Kym Anderson and In-Chan Ahn*

PROTECTION POLICY AND CHANGING COMPARATIVE ADVANTAGE IN KOREAN AGRICULTURE†

South Korea's rapid industrialization during the past two decades has become world renowned. Also well known is the rapid growth in agricultural production and land productivity in Korea relative to that of other developing countries. This recent agricultural growth, however, has been due in large part to substantial increases in agricultural protection. It has occurred despite declining comparative advantage in food production. The shift in comparative advantage from agriculture toward manufacturing is expected to continue because Korea is so poorly endowed with farmland (Anderson, 1980).

The purposes of this paper are to examine briefly the increases in agricultural comparative disadvantage and protection since Korea's industrial takeoff in the mid-1960s and to look in more detail at these changes for rice in particular. (Rice accounts for about half of Korea's farm income and calorie intake.) The domestic resource cost methodology is used to measure the foreign exchange earnings foregone by keeping resources in rice production. The paper concludes that agricultural protection is unlikely to continue to achieve its objectives of slowing the decline in food self-sufficiency and helping incomes of farmers keep pace with urban incomes unless it is increased continually.

GROWTH, STRUCTURAL CHANGE, AND PROTECTION

Dramatic growth and structural changes in the Korean economy began in the early 1960s with trade and payments liberalizations and a switch toward

* Research Fellow, Department of Economics, Australian National University; and Associate Professor, Department of Agricultural Economics, Chungbuk National University, Cheonju, Republic of Korea.

† This paper draws heavily on a research report by Anderson (1981) and a Master's thesis by Ahn (1982). The authors are grateful for financial assistance from the Rural Credits Development Fund.

an export-oriented industrialization strategy.[1] Between 1963 and 1979, gross national product, manufacturing value added, and exports grew at annual rates in real terms of 10, 20, and 25 percent, respectively (Anderson and Joo, 1984). A major structural transformation accompanied this rapid growth of the economy. Even though real agricultural value added (in domestic prices) grew at a rate of 5 percent a year, agriculture's share of GNP fell dramatically from almost 50 percent in the late 1950s to only 18 percent in 1981. Less than one-third of the labor force is now engaged in agriculture, compared with almost two-thirds in the early 1960s. And agriculture now provides a negligible proportion of exports, as shown at the top of Table 1.[2]

These changes suggest a marked switch in comparative advantage away from agriculture toward manufacturing. The switch can be summarized using Balassa's "revealed" comparative advantage index (1965), which is defined as the ratio of a commodity group's share of the country's exports relative to that commodity group's share of world exports. For Korea, this index fell for agriculture (including fish and other processed food) from 2.3 to 0.7 between 1960 and 1979 and rose for nonfood manufacturing during the same period from 0.4 to 1.5.

In addition to these intersectoral adjustments, a number of major structural changes have occurred in agriculture. On the output side, the share of farm income from fruits, vegetables, and livestock products has risen rapidly, with these products increasingly supplementing cereals in the Korean diet. Furthermore, one-third of farm household income now comes from nonfarm sources, double the share during the early 1960s. On the input side, cultivated land area per farm household has been increasing, albeit rather slowly, and increases in machinery and fertilizer use have been rapidly boosting the capital intensity and productivity of farming. This increased use of purchased inputs relative to labor and land is a response to the rapid rise in wages and land values relative to other input prices.

Some of these changes would have been even more marked had it not been for the introduction of farm price supports in the late 1960s.[3] These price

[1] See Frank, Kim, and Wesphal (1975); Kim and Roemer (1980); and Krueger (1979).

[2] In the past two decades Korea has achieved almost the same degree of transformation as Japan achieved in the six to eight decades prior to 1960. This is evident from comparison of the first three rows of Table 1 with similar data for Japan (Anderson, 1983):

Share of agriculture in: *(percent)*	1885	1900	1920	1940	1960
Gross Domestic Product	45	29	22	15	13
Labor force	74	60	51	42	33
Exports	63	30	23	18	11

[3] For details of Korea's food and agricultural policies during the past two decades,

