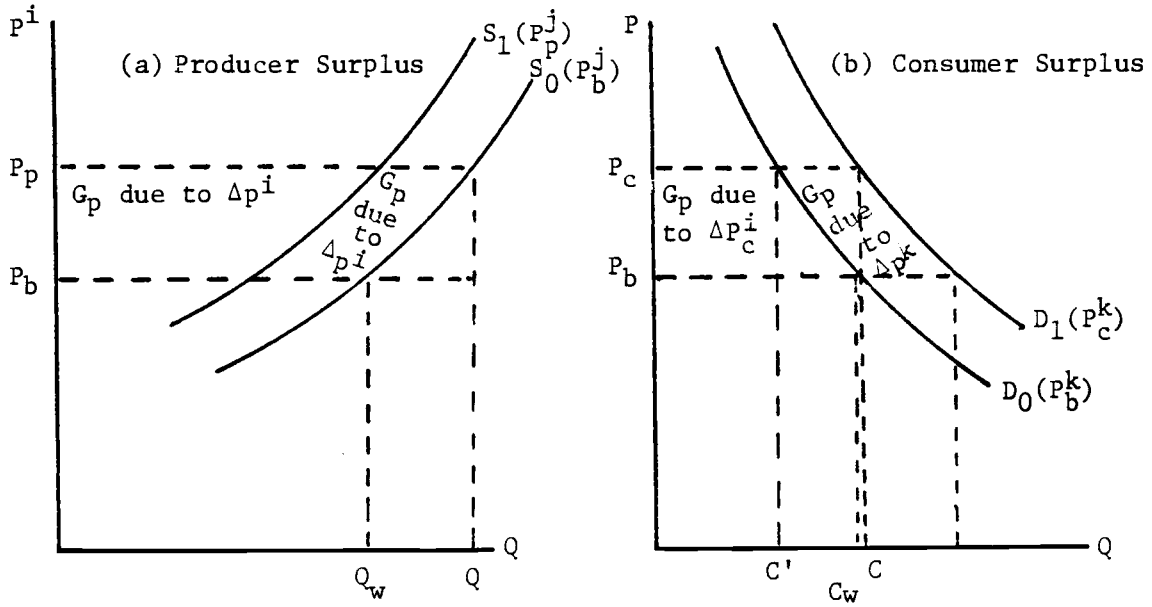
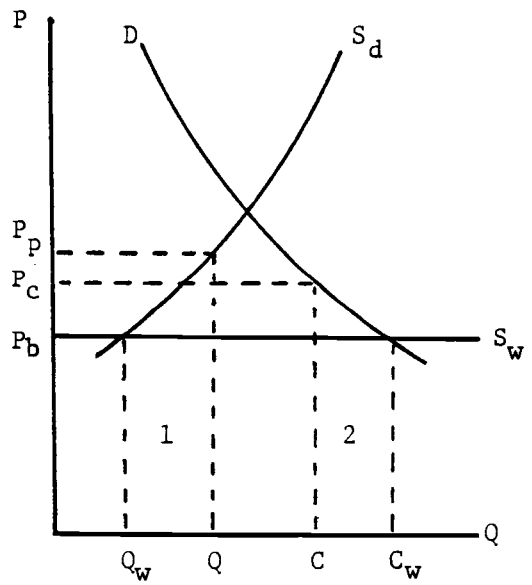
15/ Only for barley and rice (1976-78) is NSLp more than 10 percent of Gp.

Figure 4. Price Policy and Welfare Changes

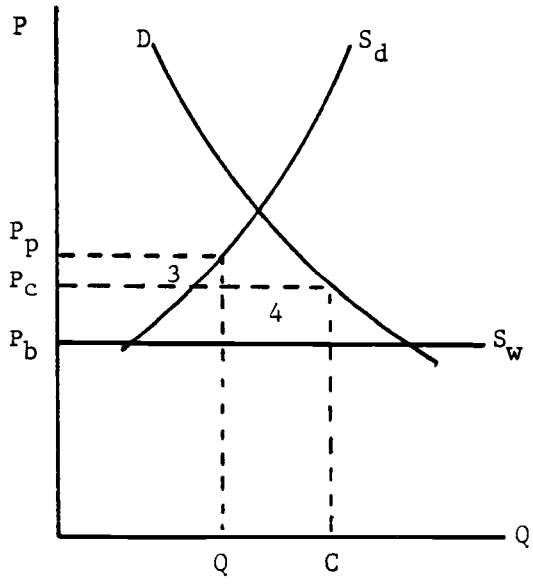


(c) Foreign Exchange



F = 1 + 2

(d) Program Costs



$\Delta R = 4 - 3$

as a result of consumer prices exceeding the opportunity cost. Similarly, net social loss in production is the cost of additional resources required to produce (Q - Qw) compared to importing the goods from abroad.

Equation (19) gives the program costs where the government handles all trade. The first term represents the revenue from domestic purchases, the second and third, revenue from imports and exports and the last, handling costs. By evaluating (19) for the relevant values of Q_m^{it} and M^{it}, one can get estimates of costs under different price conditions. M^{it} is calculated as production less human consumption and nonhuman consumption. Production and human consumption are calculated using (7) and (8) for the effect of price policy on free trade. Nonhuman consumption is assumed constant at the actual level for the period. Q_m^{it} is calculated as:[16/]

$$Q_m^{it} = (Q^{it} - \Delta Q^{it}) \quad \alpha \qquad (22)$$

where: ΔQ^{it} is determined by (7) and (8)
α is proportion of output marketed

16/ An alternative way to evaluate this is to use the elasticity of marketing with respect to price (Tolley et. al., 1981):

$$E_m = \left(\frac{\partial Q_m}{\partial p} \cdot \frac{P}{Q_m}\right) = \left(\frac{\partial Q_m}{P} \cdot \frac{P}{Q_m}\right)\frac{}{Q} + \left(\frac{\partial Q_m}{\partial Q} \cdot \frac{Q}{Q_m}\right)\left(\frac{\partial Q}{\partial p} \cdot \frac{P}{Q}\right)$$

If quantity marketed and the value for E_m were known, this would be more accurate since α is not a constant. Given the relative stability of α and the lack of precise estimates of E_m and Q_m, equation (22) is used here.

Equation (19) is calculated for the two cases where all prices are at the domestic level and where substitute prices equal world prices. The case where the domestic and world prices of the commodity are at the world level would give a zero cost. The effect of the policy shift on costs resulting from domestic sales of domestic purchase is analyzed using:

$$\Delta K^{it} = \Delta\alpha Q_m^{i0} k^{i0} + \Delta Q_m^{i1} k^{i0} + \Delta k^{i} Q_m^{i1} \quad (23)$$

where: K^{it} is program costs in period t
k^{it} is purchase less selling price in period t

The first term represents the effect on costs of the increased proportion of output which is marketed. The second term is the effect of the increase in output resulting from price policy at constant prices and the final element is the effect of the increase in unit costs.

The effect of price policy on foreign exchange requirements is given by equation (20). By using the appropriate values of Q^{it} and C^{it}, as determined by (7) and (8), for the individual periods and (10) and (11) for the policy shift, exchange needs for different price scenarios can be determined, and the effects of price policy estimated.

In a closed economy, complete price stabilization is attained when:

$$P_c^{it} = (1 + \delta) P_p^{it} \quad (24)$$

The condition for price stability is (Tolley et al, p. 191):

$$\frac{P_p^{it}}{P_s^{it}} \geq \left(\frac{1+s}{1+\delta}\right)^{\frac{n_{ii}}{m_{ii}-n_{ii}}} \qquad (25)$$

where: P_s is self-sufficiency producer price

s is storage plus transport costs as a proportion of P_p^{it}

δ is transport costs as a proportion of P_p^{it}

$n_{ii}<0$ is elasticity of demand

m_{ii} is elasticity of marketing with respect to price

The procedure given by Tolley et al. is to evaluate (25). If the inequality holds, then in a closed economy the producer price is high enough to guarantee seasonal price stabilization. If not, then the degree of seasonal stability (1 - t), where t is the proportion of the year when supply is from the private sector, can be determined by:

$$Q_m^{it'} = (1-t)\left(1+\frac{ct}{(1+\delta)}\right)^{n_{ii}} \frac{Q_m^{it}}{K} \qquad (26)$$

$$K = \left(\frac{1+\delta}{1+s}\right)^{n_{ii}} \left(\frac{P_p^{it}}{P_s^{it}}\right)^{m_{ii}-n_{ii}} \qquad (27)$$

$Q_m^{it'}$ is quantity handled by government

c is s plus δ

Thus, if all variables other than t are known, t can be determined for a closed economy and the degree of price stability obtained.

CHAPTER IV

DATA SOURCES AND ADJUSTMENTS

Prices

Average annual prices received by producers, compiled by the Ministry of Agriculture, Korea, are reported in the Korean Agriculture Cooperative Yearbook. These prices are deflated by the wholesale price index (1975 = 100) as reported in the Korean Statistical Yearbook. For each of the two periods the average real price weighted by production is calculated (Table 9).

Retail prices of rice, wheat and barley in Seoul, obtained from the Korean Statistical Yearbook, are converted to average real prices, weighted by consumption and deflated by the W.P.I. All prices are expressed as won per 80 kg.

Border prices are defined as c.i.f. or f.o.b. prices to Korea. The U.S. free-along-side (f.a.s.) prices adjusted for transport costs for wheat and barley. The U.S. Foreign Agricultural Statistical Report gives quantities and f.a.s. value of shipments to Korea in U.S. dollars. These are converted to won at the official exchange rate and deflated by the W.P.I. Finally the average annual f.a.s. prices, weighted by imports, are calculated.

Transport costs are calculated using the Clement (1982) model. Using data for the period 1978-80, he concluded that transport costs per ton exported from the Pacific Northwest are a function of distance, ship size, bunker fuel prices, volume of U.S. wheat grain exports,

Table 9. Producer, Consumer and Border Prices, 1965-67 and 1976-78 (won/80 kg)

	PRODUCER PRICES						CONSUMER PRICES						WORLD PRICES						BORDER PRICES			
	Average Price Received			Real Average Price Received			Average Price			Average Real Price			World Price			Real World Price[f]			Real Price[g]			
	R[a]	W[b]	B[a]	R	W	B	R	W[c]	B	R	W	B	R[d]	W[e]	B[e]	R[d]	W[e]	B[e]	R	W	B	
1965	3210	1650	2130	11146	5729	7396	3094	1624	2027	10745	5639	7037	2189	1545	1202	7601	5363	4173	--	--	--	
1966	3390	1770	2030	10831	5655	6486	3268	1775	2012	10441	5670	6427	2348	1463	1366	7502	4674	4362	--	--	--	
1967	3370	1880	2340	10090	5629	7006	3598	1820	2431	10771	5449	7276	3181	1376	1532	10161	4121	4586	--	--	--	
1965-67	--	--	--	10963	5671	7144	--	--	--	10662	5572	6910	--	--	--	10161	4608	4223	10890	4898	6465	P_p' c.i.f.
																			11473	5155	6805	P_c import
																			11107	4061	5124	P_c f.o.b.
																			10552	3858	4868	P_p' export
1976	22460	6910	10620	20036	6164	9474	22235	7280	10280	19835	6495	9170	9125	4655	5717	8220	4655	5100	--	--	--	
1977	24840	8210	14440	20327	6719	11817	24196	7101	13570	19800	5811	11105	10377	3503	3690	8492	3503	3019	--	--	--	
1978	29130	9560	16420	21341	7004	12029	28211	6972	14830	20677	5108	10865	14032	3589	4977	10280	3589	3646	--	--	--	
1976-78	--	--	--	20625	6502	10839	--	--	--	20125	5794	10373	--	--	--	8997	3937	3588	9306	3976	5276	P_p' c.i.f.
																			10340	4417	5863	P_c import
																			9653	3457	4273	P_c f.o.b.
																			8688	3112	3846	P_p' export

Source: Korean Statistical Yearbook, 1966-68 and 1977-79
F.A.O. Rice Situation, 1974-75
UN Monthly Bulletin Of Statistics in Tolley et. al. (1981), p. 30
U.S. Foreign Agricultural Statistical Report

[a] Polished grade 2
[b] Unmilled grade 2
[c] Wheat flour 77% extraction second grade converted to unmilled equivalent
[d] f.o.b. Bangkok 5% broken. Government contract price 1965-67. Private trade price 1976-78
[e] f.a.s. U.S. unmilled
[f] Average price weighted by imports
[g] Real world price allowing for transport costs, converted to polished rice and barley using conversion factors in Thodey (1977). P_c are consumer prices of f.o.b. Producer price (P_p) are equal to P_c less transport costs. Conversion factors are 0.9 for rice and 0.708 for barley, Domestic transport costs are assumed to be 5% in 1965-67 and 10% in 1976-78.

vessel flag (U.S. or foreign), port size and timing of shipments over the year. The estimated model is:

$$
\begin{array}{lll}
\text{Rate} = 6.576\,\text{Dist} - .280\,\text{Disz} - .362\,\text{Ton} & & \\
\text{t Statistic} \quad (-5.43) \quad (-2.33) \quad (-5.43) & & \\
+ 1.843\,\text{Fuel} - .021\,\text{Ex} + 50.517\,\text{F} & & \\
\quad (-2.99) \quad (19.24) \quad (1.64) & & \\
- 1.337S_2 - 3.133S_3 - 3.412S_4 & & (24) \\
\quad (-.778) \quad (-1.83) \quad (-2.07) & & \\
- 16.75 \qquad R^2 = .903 & & \\
\quad (-2.48) \qquad \text{F Statistic} = 94.37 & &
\end{array}
$$

where: Dist is distance 1000's miles
Disz is distance squared
Ton is shipment size in 1000's of long tons
Fuel is price of bunker C fuel in dollars per barrel
Ex is West Coast grain exports in 1000's of long tons
F is dummy variable for U.S. flagship
P is dummy variable for port size
S_i are dummy variables for timing of shipments
(2 = July to September; 3 = October to December;
4 = January to March)

In determining transport costs to Korea data, as reported in Clement, is used for Dist. The average shipment size is taken as that given by Clement for 1976-78. This is lowered by two-thirds representing the difference in the ratio of size of dry bulk carriers in 1964 (20,000 D.W.T.) to the maximum size of vessels using the Columbia Basin (33,000 D.W.T.). West Coast grain export figures are available in the U.S. Grain Marketing News. F and P are set equal to zero and S_i weighted by the proportion of grain shipped in the i^{th} quarter. Crude oil prices are used as a proxy for fuel.