Table 1 Structural Adjustment Indicators, Korea, 1963 81

	1963	1968	1973	1978	1981
Share of agriculture *(percent)* in					
GNP (1975 prices)	44	34	26	19	18
Labor force	61	50	47	37	32
Exports	13	4	3	4	2
Share of gross agricultural receipts *(percent)* from					
Cereals	74	57	56	48	49
Vegetables and fruit	9	14	13	23	22
Livestock products	7	14	16	21	22
Other farm products	10	15	15	8	7
Share of net farm household income from off-farm sources *(percent)*	18	24	19	28	33
Cultivated area per farm household *(ha)*	.86	.90	.92	1.00	1.08
Farm machinery, fertilizer, and labor use per thousand hectares of cultivated area					
Power tillers	0	2	12	65	126
Power threshers	3	8	28	62	86
Water pumps	4	12	20	60	75
Chemical fertilizers	97	145	260	289	301
Employed farm workers	1,330	1,390	1,730	1,640	1,640

Sources: Economic Planning Board. *Korean Statistical Yearbook*, 1981, and *Major Statistics of Korean Economy*, 1982, Seoul. Ministry of Agriculture and Fisheries, *Yearbook of Agriculture and Forestry Statistics*, various issues, Seoul.

supports, together with quantitative restrictions or prohibitions on imports of many food items, have allowed domestic food prices to rise increasingly above international levels (see Table 2).

Both grain and livestock prices in Korea averaged more than twice international levels in the early 1980s, although they were very close to world prices in the mid-1960s. Fruit and vegetable prices also rose well above international levels.[4] Assistance to manufacturing was relatively low during this period and grew very little. According to C. H. Nam (1981), the average nominal rate of

see Moon (1976) and Kim and Joo (1982).

[4] For example, the nominal rates of protection for red pepper and garlic, two of Korea's most important nongrain crops, were 275 and 580 percent from 1980 to 1982. See also Anderson (1981).

Table 2—Nominal Rates of Agricultural Protection, Korea, 1965–82
(percent)

	1965–69	1970–74	1975–79	1980–82
Rice	6(4)	55(46)	138(130)	154(163)
Barley	−6(−6)	35(20)	77(11)	107(24)
Wheat	18(19)	16(−2)	45(6)	128(23)
Corn	17	43	67	101
Soybeans	51	63	109	226
Grain (average)	5	51	124	143
Beef	55	88	281	326
Pork	82	111	113	208
Chicken	132	103	153	140
Eggs	10	10	2	21
Milk	*n.a.*	*n.a.*	251	251
Livestock (average)	49	64	103	157

Sources: Updates of estimates from Kym Anderson, 1981. "Northeast Asian Agricultural Protection in Historical and Comparative Perspective: The Case of South Korea," Australia–Japan Research Centre Research Paper No. 82, Canberra, Australia. Also based on price data from various issues of Bank of Korea, *Price Statistics Summary;* National Agricultural Cooperatives Federation, *Agricultural Cooperatives Yearbook;* Office of Customs Administration, *Monthly Foreign Trade Statistics;* and Food and Agriculture Organization, *Trade Yearbook.*

Nominal rates of protection are defined as the percentage by which the domestic price exceeds the border price. The producer price is used in the case of grains and soybeans and so underestimates the rate of protection by the extent price of the producer-to-wholesale marketing margin. The wholesale price is used for livestock products. The weights used to obtain the averages are based on domestic production valued at border prices.

Figures in parentheses show the percent by which wholesale prices for rice, barley, and wheat flour were above the border prices.

protection for manufacturing was around 10 percent in both 1968 and 1978, and the effective rates of manufacturing protection increased slightly from −5 to 7 percent between 1968 and 1978.

This rise in relative agricultural protection, together with the marked changes in farm output and input mixes in response to changing product and factor prices was sufficient to ensure some growth in agricultural production despite Korea's rapid increase in comparative advantage in manufacturing. Food demand expanded even more rapidly, however, and so some food imports were allowed. Self-sufficiency ratios consequently fell (see Table 3), and they would have fallen much more if domestic producer and consumer food prices had remained at international levels.

Table 3—Food Self-Sufficiency, Korea, 1965–81
(percent)

	1965–69	1970–74	1975–79	1980–81
Rice	95	89	98	75
Barley	100	90	96	100
Wheat	21	9	3	4
Corn	40	15	6	6
Soybeans	94	81	66	33
Beef	100	99	78	81
Pork	100	102	99	100
Chicken	100	100	100	100
Eggs	100	100	100	100
Milk	100	100	95	95

Source: Australian National University, Agricultural Trade Data Bank; based on official government publications.