Transport costs are converted to won per 80 kg., deflated by the W.P.I. and added to the average f.a.s. prices. Finally, the cost in full prices for barley are converted to the price for polished grain using conversion factors given by Thodey (1977). Results are given in Table 9.

World rice prices, taken as the price f.o.b. Bangkok as reported in FAO Rice Report and U.N. Monthly Bulletin of Statistics, are adjusted to real won per 80 kg. Transport costs are those from the Pacific Northwest less $1.13 for each 1,000 miles. This figure is based on a study by Harrar quoted in Clement (p. 75). Finally, the price is converted to the equivalent for polished rice using factors in Thodey (1977).

Analysis of program costs requires government purchase and selling prices. These are collected by the Ministry of Agriculture and published in the Korean Statistical Yearbook and Monthly Bulletin of Statistics. The financial accounts of the Grain Management Fund are given in the Korean Statistical Yearbook.

Self-sufficiency prices for rice and barley for the two periods are calculated by adjusting the actual producer price according to whether the commodity was exported or imported. During the first period, imports of rice were less than one percent of production so the producer price of 10,963 won per kg. is taken as the self-sufficiency price (P_s). Some 242,000 mt. of barley were exported. P_s is therefore between the actual price of 7,144 won and 5,335 won which is the supply price at 1,572,000 mt. However, as price falls so consumption increases. Each percentage decrease in price lowers supply by .869 and raises

demand by one percent. This gives a self-sufficiency price of about 6,150 won per 80 kg. at which 1,683,000 mt. are supplied.

A similar analysis for the period 1976-78 gives a self-sufficiency price for barley of about 10,300 won per 80 kg. The self-sufficiency price for rice is that estimated by Tolley et. al. of 28,500 won for the period 1979-80, deflated to 1975 prices and adjusted for changes in income. The estimated price is 19,400 won per 80 kg.

Production and Consumption

Production and consumption figures at domestic prices are obtained from the Korean Statistical Yearbook and Thodey (1977) as computed by the Ministry of Agriculture. Details of their compilation is given in Thodey (1977) pp. 105-115. The figures are shown in Table 10.

Table 10. Production and Consumption At Domestic Prices 1965-67 and 1976-78 (1000 MT)

	Production			Consumption					
				Human			Total		
Year	Rice	Wheat	Barley	Rice	Wheat	Barley	Rice	Wheat	Barley
1965	3,954	300	1,807	3,794	743	1,487	3,925	798	1,487
1966	3,501	315	2,018	3,332	677	1,655	3,531	774	1,655
1967	3,919	310	1,914	3,911	960	1,672	3,954	1,110	1,809
Average 1965-67	3,791	308	1,914	3,679	793	1,572	3,803	894	1,650
1976	4,669	82	1,759	4,339	1,352	1,411	4,538	1,815	1,713
1977	5,215	45	814	4,481	1,366	1,379	4,802	1,959	1,678
1978	6,006	36	1,348	5,014	1,412	1,397	5,686	1,691	1,710
Average 1976-78	5,297	54	1,307	4,611	1,377	1,396	5,008	1,822	1,700

Source: Korean Statistical Yearbooks, 1965-1979
Thodey (1977)

Elasticities Of Demand And Supply

Determination of consumption and production at world prices requires estimates of elasticities of demand and supply. For this thesis, price and income elasticities of demand were chosen based upon results from a number of other studies. Elasticities of supply were estimated using a Nerlovian price adaptation supply response model.

The literature on demand elasticities for foodgrains is vast. The results of the studies on Korea are often conflicting and depend on the data, functional form, deflator employed and effect of noneconomic, and often unquantifiable, factors. Selection of the elasticities for this study is based upon the results of previous work and reasoned judgement. Three criteria are used:

(a) unless definitely proven, the elasticities are assumed to have the same sign as that predicted by economic theory;

(b) in the presence of conflicting results, it is assumed that Korean behavior approximates that in other countries; and

(c) results for total and urban population studies will be given more weight since rural consumers constitute a small proportion of commercial market demand.

Thodey et. al. (1977) estimated price and income elasticities for food in Korea between 1965 and 1974 with the objective of selecting values to be used in the Korean Agricultural Sector Model.[17/] Data aggregated at the national, sectoral and household level was used to

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17/ This is a model developed jointly by the Korean government and Michigan State University, aimed at assisting in Korean government policy formation.

derive demand relations by single equation estimation techniques. The best estimates obtained were then adjusted in accord with expected values as determined by economic theory and the results of previous studies. These new values were tested for consistency with historical performance before being altered to make them consistent with predicted consumption levels over the next 25 years.

Thodey et al. (1977) conclude that the nonfarm income elasticities for demand for rice, wheat and barley were 0.2, -0.25 and 0.5, respectively, while the price elasticities were -0.3, -0.2 and -0.7. These results are fairly representative of those found in other studies. A previous KASS study uses a log-log functional form applied to data from the Urban Household Survey over the period 1963-70. Teigen has selected the "best" results from the study:

Table 11. Price and Income Elasticities Of Demand, Selected by Teigen

	Income	Price		
		Rice	Barley	Wheat
Rice	0.211	-0.556	0.196	--
Barley	-1.311	-1.664	-0.948	-0.561
Wheat	-1.136	1.256	--	-0.827

Source: Thodey et. al. (1977, p. 130)

The major discrepancies occur with respect to the income elasticities of demand for wheat and barley and the price elasticities for rice and barley. Results of other studies would support lower income elasticities. Gibson, using monthly data for 1966-72, concludes that the income elasticities are -0.11 and 0.04 for barley and wheat. Kim (1979)

in his paper on issues and strategies for agricultural development, gives the income elasticities of demand for rice as 0.15. This is fairly close to the Thodey estimate which is used here. The evidence on wheat is limited and mixed. It is likely that earlier estimates were biased by nonprice government policy which encouraged wheat consumption and the Gibson estimate of 0.04 is used here.

The own price elasticities for wheat and rice appear more in line with those found in other countries. Gallagher et al. (1979) estimate import demand elasticities for rice and wheat as -0.27 and -0.71 which are close to those of Thodey et al. Gibson (1974) puts the estimates at -0.34 and -0.71, respectively.[18/] The barley elasticity, as estimated by Thodey et. al. is probably on the low side. NAERI (1973), using annual data for the period 1960-71, estimate the elasticity as -0.88 while Gibson gives -1.21. It is possible that forced barley consumption as a result of government policy biased the Thodey et. al. estimate down and a figure of -1.0 is used here.

Thodey et. al. calculate crop price elasticities using substitute proportions.[19/] This method relies heavily on having

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18/ Estimates based on data for 1950's and early 1960's give much higher price elasticities for rice of -0.81 to -1.63. Tolley et. al. (1981) assume the elasticity is -1.0.

19/ If the elasticity of i^{th} good (e_{ii}) is known, then the cross elasticity of j^{th} on i^{th} good (e_{ji}) can be determined using substitute proportions. For instance, 90 percent of a one unit decrease in consumption of i is made up by j^{th} good ($\alpha_i = .9$) then:

$$\partial Q_i = e_{ii} \frac{\partial P_i}{P_i} Q_i = -1$$

$$\Delta Q_j = -\alpha_i \Delta Q_i = -\alpha_i e_{ii} \frac{\Delta P_i}{P_{i\,(t-1)}} Q_{i(t-1)}$$

$$\text{and } e_{ji} = \frac{\Delta Q_j}{Q_{j(t-1)}} / \frac{\Delta P_i}{P_{i(t-1)}} = -\alpha_i e_{ii} \frac{Q_{i(t-1)}}{Q_{j(t-1)}}$$

accurate estimates of own price elasticities which are not always available. Teigen estimates the cross-price elasticities of rice on wheat as 1.3 and which seems reasonable given that rice accounts for 55 percent of grain substituted for every unit decrease in wheat consumption. The effect of wheat prices on rice consumption is negligible. The relationship between rice and barley is more difficult to determine due to the simultaneous nature of the foodgrain market. Gibson (1974) gave estimates of 0.6 for rice on barley, and 0.3 for barley on rice. These seem reasonable in view of the substitution proportions. Finally, the cross-price elasticity between wheat and barley is taken as 0.3. Elasticities used in the study are given in Table 1.5.

A number of studies have estimated the price elasticity of supply for foodgrains and in particular for rice.

The Korean Agricultural Economic Research Institute (AERI) estimated rice farmers' responses for the period 1960-71 using an acreage/yield response model (AERI, 1973). The conclusion was that farmers do respond positively to changes in rice prices, and that producers were more responsive in yields than acreage. The supply elasticity with respect to expected price was 0.506, about twice as large as the elasticity with respect to the previous year's price.

Moon (1973) analyzed the barley and rice markets for the period 1963-71. Six behavioral and two identity equations were specified and were estimated, both as independent equations and as a simultaneous equation system. The method given by Griliches was used. This is based on the assertion that if inputs respond to price changes, then

farm output will also change.[20] The results for the independent equation method are shown in Table 12.

Table 12. Estimates Of Partial Response Of Foodgrain Producers To Price

Commodity	Yield Response	Acreage Response
Rice	0.1185	0.2569
Common Barley	0.1822	0.1084
Naked Barley	0.1708	0.1345

Source: Moon (1973)

The yield response is lower than that found in other studies which vary between 0.15 and 0.329 while the acreage response is much higher. Moon does not attempt to explain this but, given the limited supply of paddy land, his estimates do appear high.

Estimation of the total response by farmers gave significant differences. In particular, the rise in farm stock value due to price increases and repercussions of higher rice prices on the barley market actually result in an increase in the demand for rice. Given that farmers in Korea are both consumers and producers, the final effect of an increase in the price of rice may be to lower farm sales.[21]

20/ Supply elasticity (eqp) can be written as:

$$eqp = \sum_i k_i e_{ip}$$

where: k_i is share of factor i in total cost
e_{ip} is elasticity of demand for factor i with respect to price product.

21/ Response of farm sales to a change in price is a difference concept to supply response as estimated by AERI (1973). However, Moon's arguement does serve to highlight the simultaneous nature of the foodgrain market.