Food self-sufficiency is production divided by production plus net imports minus change in stocks, expressed as a percentage.

Nominal rates of protection for rice (which is by far Korea's most important farm product and food item) provide a reasonable indicator of the growth in agricultural protection as a whole in Korea. The next section therefore examines this trend more closely by concentrating on rice and using the domestic resource cost methodology.

DOMESTIC RESOURCE COST OF RICE PRODUCTION

The domestic resource cost methodology provides an index of foreign exchange losses from protection, allows a comparison to be made with available estimates of rice DRCs for other countries, and enables estimates to be made of the effects of policy on farms of different sizes. It requires calculating at the margin the social opportunity cost of employing land, labor, and capital resources in rice production relative to value added by these factors measured at world market prices.[5] This ratio is called the domestic resource cost (DRC) coefficient. A DRC of greater (or less) than one suggests that it would be socially profitable to move some resources out of (or into) rice production, since those resources could thereby earn or save more foreign exchange for the country.[6]

[5] The methodology used here is similar to that outlined by Pearson, Akrasanee, and Nelson (1977). See the Appendix for details of calculations.

[6] The concept of social profitability used here is a narrow economic one that should not be thought of as indicating necessarily what is socially desirable for a country. Citizens may, for example, have a strong preference for producing some goods domestically for security reasons rather than being dependent on imports of those goods,

The difference between the denominator and the numerator of the DRC ratio provides a measure of the net social profitability of this productive activity.

The DRCs for rice production in Korea are shown in Table 4 for selected years between 1965 and 1980. The strong upward trend of the nominal protection coefficient on output, apart from the mid-1970s period of exceptionally high world prices, contrasts with irregular variation in that of inputs (line 13).

The domestic resource cost coefficient for Korean rice (line 16) rose from 1 in 1968 to 2 in 1977 and 3 in 1980; for every unit of foreign exchange saved by producing rice domestically in the late 1970s, it cost Korea more than two units of foreign exchange that could have been earned by employing these resources in industries with a stronger international comparative advantage. This cost is extremely high by world standards and is probably exceeded only in Japan. In 1974, the Korean DRC of 1.07 was already higher than in the Philippines (0.83 to 0.95, depending on region), Taiwan (0.73 for the first crop, 1.02 for the second), Thailand (0.29 to 0.46, depending on region and whether first or second crop), and the United States (0.28 to 0.50, depending on region).[7] Chart 1 shows the sensitivity of the DRC for rice production in each of these countries to the level of world prices in 1974, other things equal. Clearly Korean rice producers were the least efficient of this group in generating or saving foreign exchange through rice production in that year. Since then, their relative inefficiency has probably increased further, given the extremely rapid rise in Korea's effective rice protection since the mid-1970s.[8]

Estimated DRCs for different farm sizes in Korea are shown in Table 5. While there seem to have been almost no differences between the efficiencies of the various groups up to the mid-1970s, it would appear that since then smaller farms have lost comparative advantage more rapidly. Closer inspection of the trend for the smallest and largest farm-size groups reveals that the divergence between rates of decline in comparative advantage may have begun in the early 1970s but did not show up during the exceptionally high world price years of the mid-1970s (Chart 2). Presumably this reflects the greater capacity of larger farms to substitute lumpy mechanical implements for labor in response to the rapid rise in farm wages relative to farm implement prices. This ratio doubled in the 14 years before 1977, but rose a further two-thirds between 1977 and 1979 following huge real wage increases in Korea's urban sector.[9]

---

even if imports are available at lower prices.

[7] See Akrasanee and Wattananukit (1977); Monke, Pearson, and Akrasanee (1977); Herdt and Lacsina (1977); Mears (1977); and Wu and Mao (1977).

[8] Some caution is needed in interpreting Chart 1, since the various curves do not refer to the same quality of rice. For the qualities represented, the border prices in 1974 for the United States, Thailand, Korea, Taiwan, and the Philippines were $590, $550, $430, $360, and $350, respectively. This does not, however, affect the conclusion about Korea's inefficiency.

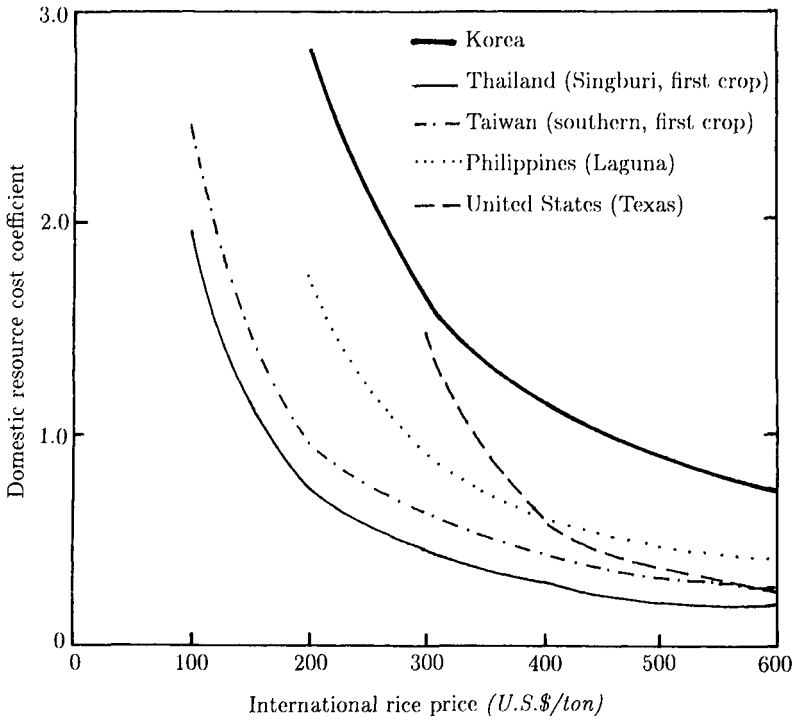
[9] See Anderson and Joo (1984). This possibility of an emergence of economies of scale in Korean rice production was forecast by Oh and Kim (1980), even though prior to the late 1970s there appeared to be a tendency not only for a decline in the share

Table 4 Average DRC Calculation for Rice Production, Korea, 1965 80
(Korean won per kilogram, or as indicated)

	1965	1968	1971	1974	1977	1980
1. Gross output at domestic prices	40.1	54.9	59.9	184.4	310.5	616.4
2. Tradable inputs at domestic prices	7.3	10.2	12.8	21.4	45.5	130.0
3. Value added at domestic prices (1 – 2)	32.8	44.7	83.1	163.0	265.0	486.4
4. Factor costs other than capital, actual market prices	30.6	41.8	79.5	157.6	254.2	442.7
5. Taxes	.8	.9	.9	1.2	4.4	1.8
6. Private profitability (3 – 4 – 5)	1.4	2.0	2.7	4.2	6.4	42.9
7. Gross output border prices	42.5	48.5	52.3	173.0	106.0	220.1
8. Tradable inputs at border prices	7.7	10.0	12.3	26.0	39.6	118.8
9. Value added at border prices (7 – 8)	34.8	38.5	40.0	147.0	66.4	101.3
10. Social opportunity cost of factors	33.3	40.6	56.6	156.0	127.7	302.1
11. Net social profitability at official exchange rate (9 – 10)	1.5	-2.1	-16.6	-9.0	-61.3	-200.8
12. Nominal protection coefficient on output (1 ÷ 7)	.95	1.13	1.83	1.07	2.93	2.80
13. Nominal protection coefficient on tradable inputs (2 ÷ 8)	.95	1.02	1.04	.82	1.15	1.09
14. Value added share of output at border prices (9 ÷ 7)	.82	.79	.76	.85	.62	.46
15. Effective protection coefficient on value added (3 ÷ 9)	.94	1.16	2.08	1.11	3.99	4.80
16. Domestic resource cost coefficient (10 ÷ 9)	.96	1.06	1.41	1.07	1.93	2.98

Source: In-Chan Ahn, 1982. "Changing Comparative Advantage in Korean Agriculture: A Domestic Resource Cost Study." Master's thesis, Australian National University. Canberra, Australia. Table 5.1.

Chart 1—DRCs at Alternative International Rice Prices, 1974



Sources: Eric Monke, Scott R. Pearson, and Narongchai Akrasanee, 1977. "Comparative Advantage, Government Policies, and International Trade in Rice," *Food Research Institute Studies,* Vol. 15, No. 2, 1976. In-Chan Ahn, 1982. "Changing Comparative Advantage in Korean Agriculture: A Domestic Resource Cost Study." Master's thesis, Australian National University. Canberra, Australia.