The model given by (28) and (29) adopted here is the same as that used by AERI (1973):

$$Y_t^i = Y\,(P_{t-1}^i,\ P_{t-1}^s,\ Y_{t-1}^i,\ C_t^i,\ W_t) \qquad (28)$$

$$A_t^i = A\,(P_{t-1}^i,\ P_{t-1}^s,\ A_{t-1}^i) \qquad (29)$$

where: P_t^i is deflated price of the product in period t

P_t^s are deflated prices of substitutes in period t

Y_t^i is yield of the product in period t

A_t^i is acreage allocated to the product in time t

C_t^i is deflated cost of production of the product in time t

W_t is rainfall in period t

Domestic production is given by:

$$Q_t^i = Y_t^i \cdot A_t^i \qquad (30)$$

Differentiating with respect to P_{t-1}^i gives:

$$\frac{\partial Q_t^i}{\partial p_{t-1}^i} = \frac{\partial Y_t^i}{\partial p_{t-1}^i} \cdot A_t^i + \frac{\partial A_t^i}{\partial p_{t-1}^i} \cdot Y_t^i \qquad (31)$$

Dividing by $P/_Q$ and rearranging gives the total supply elasticity of last year's price as the sum of the yield and acreage elasticities:

$$\frac{\partial Q_t^i}{\partial p_{t-1}^i} \cdot \frac{p_{t-1}^i}{Q_t^i} = \frac{\partial Y_t^i}{\partial p_{t-1}^i} \cdot \frac{p_{t-1}^i}{Y_t^i} + \frac{\partial A_t^i}{\partial p_{t-1}^i} \cdot \frac{p_{t-1}^i}{A_t^i} \qquad (32)$$

Equations (28) and (29) give the variables that are included in the general model. Response of farmers to changes in prices of the product are hypothesized to be positive while the expected effect of substitute prices is negative. The inclusion of a lagged endogenous variable in each of the equations reflects the assumption that producers respond to output prices in periods prior to the last period. This is based on a Nerlovian price adaptation model in which the expected price in the current year is a function of previous years' actual and expected prices:

$$*p_t^i = *p_{t-1}^i + \beta(p_{t-1}^i - *p_{t-1}^i) \quad (33)$$

This can be written as:

$$*p_t^i = \sum_{i=0}^{T} \beta(1-\beta)^i \, p_{t-1-i} \quad (34)$$

where: β is coefficient of expectations, $0 < \beta < 1$
p_t^i is expected price in year t

The acreage response to expected yield can be obtained by estimating the equation:

$$A_t^i = a_1 + b_1 *p_t^i + b_2 p_{t-1}^s + u_t \quad (35)$$

Lagging equation (35) one period, rewriting for $*p_{t-1}^i$ in terms of X_{t-1}, p_{t-1}^s and U_{t-1} and substituting into (33) gives:

$$*p_t^i = \frac{a_1\beta - a_1}{b_1} + (1-\beta)A_{t-1}^i + \beta b_2 - b_2 \, p_{t-1}^s + \frac{\beta-1}{b_1} p_{t-1}^s + \beta p_{t-1} + \frac{\beta-1}{b_1} U_{t-1} \quad (36)$$

Substituting back into equation (35) and simplifying gives:

$$A_t^i = a_1\beta + b_1\beta p_{t-1} + b_2(\beta-1)p_{t-1}^s + (1-\beta)A_{t-1}^i + U_t - (1-\beta)U_{t-1} \quad (37)$$

If $\widehat{a_1\beta}$ is the estimate of $a_1\beta$, $\widehat{b_1\beta}$ of $b_1\beta$, $\widehat{b_2(1-\beta)}$ of $b_2(1-\beta)$ and $\widehat{(1-\beta)}$ of $(1-\beta)$, then it can be shown that:

$$\hat{\beta} = 1-\widehat{(1-\beta)} \quad (38)$$

$$\hat{b} = \frac{\widehat{b_{1\beta}}}{\hat{\beta}} \quad (39)$$

Equation (39) gives the estimated response of producers to the expected price.

Hectares harvested and yields (100 kg/hectare) are reported in the Korean Statistical Yearbook. Costs of production are collected by MAF and published in the Korean Agricultural Cooperative Yearbook. Price variables are average annual prices received by farmers. All prices and the cost of production are deflated by the index of prices paid by farmers (1975 = 100). The index is compiled by the N.A.C.F. and published in the Korean Agricultural Cooperative Yearbook. Rainfall in m.m. per annum was used as a proxy for weather conditions. These figures are collected by the National Central Meteorological Office and reported in the Korean Statistical Yearbook.

The yield and equations are estimated for the period 1963-78. The logarithmic form of the Cobb Douglas model is used. Initial regressions using a linear equation gave worse statistical results, a finding which is consistent with other studies (AERI, 1973). The

advantage of the logarithmic form is that elasticities are given by the estimated parameters of the explanatory variables.

The presence of a lagged endogenous variable in the model raises estimation problems when ordinary least squares are used. These problems result from the fact that the error term in equation (37) given by V_t, is a function of the current and previous year's errors:

$$V_t = U_t - (1-\beta)U_{t-1} \quad (40)$$

Bias in the estimates occurs because the lagged endogenous variable depends on the lagged error term U_{t-1} so that contemporaneous correlation exists. The second problem is that serial correlation may exist. This depends on the assumptions that are made concerning the error terms in equation (39). If it is assumed that they are normally distributed with mean zero and variance σ_U^2, then the error term in the estimated equation (V_t) will be serially correlated. Alternatively, the estimated error terms (V_t) can be assumed to have desirable O.L.S. properties. In the latter case, the introduction of the lagged endogenous variable removes serial correlation and O.L.S. can be used, although the estimates will still be biased.

A number of estimation procedures have been developed to deal with these problems. Essentially the method used depends on the assumption made concerning the error term (Johnston, p. 304). The correct assumption in the case of an adaptive expectation model is given by (40) and either (41) or (42):

$$U_t \sim N(0, \sigma_m^2) \quad (41)$$

$$U_t = pU_{t-1} + E_t \quad |p|<1 \quad E_t \sim N(0,\sigma^2) \quad (42)$$

The procedure used in this study is to estimate instruments of the lagged endogenous variable as a function of the remaining explanatory variables and to use them as instruments in equation (37). This gives unbiased estimates. These equations were then tested for autocorrelation using the Durbin Watson test (Koutsoyiannis, 1973) and, if necessary, corrected using the Cochrane - Orcult iterative technique to obtain consistent estimates.

The results of the estimation procedure and the significance of the coefficients are given in Table 13. All the variables have the expected sign. Tests for autocorrelation using the Durbin Watson statistic were either indeterminate or led to the rejection of the hypothesis that autocorrelation was present. The wheat acreage equation was estimated for the period 1964-75 because the dramatic fall in acreage from 142,000 ha. in 1971 to 17,000 in 1978 gave a coefficient of the lagged endogenous variable greater than one. This means a negative long run response which is inconsistent with economic theory. There are two possible reaons for the collapse of the model:

(a) the change in government policy which resulted in higher rice and barley prices has a short run effect on wheat acreage, which was picked up by the lagged substitute price, and a long run response which was picked up by the lagged endogenous variable; and

(b) the ending of nonprice measures, aimed at encouraging consumption of wheat as a substitute for rice, and an end to the maintenance of fixed wheat prices to consumers may have biased the coefficient.

Long and short run supply responses are given in Table 14. These are calculated using equations (38) and (39).

Table 13. Estimated Acreage and Yield Equations For Rice, Barley and Wheat, 1963-78

RICE

$$\log A^r_t = 1.27 + 0.0104\ P^r_{t-1} + 0.8208 \log A^r_{t-1} \qquad R^2 = .24 \quad F = 1.86 \quad DW = 2.27$$

(OLS) (.413) (.360) (1.896)***

$$\log Y^r_t = 1.1585 + 0.2419 \log P^r_{t-1} + 0.5354 \log Y^r_{t-1} - 0.0078 \log C^r_{t-1} - 0.1592 \log P^w_{t-1} + 0.1458 \log W_t$$

(C - O) (.673) (.752) (1.168)* (1.800)*** (.609) (1.410)**

$R^2 = .84$ F = n.a. DW = 1.42

BARLEY

$$\log A^b_t = 2.016 + 0.7184 \log P^b_{t-1} + 0.7725 \log A^b_{t-1} - 1.0428 \log P^r_{t-1} \qquad R^2 = .62 \quad F = 5.89** \quad DW = 1.14$$

(OLS) (.57) (2.76)*** (1.54)** (2.53)***

$$\log Y^b_t + 2.027 + 0.151 \log P^b_{t-1} + 0.1814 \log Y^b_{t-1} - 0.0052 \log C^b_t - .17053 \log P^w_{t-1} + 0.1136 \log W_t$$

(OLS) (1.67)** (.524) (.82) (1.39)** (.50) (.58)

$R^2 = .49$ F = 1.71* DW = 2.54

WHEAT

$$\log A^w_t = 2.3179 + 0.6778 \log P^w_{t-1} + 0.6643 \log A^w_{t-1} - 1.0496 \log P^r_{t-1} \qquad R^2 = .84 \quad F = 14.39*** \quad DW = 1.20$$

(1964-75) (2.15)** (3.18)*** (3.41)*** (3.62)***

$$\log Y^w_t = 1.6587 + 0.1 \log P^w_{t-1} - 0.1174 \log C^w_t + 0.1992 \log Y^w_{t-1} - 0.16 \log P^r_{t-1} + 0.1276 \log W_t$$

(OLS) (1.68)** (.57) (.41) (.43) (.81) (1.26)*

$R^2 = .38$ F = 1.10 DW = 2.23

*** Significant at 5% level (one tailed)
** Significant at 10% level (one tailed)
* Significant at 20% level (one tailed)

Table 14. Long and Short Run Price Elasticities For Rice, Barley and Wheat

	RICE			BARLEY			WHEAT		
	Yield	Acreage	Total	Yield	Acreage	Total	Yield	Acreage	Total
P^{i}_{t-1}	.242	.010	.252	.151	.718	.869	.100	.678	.778
P^{*}_{t}	.520	.056	.576	.184	3.149	3.334	.125	2.018	2.143
P	.465	.179	--	.819	.228	--	.801	.336	--

The long and short run responses for rice are similar to those found by other studies. The low price response in the acreage is due to limited availability of paddy land. Barley and wheat responses are much higher for acreage than yields, indicating that further increases in supply are likely to be affected by land availability. As is expected, the long run elasticities are larger than the short run elasticities.

Elasticity Of Net Farm Income

Elasticities of net farm income (Y) with respect to output are calculated using the method given by Tolley et. al. (1981). Assuming that prices are constant and that the shares of the i^{th} good in agricultural revenue and expenses are equal, it can be shown that:

$$\frac{\partial Y}{\partial Q_i} \cdot \frac{Q_i}{Y} = G \cdot F \qquad (43)$$

where: G is ratio of gross income from i^{th} good to Y
F is ratio of net to gross income from i^{th} output

Values for G and F are given in Table 15. F is taken as the net return per 80 kg. bag expressed as a fraction of the price. Cost and price estimates were obtained from the Agricultural Cooperative Yearbook and Korean Statistical Yearbook, respectively. Agricultural

income estimates are taken from the Korean Statistical Yearbook and gross income from i^{th} good is calculated as the average price received multiplied by output.

The proportion of output marketed (α) is calculated as the ratio of off-farm to total food consumption. The data are obtained from the Korean Statistical Yearbook, and values of α given in Table 15.

Table 15. Elasticities Of Net Farm Income With Respect To Output

	1965-67				1976-78			
	F	G	Y_{pi}	α	F	G	Y_{pi}	α
Rice	.631	.177	.112	.49	.776	.471	.366[a]	.67
Barley	.459	.058	.027	.31	.337	.054	.020	.42
Wheat	.153	.007	.001	.55	.188	.001	.0002	.70

[a] Calculated by Tolley et. al. (1981)

CHAPTER V

RESULTS OF EMPIRICAL ANALYSIS

Policy Shifts

Table 16 gives the nominal protection coefficients as defined by equation (6) for consumer and producer prices. The ratios for 1965-67 show that there was little difference between world and domestic prices and that incentives to producers due to price policy were largest for wheat farmers. Lower consumer prices for rice are indicated by the lower ratio of domestic to world prices. The wheat and, to a lesser extent, barley ratios are probably an underestimate due to the ability of the Korean government to obtain supplies of PL 480. It would appear that, ignoring substitution effects, the impact of price policy in the first period was to encourage production of barley and wheat while having little effect on rice. At the same time, rice consumption was subsidized as government sought to keep down the cost of food to the urban labor force.

Policy in 1976-78 encouraged production and discriminated against consumption.[22/] This is true for all grains and is consistent with the goal of self-sufficiency and higher producer incomes. The change is most marked for rice where the NPC more than doubled. Smaller changes in the wheat ratio led to a policy shift from where wheat was afforded the greatest degree of protection to where it was

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22/ This ignores the effects of substitution in production and consumption.

given the least. There was, therefore, a shift not only with respect to foodgrains as a whole but also between grains.

Table 16. Nominal Protection Coefficients In Production and Consumption For Rice, Barley and Wheat, 1965-67 and 1976-78

	RICE		BARLEY		WHEAT	
	c.i.f. import[a]	f.o.b. export[b]	c.i.f. import	f.o.b. export	c.i.f. import	f.o.b. export
Production						
1965-67	1.00	1.04	1.11	1.47	1.16	1.47
1976-78	2.22	2.37	2.05	2.82	1.64	2.09
Consumption						
1965-67	.93	.96	1.02	1.35	1.08	1.37
1976-78	1.95	2.09	1.77	2.43	1.31	1.68

[a] c.i.f. import price (less internal transport costs for producers).
[b] f.o.b. export prices (less internal transport costs for producers).