CONCLUSIONS AND POLICY IMPLICATIONS

The main conclusion that emerges from this analysis is that Korea's comparative advantage in food production is declining rapidly. The trade statistics and self-sufficiency ratios would have shown a much faster growth in food import dependence had it not been for increasing agricultural protection since the late 1960s. Second, the cost of this protection policy is increasing steadily. The efficiency cost for rice is clear from the rise in the DRC coefficient from 1.0 between 1965 and 1967 to 1.4 between 1971 and 1973 and 2.0 from 1977 to 1979. The DRC for barley, Korea's second most important foodgrain, has risen even

of farm households with less than 0.5 hectares of cultivated land (from 41 percent in the early 1960s to 29 percent in the late 1970s), but also for a slight decline in the share of those with more than 1.5 hectares (from 16 to 13 percent).

Table 5 DRCs for Rice Production by Farm Size, Korea, 1965 80

	< .5 ha	.5 1.0 ha	1.0 1.5 ha	1.5 2.0 ha	> 2.0 ha	Average
1965 67	1.0	1.0	1.0	1.0	1.0	1.0
1968 70	1.1	1.1	1.1	1.2	1.1	1.1
1971 73	1.5	1.4	1.4	1.3	1.3	1.4
1974 76	1.3	1.3	1.3	1.3	1.3	1.3
1977 79	2.2	2.1	2.0	1.9	1.9	2.0
1980	3.6	3.2	3.0	3.0	2.6	3.0

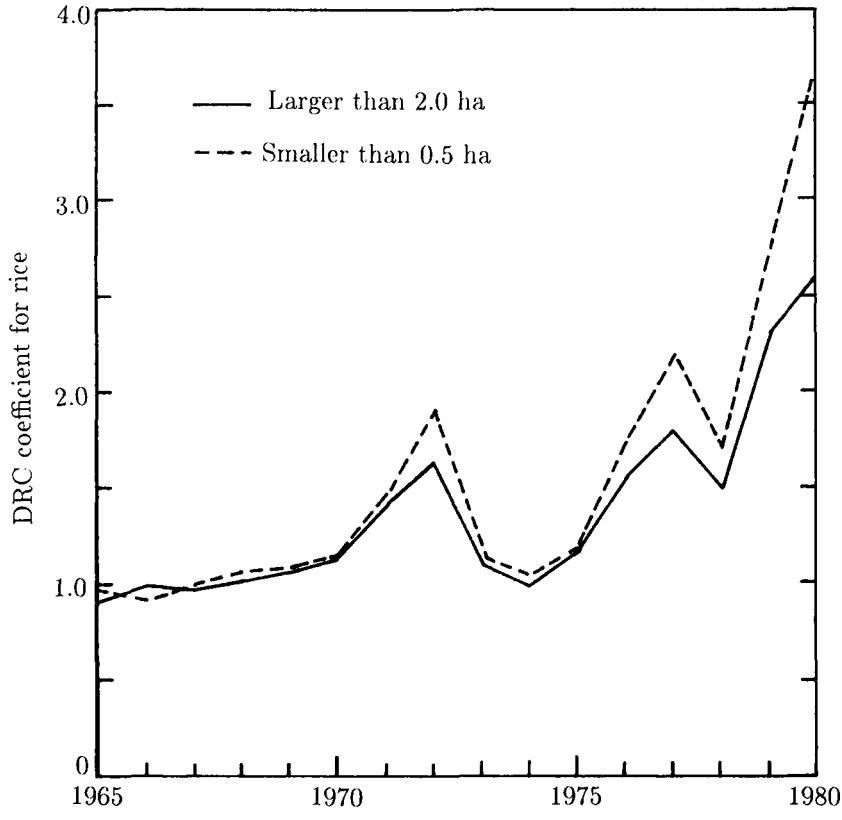
Source: In-Chan Ahn, 1982. *Changing Comparative Advantage in Korean Agriculture: A Domestic Resource Cost Study.* Master's thesis, Australian National University. Canberra, Australia. Table 5.4.

more between these periods, from 0.8 to 1.6 and 4.5 (Ahn, 1982, Table 5.8). Similar or perhaps greater rises may have occurred in the livestock industries: although their nominal protection coefficients have risen by amounts similar to those for crops (Table 2), the value-added share of output in livestock production is lower and is falling more rapidly than for crops as the feeding of grains (imported free of duty) becomes more common (Anderson, 1981, p. 9). Thus even if the Korean society believes the benefits from this policy are worth the costs today, it needs to appreciate that those costs will probably continue to rise relative to the benefits.