Self-Sufficiency

The changes in output (ΔQ^{it}) and consumption (ΔC^{it}) due to price policy as calculated using equation (7) and (8) are shown in Table 17. In order to evaluate the effect of price policy on foodgrains, human consumption figures are used. Border prices used are those predicted by the self-sufficiency ratios as discussed in Chapter III. In all cases, higher substitute prices shifted the supply curves to the left (S_w to S_d). This was offset by higher own prices so that barley and wheat production increased while rice output fell relative to free trade levels. The results are shown in Figures 5 and 6.

Table 17. Changes In Output and Consumption Due To Price Policy, 1965-67 and 1976-78 (1000 MT)

		RICE [a]					BARLEY [b]					WHEAT [c]				
			Change in Q due to:					Change in Q due to:					Change in Q due to:			
			ΔP^i					ΔP^i					ΔP^i			
		Actual Output	SR	LR	ΔP^j	$\Delta K,Y$	Actual Output	SR	LR	ΔP^j	$\Delta K,Y$	Actual Output	SR	LR	ΔP^j	$\Delta K,Y$
	1965-67	3791	36	82	-82	--	1914	313	607	-122	--	308	34	92	-14	--
ΔQ^{it}	1976-78	5297	773	1674	-328	--	1307	641	2235	-836	--	54	16	45	-38	--
	Policy Shift	5297	701	1601	-99	-19	1307	576	2207	-1065	-5	54	19	53	-134	-10
	1965-67	3679	46		285	--	1572	-147	-24	-4	--	793	-42		19	--
ΔC^{it}	1976-78	4611	-720	-673	602	--	1396	-682	-607	536	--	1377	-229		1111	--
	Policy Shift	4611	-765		498	489	1396	-595		564	-218	1377	-30		977	26

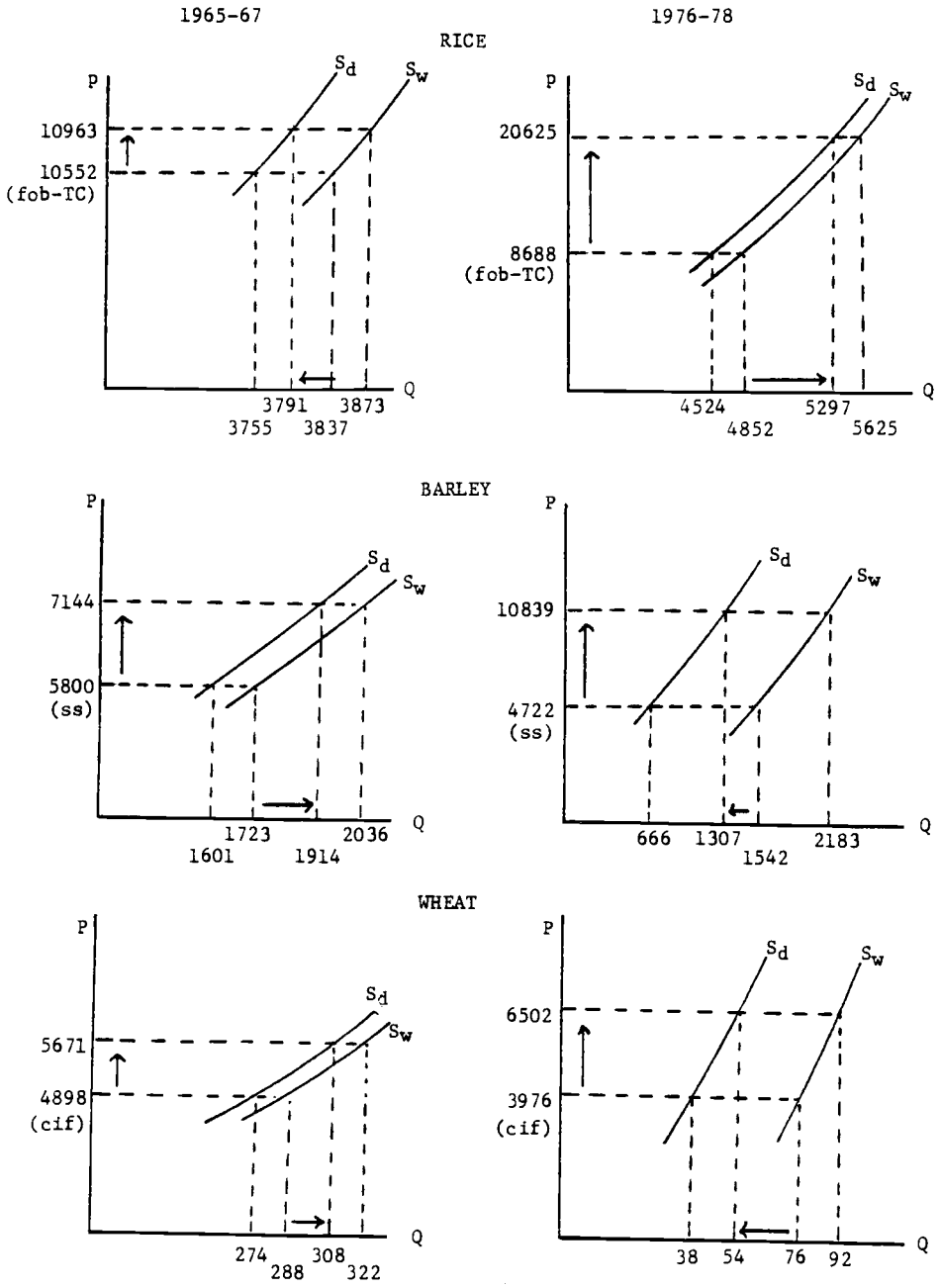
[a] Calculated using f.o.b. rice prices for 1965-67 and 1976-78 in short run. The c.i.f. prices are used for 1976-78 long run. Border price of substitute used are those predicted by their actual self-sufficiency ratios.

[b] Calculated using barley self-sufficiency prices for short run and c.i.f. for long run in both periods.

[c] Calculated using c.i.f. wheat prices.

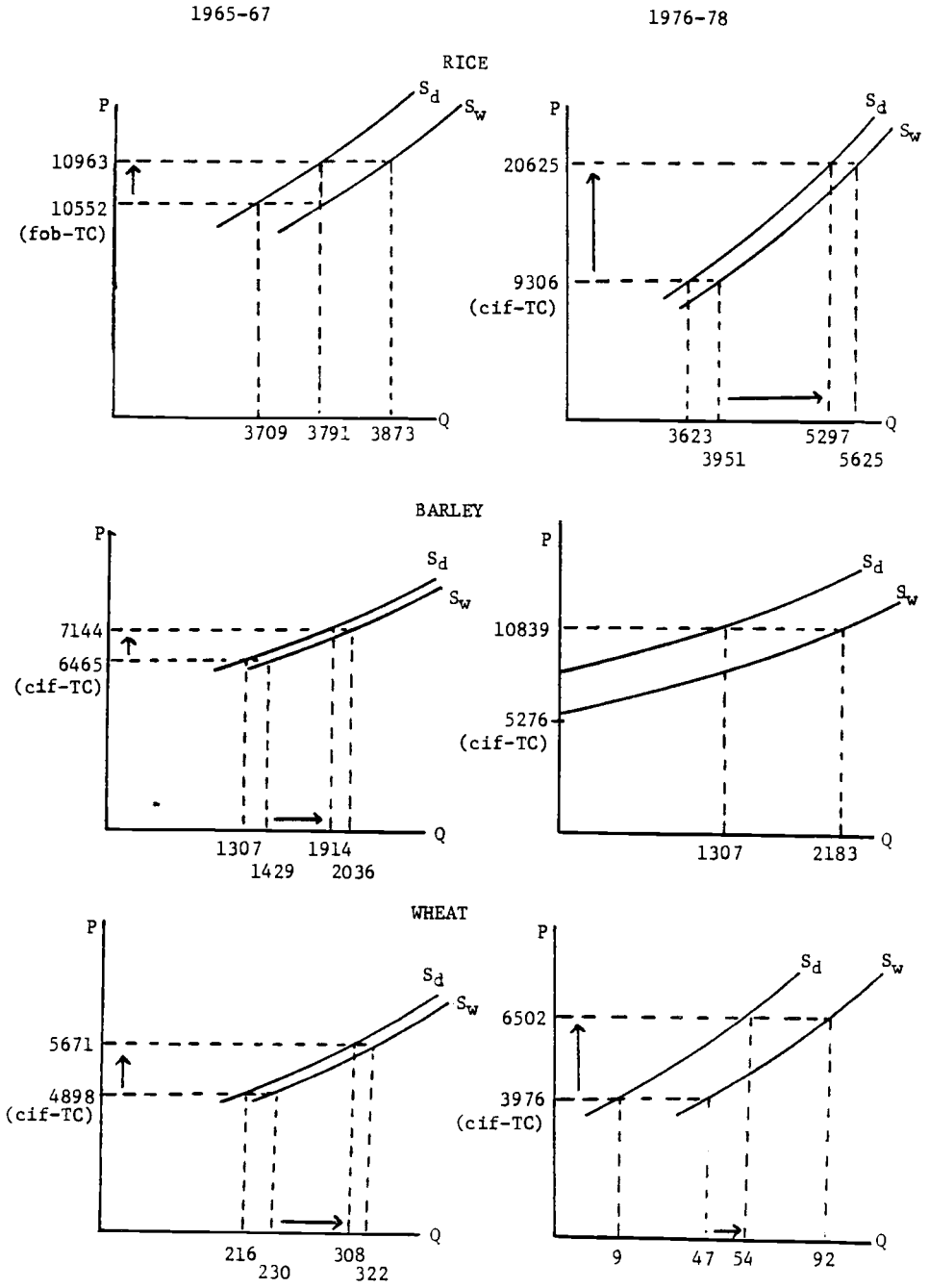
[d] Policy shift and free trade not comparable since arc elasticities are used for policy shift and point elasticities for free trade analysis.

Figure 5. Price Policy and Supply In The Short Run, 1965-67 and 1976-78*



* Arrows indicate policy direction of prices and net effect of price policy on quantities produced and consumed.

Figure 6. Price Policy and Supply In The Long Run, 1965-67 and 1976-78



After 1970, producer prices moved the domestic supply curves to the left for all foodgrains as substitute prices were raised. The shift was particularly marked for barley and wheat. Price policy also led to an increase in output as producers responded to higher prices as represented by a move along the supply curve. In the case of rice, this offset the leftward shift in the supply curve so raising output above that attainable under free trade conditions. Production of barley and wheat fell. When the long run price response is analyzed, output of all grains increased. In the case of barley, a low world price would cause producers to move completely out of barley and into wheat and rice.

The effects of the change in policy are analyzed using the long run price response for rice and the short run response for barley and wheat. The reason for this is that the predicted output in 1965-67, obtained by adjusting the 1976-78 output for changes in prices, is closest to the actual output. In the case of rice, the difference is only 4,000 MT or about one-tenth of one percent of the 1965-67 output. For barley and wheat, the errors are larger; in the case of barley, six percent, which is acceptable, and 45 percent for wheat, which is not.

Three factors help explain the error in wheat. First the influence of costs, which are negligible for rice and barley, increased wheat's predicted output to 179,000 MT. The second factor is that, as discussed earlier, the model used to estimate the elasticities breaks down after 1975 as wheat acreage fell dramatically. It was concluded in chapter IV that this was probably due to non-economic factors and the lower emphasis given to wheat by government.

Thirdly, the cross-price elasticities for rice and barley may be low. Acreage of wheat may have shifted into other grains, or other crops not included in the model.

The change in policy shifted the supply curves of rice, barley and wheat to the left so lowering output while the higher prices induced a move up along the curves, thus increasing output (Figure 7). The net effect was to increase rice production but lower that of barley and wheat relative to what the level would have been with no change in policy.

The influence of price policy on demand is shown in Table 17 and Figure 8. During the period 1965-67, consumer prices for rice were below world levels which caused the demand functions for barley to move to the left. The quantity demanded of barley was further decreased by keeping prices above world levels. Consumption of wheat also fell while that of rice rose. In general, however, consumer prices were fairly close to world levels for all foodgrains, resulting in little distortion of market prices.

Government policy in 1976-78 maintained domestic prices above world levels which depressed consumption. The effects of higher priced consumer substitutes shifted the demand curves to the right which, in the case of wheat, more than offset the effect of higher wheat prices. The net effect of price policy on barley and rice was to lower consumption by 5.1 percent and 2.5 percent below the free trade consumption level. Thus, price policy did not have a major impact on the quantity consumed of barley and rice, but increased the quantity of wheat consumed by over 300 percent.