Korea's agricultural protection policy has undoubtedly slowed the decline in national food self-sufficiency. It has also helped to ensure that household incomes of farmers have not fallen below those of urban wage and salary earners—in fact, the ratio of the two rose from an average of 74 percent in the latter half of the 1960s to 84 percent during the first half of the 1970s; it rose again to 97 percent in the second half of the 1970s (Anderson, 1981).

In evaluating policy, however, one must also examine the extent to which other factors contributed to these goals and the cost of chosen policies as compared with alternative policies. At least three other factors were also important causes of the rises in farm incomes and food self-sufficiency in Korea in the 1970s. The first was the very rapid response of farmers to increases in real wages in the manufacturing sector (6 percent a year in the first half of the 1970s and 16 percent in the second half) that attracted farm workers to part-time and full-time industrial jobs. It has been estimated that the percentage of the farm labor force leaving agriculture rose from less than 3 percent a year in the late 1960s to around 5 percent in the mid-1970s and then to more than 7 percent in the late 1970s (Y. S. Kim, 1980). The second important factor was on-farm adjustment. The rise in wages relative to the cost of farm machinery services has induced a substantial and increasing degree of capital-labor substitution on farms (see Table 1). As a result, farm labor productivity grew at 9 percent a year during the 1970s, compared with 5.6 percent in the late 1960s and only 0.7 percent in the decade before that (Ban, 1981). The third factor was

Chart 2—Domestic Resource Cost Coefficient for Rice by Farm Size, Korea, 1965–80



Source: In-Chan Ahn, 1982. "Changing Comparative Advantage in Korean Agriculture: A Domestic Resource Cost Study." Master's thesis, Australian National University. Canberra, Australia.

the development and dissemination of new farm technologies. High-yielding, fertilizer-responsive rice varieties boosted land productivity in the 1970s by almost 6 percent a year compared with less than 2.5 percent in the 1960s (Ban, 1981). This not only raised farm incomes but also boosted food self-sufficiency and forestalled some decline in efficiency.

Thus society's needs have been met in large part by the ability of farmers to adjust efficiently to changing economic circumstances: their adoption of profitable new technologies as they became available; their substitution of machinery for labor and draft power as relative factor prices changed; and, most important, their ability to allow some members of their families to leave

agriculture and obtain employment in the nonfarm sector.

In view of the high and rapidly rising cost of Korea's current agricultural protection policies, perhaps emphasis should be given to assisting families in adjusting to changing circumstances rather than to protecting them from those pressures.

CITATIONS

In-Chan Ahn, 1982. "Changing Comparative Advantage in Korean Agriculture: A Domestic Resource Cost Study." Master's thesis, Australian National University. Canberra, Australia.

Narongchai Akrasanee and Atchana Wattananukit, 1977. "Comparative Advantage in Rice Production in Thailand." *Food Research Institute Studies*, Vol. 15, No. 2, 1976.

Kym Anderson, 1980. "Changing Agricultural Comparative Advantage in the Pacific Basin." Chapter 2 in Kym Anderson and Aurelia George, *Australian Agriculture and Newly Industrialising Asia: Issues for Research.* Australia-Japan Research Centre. Canberra, Australia.

_____1981. "Northeast Asian Agricultural Protection in Historical and Comparative Perspective: The Case of South Korea." Australia-Japan Research Centre Research Paper No. 82. Canberra, Australia.

_____1983. "Growth of Agricultural Protection in East Asia." *Food Policy*, Vol. 8, No. 4.

Kym Anderson and Yong-Jae Joo, 1984. "South Korea's Rapid Industrialisation: Implications for Agricultural Trade." In Mike Adams, ed. *Economic Development in East and Southeast Asia.* Australian Government Publishing Service for the BAE. Canberra, Australia.

Bela Balassa, 1965. "Trade Liberalization and 'Revealed' Comparative Advantage." *Manchester School of Economic and Social Studies*, Vol. 33, No. 2.

Sung Hoon Ban, 1981. "The Growth of Agricultural Output and Productivity in Korea, 1918 to 1978." *Journal of Rural Development*, Vol. 4, No. 1.