Figure 7. Effect Of Policy Shift On Supply and Demand

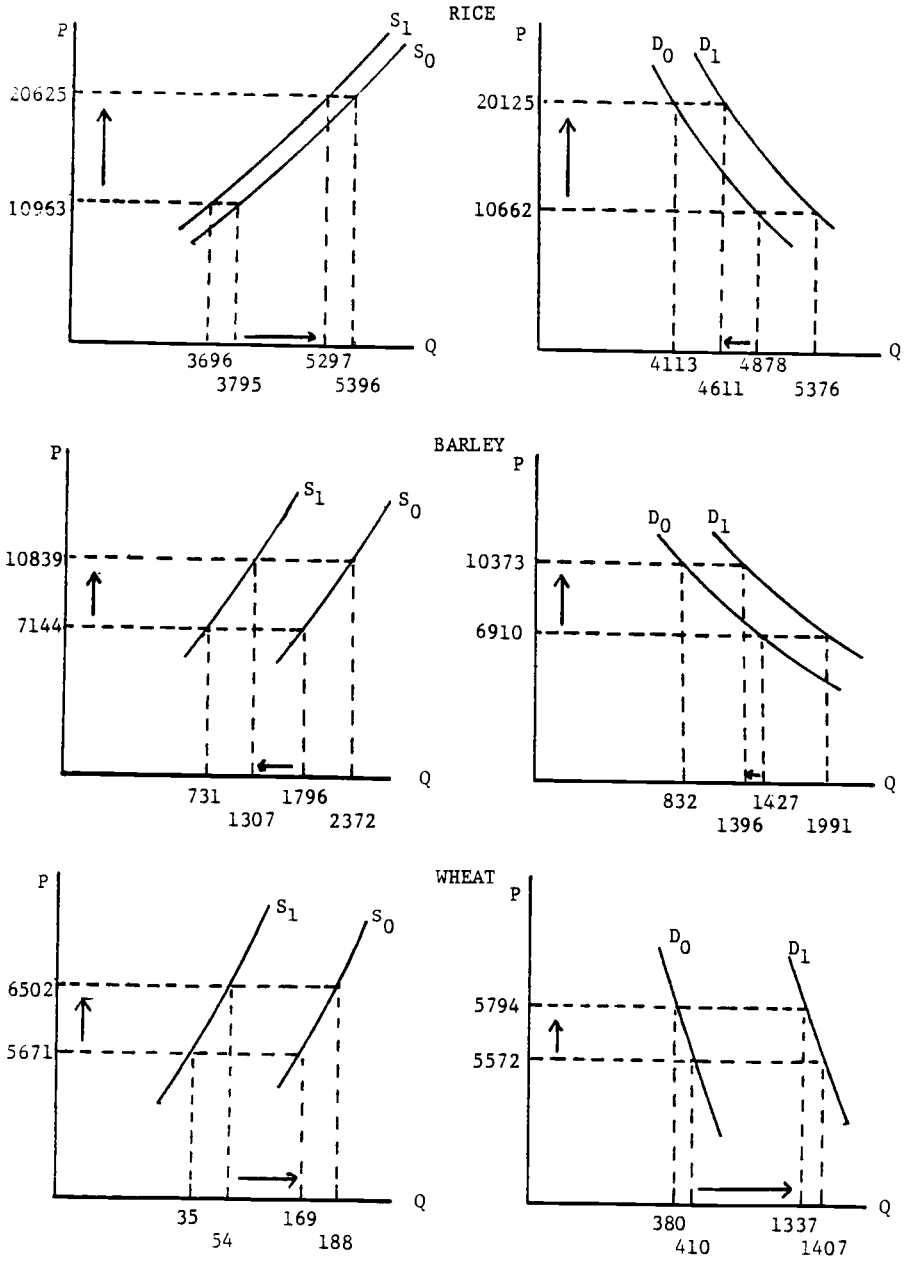
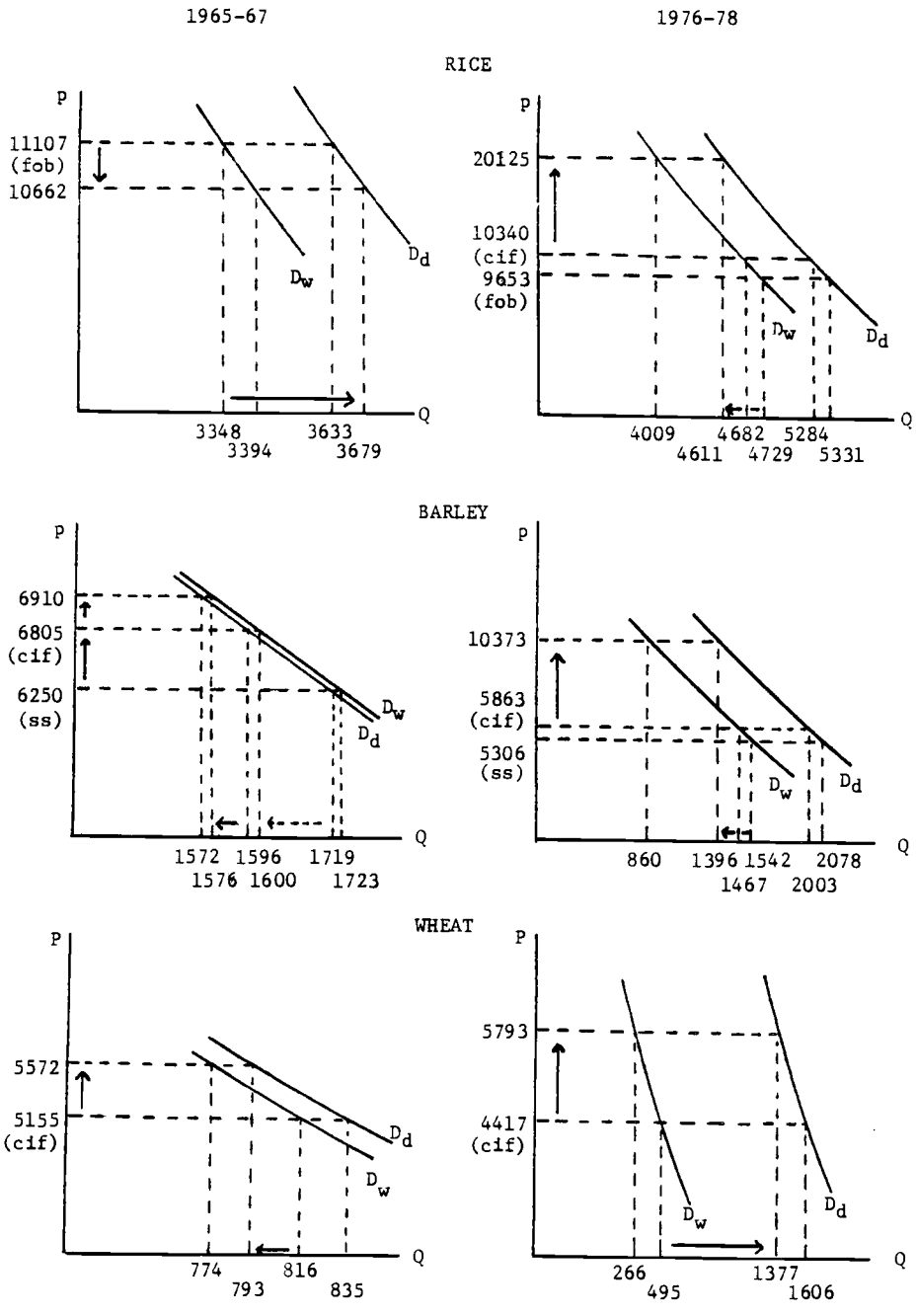


Figure 8. Price Policy and Demand, 1965-67 and 1976-78



The shift in policy had a similar effect on demand to that of policy in 1976-78. Demand curves shifted to the right as a result of higher prices of substitutes, while quantity consumed fell due to the higher price of the good itself (Figure 7). Rice and barley consumption fell, while that of wheat rose.

The differences between the predicted and actual consumption levels in 1965-67 are larger than for quantities supplied. One reason is that income plays a significant role. In nominal terms, Korea's GNP rose from U.S. $4.04b in 1966 to $31.73b in 1977. This represents a growth in real GNP of 59 percent of the average GNP for the two years. Using the income elasticities in Table 5, the effect of the growth in income on consumption is shown in Table 18.

Table 18. Predicted Consumption Levels In Korea, 1965-67

Commodity	Predicted by price policy(1)	[a]Adjusted for change in income(2)	Actual (3)	Difference (2) - (3)
Rice	4,878	4,389	3,679	710
Barley	1,427	1,645	1,572	73
Wheat	410	384	793	-409

[a] Effect of income growth is calculated $.59 \times n_{yi} \times \frac{1}{2} (C^{i0} + C^{i1})$

The difference for barley is small and it would seem that price and income are the major factors in explaining barley consumption. In the case of rice and wheat, there are two possible explanations. First, that the income elasticity of rice is higher than 0.2. For instance, an elasticity of 0.5 would give a predicted consumption of 3,360,000 MT.

In the case of wheat, the income elasticity of demand would need to be negative, for which there is no evidence. The second argument is that noneconomic factors shifted the demand curve for rice in 1965-67 to the left and that of wheat to the right. In fact, policy did encourage the substitution of wheat and barley for rice through rice-free days.[23/]

The effect of price policy on self-sufficiency is shown in Tables 19 and 20. The ratio is defined as human consumption to production so that the effect of price policy on the former as opposed to changes in the composition of total demand can be determined. The impact of policy depends on the net change in supply and demand.

During the first period, price policy had a negligible effect on self-sufficiency in foodgrains (Table 19). The ratio for rice fell as a result of government action which lowered supply and increased demand. Self-sufficiency in barley and wheat increased as output rose and demand fell.

Policy in 1976-78 had a greater impact. High rice prices were a major factor in increasing self-sufficiency in rice but lowered self-sufficiency in wheat substantially. In the short run, consumption and production of barley fell with the latter offsetting the former, so lowering self-sufficiency. In the long run, production above free trade level increased self-sufficiency. The net effect of price policy in the long run was to increase self-sufficiency in rice and barley but lower that in wheat.

23/ It is also possible that the cross-price elasticities of barley and rice on wheat are too high.

Table 19. Production To Human Consumption Ratios For Rice, Barley and Wheat, 1965-67 and 1976-78[a]

		1965-67			1976-78		
		World Prices[b]	Domestic Substitute Prices[c]	Actual[d]	World Prices	Domestic Substitute Prices	Actual
Short Run	Rice	1.15	1.03	1.03	1.03	.87	1.15
	Barley	1.00	1.00	1.22	1.00	.43	.94
	Wheat	.36	.33	.39	.45	.02	.04
Long Run	Rice	1.13	1.03	1.03	.84	.69	1.15
	Barley	.90	.82	1.22	--	--	.94
	Wheat	.28	.26	.39	.10	.01	.04

[a] Ratios > 1, f.o.b. export prices are used to determine production and consumption. Ratios < 1, c.i.f. import prices are used to determine production and consumption. Ratios = 1, f.o.b. prices predict imports and c.i.f. exports, so self-sufficiency price is used.

[b] Predicted ratio with all prices at world level.

[c] Predicted ratio with domestic prices of substitutes and world price of commodity.

[d] Column 3 - 2 gives effect of increase in own price.

Table 20. Effect Of Change In Policy On Self-Sufficiency

	1976-78 Actual Ratio	1976-78 Ratio adjusted for:			1965-67 Actual Ratio
		Δp^i [a]	$\Delta p_{i,j,k}$ [b]	$\Delta p_{i,j,k,Y}$	
Rice (LR)	1.15	.69	.78	.89	1.03
Barley (SR)	.94	.37	1.25	1.09	1.22
Wheat (SR)	.04	.02	.41	.44	.39

[a] s-s ratio at 1976-78 substitute prices and 1965-67 own price. The difference between this figure and column one gives effect of changes in p^i.

[b] s-s ratio at 1965-67 prices. Column 2 - 3 gives the effect on s-s of change in substitute prices.

Changes in self-sufficiency due to the policy shift are shown in Table 20. The effect of higher prices of i^{th} good is obtained by comparing column one and two. In all three cases, self-sufficiency increased as a result of the change in policy. However, when substitution effects are allowed for, self-sufficiency in rice increased but only at the expense of that in barley and wheat. This is because the relatively greater rise in rice prices encouraged producers to move from wheat and barley to rice, while consumers moved in the opposite direction.

As would be expected, the increase in income between the two periods lowered self-sufficiency for normal goods (rice and wheat) but raised it for inferior goods such as barley. Finally, the difference between the actual ratio in 1965-67 and that predicted by adjusting the 1976-78 ratio for changes in price and income (column 5 - 4) gives the effect of nonprice and other factors. These have been discussed earlier in relation to quantities supplied and demanded, and they are clearly not insignificant.

Net Farm Income

The effect of price policy on net farm income is shown in Table 21. The effect of increases in output, with prices constant, on net farm income was negligible with the exception of rice in 1976-78 and as a result of the policy shift. The major impact of price policy was as a result of the increase in net returns per unit.

Wheat and barley price policy had much less effect on net farm income. This is not surprising given the importance of these grains

Table 21. Percentage Increase In Net Farm Income Due To Price Policy

		1965-67			1976-78			Policy Shift		
		Y_{pi} [a]	Δpi [b]	Total	Y_{pi}	Δpi	Total	Y_{pi}	Δpi [e]	Total
RICE	Short run: no substitution[c]	.1	.4	.5	5.3	17.3	22.6	3.68	19.41	23.09
	Short run: substitution[d]	.1	.4	.5	3.1	16.3	19.4	3.07	19.05	22.12
	Long Run	.2	.4	.6	9.3	15.4	24.7	7.80	19.05	26.85
BARLEY	Short run: no substitution	.4	.4	.8	.9	2.2	3.1	.90	2.37	3.27
	Short run: substitution	.3	.4	.7	-.5	1.3	0.8	-.76	1.31	.55
	Long Run	.7	.2	.9	2.1	1.2	3.3	1.80	1.31	3.11
WHEAT	Short run: no substitution	.01	.03	.04	0	.03	.03	0	.20	.20
	Short run: substitution	0	.03	.03	0	.02	.02	-.03	.06	.03
	Long Run	.02	.03	.05	0	.02	.02	-.02	.06	.04

[a] Calculated as $\Delta Q^{it} Y_{pi}$

[b] Calculated as $\frac{p_p^{it} - p_b^{it}}{NFI} \alpha Q^{it}$

[c] Change in income if substitute prices are constrained to the original level

[d] Change in income if substitute prices change

[e] Calculated as $\frac{p_p^{i1} - p_p^{i0}}{\frac{1}{2}(NFI_0 + NFI_1)} \alpha Q^{i1}$

in net farm income relative to rice. A second factor influencing the low ratios of Y_{pb} and Y_{pw} is the smaller margin per unit marketed. In 1976-78, the margin on rice was twice that of barley and over three times that of wheat.

The change in policy had a significant effect on net farm incomes resulting in an increase of about 25 percent. Rice was, again, the major factor accounting for over 90 percent of the increase. The other main factor contributing to the increase in net farm income during this period was off-farm sources. Between price policy and off-farm income, nearly 90 percent of the increase in farm income between 1966 and 1977 is accounted for.

Welfare Effects Of Price Policy

The effects of Korean price policy on producer and consumer surpluses are shown in Table 22 and 23 and Figures 5 through 8. Price policy during 1965-67 had very little effect on consumers' or producers' welfare as prices were maintained at levels close to world prices. Rice producers' surplus rose by 3.7 percent of value of output, while consumers gained by 4.2 percent. Wheat and barley producers both gained, while consumers' surplus in barley and wheat fell. In the long run, net social losses in production rose while net social losses in consumption fell.

Price policy in the second period had a much larger effect. Net gains to rice producers were over 50 percent of the value of output while those for barley were 10 percent. Consumers lost heavily as higher prices led to falls in consumer surplus equivalent to 40 percent

Table 22. Producer Surplus and Price Policy

			World Prices		Effect of Price Parameter Changes[c]		Domestic Prices[d]			Change in: Producer surplus due to:			Net Effect Of Price Policy
			Output[a]	Value[b]	Output	Value	Output	Value (World Prices)	Value	Δp^j	$\Delta p^{i e}$	NSLp[e]	
RICE	1965-67	SR	3,837	550.2	3,755	503.2	3,791	543.6	527.8	-.44	19.7	.09	19.3
		LR	3,791	543.6	3,709	531.8				.44	19.6	.20	19.2
	1976-78	SR	4,852	616.0	4,524	574.4	5,297	672.5	1,387.5	-49.7	744.4	58.6	694.7
		LR	3,951	501.6	3,623	460.0				-47.2	641.1	120.3	593.9
	Policy Shift		3,795	481.8	3,696	469.3	5,297	672.5	1,387.5	-12.1	551.8	98.2	539.7
BARLEY	1965-67	SR	1,723	130.5	1,601	121.3	1,914	150.0	173.6	-3.89	28.2	2.67	24.3
		LR	1,429	108.3	1,307	99.0				-1.04	13.9	2.62	12.9
	1976-78	SR	1,542	99.3	666	42.9	1,307	84.1	179.9	-68.1	76.6	24.9	8.5
		LR	--	--	--	--				--	--	--	--
	Policy Shift		1,796	115.6	731	47.1	1,307	84.1	179.9	-50.0	47.8	13.5	-2.2
WHEAT	1965-67	SR	288	16.9	274	16.0	308	18.0	22.2	-.14	2.85	.17	2.7
		LR	230	13.5	216	12.6				-.14	2.57	.45	2.4
	1976-78	SR	76	3.8	38	1.9	54	2.7	4.5	-1.67	1.25	.03	-.42
		LR	47	2.4	9	.5				-1.22	1.01	.72	-.21
	Policy Shift		169	8.5	35	1.8	54	2.7	4.5	-1.41	.47	.10	-.94

[a] 1000s MT

[b] b won. Valued at world prices excluding transport costs. i.e. f.o.b. Bangkok for rice and f.a.s. U.S. for wheat and barley.

[c] Production and producer surplus with domestic substitute prices and world prices of i^{th} good for 1965-67 and 1976-78.

[d] Production and producer surplus at domestic prices.

[e] Calculated at domestic substitute prices for 1965-67 and 1976-78 and at 1965-67 substitute prices for policy shift.

Table 23. Consumer Surplus and Price Policy

			World Prices		Effect of Price Parameter Changes[c]		Domestic Prices[d]			Change in:[e] Consumer surplus due to:			Net Effect Of Price Policy
			Human Cons.[a]	Value[b]	Human Cons.	Value	Human Cons.	Value (World Prices)	Value	Δp^s	Δp^i	NSL_c	
RICE	1965-67	SR	3,348	480.0	3,633	520.9	3,679	527.5	498.2	1.6	20.7	.13	22.3
	1976-78	SR	4,729	600.4	5,331	676.8	4,611	585.4	1,178.5	80.0	-661.1	47.9	-501.1
		LR	4,682	594.4	5,284	670.8				74.8	-614.8	41.8	-465.2
	Policy Shift		4,876	619.1	5,376	682.6	4,611	585.4	1,178.5	59.85	-600.1	46.0	-480.4
BARLEY	1965-67	SR	1,723	130.5	1,719	130.2	1,572	119.1	137.9	-.03	-13.8	.61	-13.8
		LR	1,600	121.2	1,596	120.9				--	-2.1	.02	-2.1
	1976-78	SR	1,542	99.3	2,078	133.7	1,396	89.9	183.9	34.6	-111.7	21.9	-42.5
		LR	1,467	94.4	2,003	128.9				30.6	-97.4	17.4	-36.2
	Policy Shift		1,427	91.8	1,991	128.1	1,396	89.9	183.9	24.88	-74.5	13.1	-24.9
WHEAT	1965-67		816	47.8	835	48.9	793	46.4	56.1	.01	-0.6	.02	-.60
	1976-78		495	24.8	1,606	80.3	1,377	68.9	101.3	15.4	-22.1	2.0	8.7
	Policy Shift		410	20.5	1,407	70.4	1,377	68.9	101.3	5.09	-7.11	.08	3.1

[a] 1000 MT

[b] b won. Valued at world prices excluding transport costs. i.e. f.o.b. Bangkok for rice and f.a.s. U.S. for barley and wheat.

[c] Consumption and consumer surplus at domestic substitute price and world price of i^{th} good for 1965-67 and 1976-78.

[d] Consumption and consumer surplus at domestic prices.

[e] Calculated at domestic substitute prices for 1965-67 and 1976-78 and at 1968-67 substitute prices for policy shift.

for rice and over a quarter for barley. Net social losses in both production and consumption were also large relative to the first period and are between 5 and 15 percent of the value of output. The effect of changes in substitute prices was fairly insignificant for rice. The impact of higher rice prices on barley and wheat were more important and lowered producers' surpluses by a third of the value of output.

The change in price policy had a major impact with producer surplus being increased by up to 40 percent of the value of ouput. Consumer surplus fell by nearly 50 percent for rice and high rice prices also affected barley and wheat producers and consumers. Finally, net welfare losses were less than 10 percent of the value of ouput.

The net effect of price policy clearly shows the importance of rice. Despite higher barley and wheat prices in the period 1976-78, rice price imports meant that barley and wheat producers actually suffered a loss in surplus as they shifted into rice, while wheat consumers gained. It is clear that the usual measure of price policy effects (ΔP^i column in Tables 22 and 23), which ignores the effect of substitutes, does not give a complete picture of the impact of price policy.

Care must be taken in interpreting the effects of changes in substitute prices on producer and consumer surpluses. The estimates in Tables 22 and 23 give the changes in surpluses due to substitute prices but are bounded by the two prices of the commodity in question. To obtain a full estimate, the area between the two supply (demand) curves which is below (above) the lower (upper) price should be

included. To do this would require the assumption that the demand and supply functions can be extrapolated over the whole range of prices. The failure of the wheat acreage equation to give theoretically consistent results after 1975 when wheat acreage was very low indicates the weakness of the assumption. Similarly, there is no reason to believe that at very high consumer prices the demand function will be the same as over the range of prices considered. However, the conclusions concerning the net effect of price policy still hold. Indeed, given that the estimates are on the low side, the actual effect of substitutes would strengthen the results.

The effect of price policy on barley shows an interesting result in that the relevant opportunity cost (border price) is different in the short and long run. In the short run, Korea is either an exporter of barley (domestic prices) or self-sufficient (world prices). In the long run, under world prices, it is an importer. This means that the net social losses in the long run were less than in the short run because the opportunity cost is higher. This change in the border price is also the reason why short and long run policy effects on consumer surplus differ.

The effect of price policy on program costs is given in Table 24. Between 1965 and 1967, with handling costs at nine percent of producer prices, net costs (column six) were virtually zero. The published accounts of the Grain Management Fund indicate that this was the case. The nine percent handling cost is lower than the 28 percent estimated by Tolley et. al. (1981) for 1977-78. In fact, lower interest rates in the 1960's and the lower cost of transport

mean that the Tolley et. al. estimate is too high for the 1960's. Differences between world and domestic substitute prices marginally lowered the net cost of rice by raising revenue (column one) and increased revenue from wheat and barley.

The second period shows a substantial increase in costs as purchase prices exceeded selling prices. Adjusting between actual and budgeted selling and purchase prices gives an estimated figure of approximately 60b won (1975 prices). This is not too far from the figure in column seven, adjusted by the proportion of marketed output handled by the government, of just over 70b won. With a 28 percent cost of storage, Tolley et. al. calculate the cost in 1978 attributable to rice, under current accounting procedures of 225b won (165b won at 1975 prices) which is very close to the 150b won obtained by adjusting column 12 by the proportion of rice purchased by government.

The effect of trade on program costs, if all imports and exports are handled by the government, is shown for the two periods. The figures show that if world prices are below domestic ones, imports will increase government revenues and exports will increase costs. This concurs with the conclusion of other researchers.

The impact of the change in policy on costs of domestically sold purchases is shown in Table 25. Three effects can be seen. First, the increase in the margin between selling and purchase prices substantially raised the per unit cost and was by far the major factor. If domestic production had increased, with prices remaining at the 1965-67 level, then revenues would have risen but the relative effect is small. The impact of substitute prices changes on costs was also small.

Table 24. Program Costs and Price Policy[a]

		1965-67						1976-78					
		Domestic Sales[b] (1)	Imports (2)	Exports (3)	Handling Costs 9% (4)	Handling Costs 18% (5)	Total (6) = (1) + (4)	Domestic Sales (7)	Imports (8)	Exports (9)	Handling Costs 9% (10)	Handling Costs 28% (11)	Total (12) = (7) + (11)
RICE	Actual	-21.7	--	.6	23.3	46.6	1.6	223.9	--	84.6	76.2	239.1	461.0
	World Substitute Prices[c]	-22.2	--	2.7	23.8	47.6	1.6	237.7	--	208.7	80.9	251.8	489.5
BARLEY	Actual	-5.2	--	10.5	4.9	9.8	-.3	22.8	-1.9	--	6.8	21.2	44.0
	World Substitute Prices	-5.5	--	14.1	5.2	10.4	-.3	38.1	--	109.7	11.4	35.5	73.6
WHEAT	Actual	-1.3	1.5	--	1.1	2.2	-.2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	World Substitute Prices	-1.4	1.4	--	1.1	2.2	-.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

[a] b. won

[b] Negative figures are revenue

[c] Costs if price of good at domestic level and substitutes at world levels.

Finally, the predicted cost is shown in column four. This is the estimated cost in 1965 if the proportion of output marketed had remained at the 1976-78 level. The difference between this and the actual value is the effect of the change in this ratio. The analysis accounts for nearly all the increase in costs. The barley estimates are less accurate due to the lower accuracy in the explanation of the changes in output as discussed earlier. Nevertheless, the analysis does show that the change in the unit costs were the major factors increasing nonhandling costs.

Table 25. Effect Of Change In Policy On Costs Of Domestic Sales[a]

	Increase in costs due to:			
	ΔUnit Costs	ΔOutput 1965-67 Prices	ΔSubstitute Prices	Predicted Cost 1965-67
Rice	261.6	-11.41	-.71	-27.02
Barley	27.65	-2.13	-3.94	-7.08
Wheat[b]	n.a.			

[a] b. won. Excludes handling costs.

[b] Government purchase price not available for 1976-78.

The impact of price policy on foreign exchange is shown in Table 26. The first row (Actual) gives the foreign exchange requirements under the conditions which existed in Korea. The second row shows what requirements would have been if the price of the good had been at the world level and prices of substitutes at domestic levels. The difference between this and the demand for foreign exchange at world prices gives the impact of changes in substitute prices on

Table 26. Foreign Exchange Earnings and Price Policy

			1965-67				1976-78			
					Change in:				Change in:	
			Net Exports[b]	Foreign Exchange[c]	Net Exports	Foreign Exchange[d]	Net Exports	Foreign Exchange	Net Exports	Foreign Exchange
RICE	Actual	SR	112	15.8	-377	-53.1	686	84.1	563	69.0
		LR			-331	-47.6			1,464	179.5
	Domestic Substitute Prices	SR	122	17.2	-367	-51.7	-760	-99.8	883	-114.9
		LR	76	10.7			-1,671	-219.4	-893	-124
	World Prices	SR	489	68.9	--	--	123	15.1	--	--
		LR	443	62.4	--	--	-778	-95.4	--	--
BARLEY	Actual	SR	342	22.3	342	22.3	-89	-6.6	-89	-6.6
		LR			513	37.1			1,379	102.6
	Domestic Substitute Prices	SR	--	--	--	--	-1,337	-99.5	-1,337	-99.5
		LR	-289	-25.0	-118	-10.2	-2,003	-149.2	-536	-40.0
	World Prices	SR	0	0	0	0	0	0	0	0
		LR	-171	-14.8	--	--	-1,467	-109.2	--	--
WHEAT	Actual	SR	-485	-31.8	43	2.8	-1,323	-74.2	-904	-46.8
		LR			101	6.6			-875	-44.9
	Domestic Substitute Prices	SR	-561	-36.3	-33	-1.7	-1,568	-88.0	-1,149	-60.7
		LR	-619	-40.1			-1,597	-90.0		
	World Prices	SR	-528	-34.6	--	--	-419	-27.4	--	--
		LR	-586	-38.4	--	--	-448	-29.4	--	--

a Net exports defined as domestic production less human consumption

b Calculated from Figures 5.1 through 5.4

c b. won

d Calculated using c.i.f. and f.o.b. price for imports and exports respectively

exchange. The effect of the change in the price of the good itself is the difference between the first row and the demand under domestic substitute prices.

In the period 1965-67 price policy led to a reduction in foreign exchange earnings from rice as the self-sufficiency ratio fell from 1.15 to 1.03. The direction of trade in barley was reversed from an importer in long run to an exporter, so increasing earnings of foreign exchange.

While the effect of changes in substitute in the first period was not negligible, the major factor was a change in the price of the commodity itself. In the second period, substitutes played a far larger role, although the own price effect was still larger for rice. For instance, the rice price increased earnings of foreign exchange by 304b won in the short run but substitute prices reduced this by 124b won, giving the net effect of price policy as 180b won. Similarly, producers substituting out of barley and consumers into barley as a result of high rice prices meant that the gain in earnings of foreign exchange due to higher barley prices was offset by high rice prices which resulted in a loss of foreign exchange earnings in the short run. In the long run, however, significant savings were made.

The impact of the policy shift is given in Table 27. The major factor in lowering demand for foreign currency was the high price of rice. The net effect of price policy was to increase exchange earning by 217b won for rice, -34b won in barley and -60b won for wheat. Overall price policy significantly improved the Korean foreign exchange situation.

Table 27. Policy Shift and Foreign Exchange Earnings

	Net Exports 1976-78[a]	F.E. Requirements[b]	Change in F.E. due to: Δp^j	Δp^i	ΔY
Rice	686	84.1	-73.18	290.06	59.95
Barley	-89	-6.6	-121.30	87.19	16.23
Wheat	-1,323	-74.2	-63.45	2.76	-1.45

[a] 1000 MT

[b] b. won. Valued at c.i.f. for imports and f.o.b. for exports

Price Stabilization

The effect of higher producer prices on price stability is analyzed using equations (24) through (27). The inequality in (25) holds for barley in the first period, indicating that producer prices were high enough to guarantee seasonal price stability in a closed economy. In the case of rice (26) was evaluated for 1965-67, assuming that $\delta = 0.05$, $c = 0.04$ and $m_{ii} = 2e_{ii}$. The first two assumptions are consistent with the estimated handling cost of 9 percent, while the last assumption follows from Tolley et. al. (1981) who conclude that the elasticity of marketing for rice is twice the elasticity of supply. This gives a value for (1-t), the proportion of the year for which prices are stabilized, of 20 percent.

Calculating (26) for rice and barley in the second period, assuming that $\delta = .10$, $c = .18$ and $m_{ii} = 2e_{ii}$, gives a value of (1-t) for rice of 0.3 and barley 0.6. The assumptions concerning δ,s and m_{ii} are the same as made by Tolley et. al. (1981). These results are shown in Table 28.

Table 28. Price Policy and Price Stability

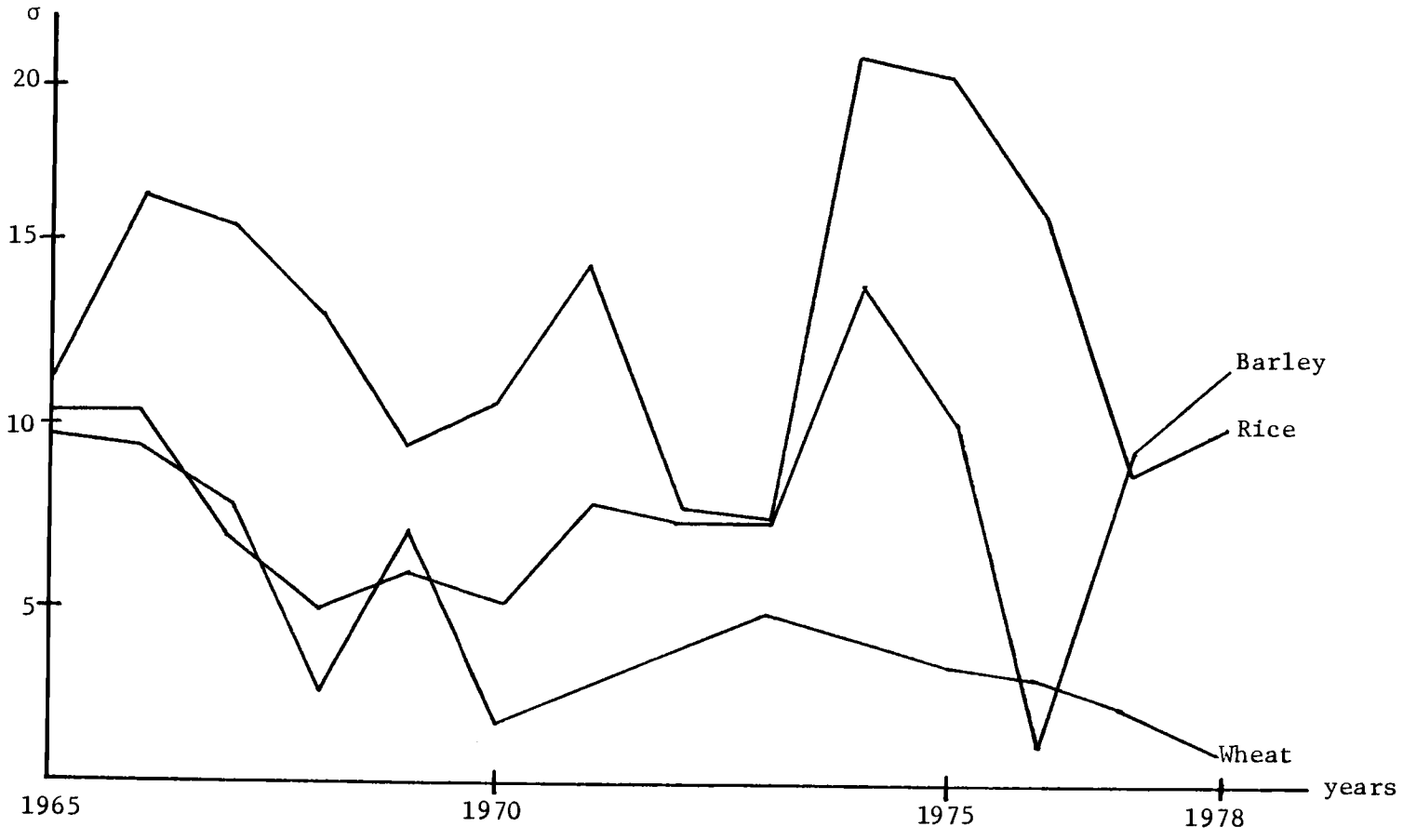
		$\frac{p_p^{it}}{p_s^{it}}$	$\frac{1+s}{1+d}\frac{n_{ii}}{m_{ii}-n_{ii}}$	K	$Q_m^{it\,a}$	1+t (Degree of Stability)
Rice	1965-67	1	1.02	.977	1850	.2
	1976-78	1.063	1.09	.958	3500	.3
Barley	1965-67	1.162	1.02	--	--	1.0
	1976-78	1.05	1.08	.828	540	.4

[a] $Q^{it}{}_{\alpha}$ gives Q_m^{it} and $Q_m^{it'} = \emptyset\ Q^{it}$ where $\emptyset$ is proportion of output handled by government.

The results show that higher producer prices, by enabling the government to purchase a greater proportion of production, increased the seasonal stability of prices in rice. In the case of barley, while producer prices did rise, the high price of rice which increased barley consumption and lowered domestic supply meant that barley price instability increased as the self-sufficiency price of barley doubled.

The actual performance of domestic prices over the period 1965-78 is shown in Figure 9. It is clear that the results in Table 28 do not predict price stability very well. This is not surprising since seasonal price fluctuations are not the only source of instability. The high barley price instability in 1965-67 is due to the fact that the government purchased a very low proportion of production. In the case of rice and barley, the high fluctuations in 1974-75 were due to instability in the world markets and the effects of the oil crises. The world price of rice increased by over 300 percent between 1972 and 1974 and then fell to half the 1974 level within three years. A similar pattern can be seen in barley.

Figure 9. Standard Deviation Of Monthly Prices For Rice, Barley and Wheat, 1965-78



The much greater stability of wheat prices is due to two factors. First, that world wheat prices are far more stable than rice and were more stable than barley up to 1972 (Table 8). World prices tend to be more stable than those in individual countries due to the oligopolistic nature of the world markets which encourages collusion. This offsets the effects of short term fluctuations in supply and demand. Unless there are major changes in the world markets, as in 1973-74, prices tend to be more stable. Secondly, the major source of supply was imports from the U.S. under PL 480, the terms of which were less uncertain than buying in the free market. This further increased stability by enabling the Korean government to set and maintain wheat prices.

CHAPTER VI

CONCLUSIONS

This thesis has evaluated Korean government foodgrain policy over the period 1965 to 1978. The effects of policy over free trade and of the policy change between 1968 and the early 1970's were estimated. Determination of the extent to which prices have been influenced by government policy clearly shows that during the 1960's world and domestic prices were similar. This indicates that the prescriptions of international trade theory, at least with respect to the agricultural sector, were followed. This conclusion is consistent with those of other studies. Westphael (1969) compared the observed structural shares with "norm" structural shares based on the Chenery-Syrquin large country sample. He concluded that policy was governed to a large extent by comparative advantage in stating that:

> "...the share of primary production was atypically low over the 1955-72 period. Secondly, the pace of industrialization was faster than in many countries. Third, the unusally rapid growth of manufacturing exports reflected the fact that capital was more than simply catching up with the dislocation caused by Japanese colonial policy and two wars" (Westphael, p. 241 in Hansen and Rao, 1979).

Policy in the 1970's placed far more emphasis on the agricultural sector. While the shift had its roots in a number of factors, including changes in the world foodgrain market and emerging domestic imbalances, a fully consistent interpretation which explains the heavier weight given to rice is only possible if the political objectives of the Korean government are taken into account. This thesis does not attempt to explain why self-sufficiency, which has been a stated

objective of every Development Plan since the Korean War, suddenly became translated into economic action. However, the pattern is not inconsistent with that found by the World Bank who concluded that the higher the level of per capita income the greater the degree of protection given to agriculture.

The increase in producer and consumer prices has the predicted impact on self-sufficiency ratios when substitution effects are ignored. Positive production and negative consumption effects increase self-sufficiency and reduce imports. For instance, the change in policy increased the self-sufficiency ratios for rice, barley and wheat by 0.46, 0.57 and 0.02 respectively. When allowance is made for substitution in production and consumption, the conclusions are very different. Self-sufficiency in rice still rose as a result of price policy but only by 0.37 as higher barley and wheat prices shifted producers into, and consumers out of, rice. In the case of barley and wheat, the change in policy actually decreased the self-sufficiency ratios by 0.31 and 0.37 as high rice prices offset the impact of higher barley and wheat prices.

This dominance of rice prices which determines to a large extent what happens in the foodgrain market as a whole reflects the relative importance of rice and the greater degree of protection afforded rice compared to barley and wheat. The implications of this for future policy are fairly important and clearly indicate that the attainment of self-sufficiency in rice is at the cost of higher barley and wheat imports. In the case of barley, the effect of higher rice prices was to reverse the trade flow, at least in the short run, as the

self-sufficiency ratio of barley fell from the free trade level of 1.02 to 0.38. This requires barley prices nearly twice world levels before self-sufficiency was even approached.

The interrelationship of the foodgrain market is not one that has been fully appreciated by policy makers in Korea. In Japan, the prices of other agricultural products are fixed relative to rice and it may be that Korea should follow this lead. It would certainly make the implication of high rice prices clearer.

The major impact of price policy on net farm income was through increases in net returns per unit marketed. The much smaller change in net farm income due to increased output indicates the minimal return per unit at world prices and, therefore, Korea's comparative disadvantage in foodgrains. The low net farm income elasticities mean that, while substitution of foodgrains led to a similar pattern as changes in self-sufficiency, it was much less important. High rice prices reduced net farm income from barley and wheat by less than two percent in the period 1976-78.

The analysis shows that price policy had little effect in 1965-67 on net farm income but increased it by about 25 percent as a result of the policy shift. This led to net farm income in 1976-78 being some 25 percent above that which would have existed at world prices. Price policy is one of two major factors which account for the increase in rural incomes between 1965-67 and 1976-78. Net farm income increased by some 65 percent of average income over the period 1967-77 with price policy accounting for over one-third of this and off-farm sources approximately one-half.

One issue not addressed in this thesis is the incidence of the increase in income. A priori one would expect large farmers, who benefit more from higher prices since they sell a large proportion of output, to have been the major beneficiaries. Tolley et al. (1981) looked at this question for rice producers and concluded that this was indeed the case. They calculated that the change in net farm income due to changes in price varied from 5.6 percent with farms of less than 0.5 cheongbo (1.25 ha.) to 35.2 percent for farms larger than two cheongbos. This means that unless small producers benefit more from other sources of income, price policy will result in an increasingly uneven distribution of income in the rural areas.

The welfare gains and losses associated with price policy are summarized in Table 29. During the first period, net social losses were small, amounting to 3.7b won in the short run, with the major benefits going to barley consumers and producers. The net social welfare losses in the second period were much larger at 155b won in the short run, with major decreases in surplus being suffered by rice consumers. The net welfare loss associated with the policy change is 171b won or U.S. $353 million at 1975 prices. This is equivalent to 1.0% percent of GNP in 1977 and 4.7 percent of agricultural GNP.[24/] These figures are simlar to those found in the World Bank studies. For instance, the net social loss due to price policy as a percentage

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24/ If government purchase and sale prices are equal to market prices, NSL = Gp + Gc + PC; but prices differ. PC estimates are also based on marketed output and not domestic production as required if the identity is to hold.

Table 29. Summary Of Welfare Effects Of Price Policy[a]

			WELFARE CHANGES				FINANCIAL IMPACT	
			Producer Surplus[b]	Consumer Surplus[c]	Production	Consumption	Program Costs[d]	Foreign Exchange
RICE	1965-67	SR	19.3	22.3	.09	.13	-21.7	-53.1
		LR	19.2		.20			-47.6
	1976-78	SR	694.7	-501.1	58.6	47.9	223.9	69.0
		LR	593.9	-465.2	120.3	41.8		179.5
	Policy Shift		539.7	-480.4	98.2	46.0	249.8	231.4
BARLEY	1965-67	SR	24.3	-13.8	2.67	.61	-5.2	22.3
		LR	12.9	-2.1	2.62	.02		37.1
	1976-78	SR	8.5	-42.5	24.9	21.9	22.8	-6.6
		LR	--	-36.2	--	17.4		102.6
	Policy Shift		-2.2	-24.9	13.5	13.1	21.6	-34.1
WHEAT	1965-67	SR	2.7	-.60	.17	.02	-1.3	2.8
		LR	2.4		.45			6.6
	1976-78	SR	-.42	8.7	.03	2.0	n.a.	-46.8
		LR	-.21		.72			-44.9
	Policy Shift		-.94	3.1	.10	.08	n.a.	-60.7

[a] b. won

[b] Calculated as G_p at domestic prices plus G_p due to ΔP^j

[c] Calculated as G_c at domestic world prices plus G_c due to ΔP^s

[d] Excludes handling costs. Negative figures are revenue

of GNP in eight countries varied between 0.01 and 1.01 percent using low elasticities, and 0.04 to 3.04 percent using high elasticities. Only in Egypt were losses much higher (Bale and Lutz, 1981). In a purely economic context, these figures are high but, from a political perspective, they may be a low price to pay for food security and political stability.

Rice was. again, the dominating factor directly accounting for 90 percent of the domestic welfare loss. As one would expect, producers--especially rice farmers--were the major beneficiaries while consumers and the government were the largest losers. The increase in producer surplus relative to value of output, resulting from the policy shift, was about 34 percent while the loss to consumers as a ratio of value of consumption was 35 percent. Both these figures hide the incidence of the loss. For producer surplus, the incidence is the same as for the policy-induced changes in farm incomes. Given the low income elasticities of income for foodgrains, one also would expect the urban poor to have suffered the largest proportionate loss among consumers. Tolley et al. (1981) conclude that the increase in expenditures by urban consumers, attributable to higher cereal prices, is four times as low for low income families as for high income families. It is reasonable to expect changes in consumer surplus to show the same pattern.

Urban consumers are not the only group who loose. While government does not sell to the rural areas, it is probable that higher urban prices raise prices in the rural areas. This is especially worrying since the rural consumer tends to be the small producer who,

it was argued, is not a major beneficiary of high producer prices. This group is, therefore, being squeezed on both sides.

The analysis clearly shows the importance of substitutes. High rice prices resulted in lower self-sufficiency in barley and wheat. Similarly, the expected gains to producers and losses to consumers as a result of high prices are offset, in the case of barley and wheat, as government increased rice prices after 1970. This led to negative producer surpluses in barley and wheat and a gain for wheat consumers. A similar pattern is seen in program costs and foreign exchange.

The effect of supporting producer prices on program costs was substantial. Costs incurred as a result of the change in policy were 271b won or two percent of GNP in 1977. Even when allowance is made for the fact that the government only purchased some 20 percent of rice produced, the fisc's deficit due to price policy was still significant at 0.6 percent of GNP. Clearly this has major implications for the Korean government's overall development policy. If the deficit is financed by increasing the money supply, there would be an inflationary effect which may be large. For instance, if the entire deficit is financed through the money supply, the resulting increase would be 13.5 percent. This is equivalent to nearly half the average annual increase of 30 percent. Similarly, fiscal financing will have a macroeconomic and distributional effect, the latter depending on the progressive or regressive nature of the tax system.

Costs in 1976-78 were greatest in rice, reflecting the greater volume of rice handled. The costs per unit, with similar handling costs, were highest for rice since the ratio of selling to purchase

prices was lowest, but this is only true since 1975. Before this, barley and wheat ratios were below that for rice. High rice prices, however, significantly affect the unit costs of barley since if the government wishes to attain self-sufficiency, it must raise barley prices and purchase domestic production at prices above world levels.

The savings made on foreign exchange expenditure amount to 123b won or 1.0 percent of GNP in 1977. As would be expected by looking at the self-sufficiency ratios, the major increase in exchange earnings due to the change in policy occured with respect to rice while losses were made due to higher imports of both wheat and barley. This was the result of high rice prices which offset the effects of barley and wheat price supports. Despite the losses in foreign exchange on winter crops, the net savings resulting from the change in policy significantly eased the foreign exchange constraint. Given the substantial increases in foreign exchange expenditures on petroleum, products which increased 248 times between 1962 and 1979, the phasing out of PL 480 which provided wheat and barley at subsidized prices and the downturn in world trade which reduced Korean exports, the value to Korea of foreign exchange savings is likely to be high.

The effect of policy on the stability of prices by offsetting seasonal price changes has been, at best, minimal. This reflects the fact that seasonality of prices is only a minor factor in price stability and that if the government is to achieve stable prices, it must not only purchase sufficient quantities to be able to market over the whole year but also predict shifts in the supply and demand curves over the year. A second point is that if trade is restricted, then

domestic demand and supply fluctuations will have a larger impact on prices since the country cannot "export" this instability. Assuming that world prices are more stable than domestic prices, fluctuations in the latter would be greater.

The analysis has shown that price policy and particularly the change in price policy between 1968 and 1970 can explain a substantial proportion of the behavior of the foodgrain market. The results are dependent to a large degree on the elasticities of demand and supply. Errors in the former have been discussed earlier, and clearly there is a need for further research to determine the magnitude of these elasticities. More reliance can be put on the elasticities of supply. The rice estimates are very close to those obtained by AERI (1973) for a period some seven years shorter. They also make sense given the limited supply of paddy land. At first sight, the barley and wheat estimates appear high. Some evidence for the fact that price elasticities may be higher than previously believed comes from Peterson (1979) who argues that long run supply elasticities are in the range of 1.25 to 1.66 rather than the 0.3 traditionally taken. The short run elasticities for wheat and barley obtained for Korea do explain reasonably well the changes in supply, however, the long run elasticities appear high given the limited supply of land.

The importance of technology has not been explicity considered. Barley and wheat yields changed very little over the period 1965-78. In the case of rice, the high yield response to price and the low elasticity of yield with respect to costs indicate that technology has been a more important factor in rice than the winter crops, but

a more detailed analysis of the interrelationship of price, costs and techology is needed.

Trade has had a major influence on both the behavior of the foodgrain markets and government policy. The lower priority accorded wheat and the policies of the government in the 1960's clearly show the importance of low world wheat prices. Secondly, foreign exchange shortages were a major determinant of policy in the 1970's. The actual effect of the PL 480 shipments has not been measured, but clearly the framework developed in chapter three allows the effect of PL 480, not only on wheat but also on rice and barley, to be determined.

Noneconomic factors have probably been, next to price policy, the major influence on demand. They are a major cause of the difference in the elasticity of demand estimates and the "residual" changes in demand. If the Korean government is to have a successful foodgrain price policy, it must have a better understanding of the impact of noneconomic influences on the foodgrain market. There is clearly considerable scope for research into this issue.

The questions just raised are not the result of idle curiosity. They are crucial areas where more information is needed if consistent and comprehensive foodgrain policies are to be developed. This thesis has shown that while government foodgrain policies have had significant impact, they also contain contradictions and have, as a result, only been a partial success. The results also show that interrelationships of foodgrain, agricultural, industrial and international policies are strong. Low food prices both affect and are affected by industrial development which, in turn, affects income disparaties and foreign

exchange, thus increasing the importance of self-sufficiency and raising rural incomes. If meaningful conclusions are to be reached, any analysis of Korean foodgrain policies must allow for these interactions and relate economic theory to the social and political environment which is Korea. Only then can the subjective and objective contradictions which theory both highlights and, from its theoretical policy prescriptions causes, be reconciled and the perceived economic costs of self-sufficiency be explained.

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