Charles R. Frank, Kwang-Suk Kim, and Larry Westphal, 1975. *Foreign Trade Regimes and Economic Development: South Korea.* Columbia University Press. New York.

Robert W. Herdt and Teresa A. Lacsina, 1977. "The Domestic Resource Cost of Increasing Philippine Rice Production." *Food Research Institute Studies*, Vol. 15, No. 2, 1976.

Wontack Hong, 1979. *Trade, Distortions and Employment Growth in Korea.* Korea Development Institute Press. Seoul, Korea.

Dong-Hi Kim and Yong-Jae Joo, 1982. *The Food Situation and Policies in the Republic of Korea.* OECD Development Centre. Paris, France.

Dong-Il Kim, 1980. "A Profile of Korean Rural Villages, Farms and Their Changing Quality of Life." *Journal of Rural Development*, Vol. 3, No. 2.

Kwang-Suk Kim and Michael Roemer, 1980. *Growth and Structural Transformation.* Studies in the Modernization of the Republic of Korea: 1945–1975, Harvard East Asian Monograph No. 86. Harvard University Press. Cambridge, Massachusetts.

Young-Sik Kim, et al., 1980. *Decreasing Farm Labour Force and Farm Mechanization* (in Korean). Korea Rural Economics Institute. Seoul, Korea.

Anne O. Krueger, 1979. *The Developmental Role of the Foreign Trade Sector and Aid.* Studies in the Modernization of the Republic of Korea: 1945 1975, Harvard East Asian Monograph No. 87. Harvard University Press. Cambridge, Massachusetts.

Leon A. Mears, 1977. "The Domestic Resource Cost of Rice Production in the United States." *Food Research Institute Studies,* Vol. 15, No. 2, 1976.

Eric Monke, Scott R. Pearson, and Narongchai Akrasanee, 1977. "Comparative Advantage, Government Policies, and International Trade in Rice." *Food Research Institute Studies,* Vol. 15, No. 2, 1976.

Pal-Yong Moon, 1976. "The Evolution of Rice Policy in Korea." *Food Research Institute Studies,* Vol. 14, No. 4, 1975.

Chong H. Nam, 1981. "Trade and Industrial Policies and the Structure of Protection in Korea." In Wontack Hong and Larry Krause, *Trade and Growth in the Advanced Developing Countries.* Korea Development Institute Press. Seoul, Korea.

Ho-Sung Oh and Jeung-Boo Kim, 1980. "A Partial Analysis of Technical Efficiency and Returns to Scale in Korean Rice Production." *Journal of Rural Development,* Vol. 3, No. 1.

Scott R. Pearson, Narongchai Akrasanee, and Gerald C. Nelson, 1977. "Comparative Advantage in Rice Production: A Methodological Introduction." *Food Research Institute Studies,* Vol. 15, No. 2, 1976.

Carson Kung-hsien Wu and Yu-kang Mao, 1977. "Interregional Comparative Advantage of Rice Production in Taiwan." *Food Research Institute Studies,* Vol. 15, No. 2, 1976.

APPENDIX

DETAILS OF DRC CALCULATIONS

Official survey production cost data provide the private unit cost of productive factors and inputs used in producing rice for each of five different farm-size groups and for an average of all farm sizes.[1] These are average rather than marginal production costs. They therefore underestimate marginal costs to the extent that the supply curve slopes upward, and so will likely lead to underestimates of the DRCs.

Labor and capital markets are assumed to operate efficiently and without distortion so that the market prices for farm labor and capital are assumed to measure both private and social costs of these factors. This is a reasonable assumption for Korea, where unemployment is low and capital and labor are quite mobile among sectors.[2] If family labor is imputed at an excessive value

[1] See the Ministry of Agriculture and Fisheries' annual publication, *Report on the Results of the Production Cost Survey for Agricultural Products.*

[2] For the precise extent of distortions in Korea's factor markets, see Hong (1979).

in the *Survey* calculation, however, DRCs may be overestimated, more or less offsetting the bias caused by using average rather than marginal costs.

In Korea, the landowner receives the residual return to crop production net of costs of inputs and factors other than land, and this is assumed to be the private rental value of land services.[3] The social opportunity cost of land services is the social profitability of land in its best alternative use. This could not be determined accurately, particularly since there were restrictions on the use of paddy land for alternative crops and all the alternative crops were also highly protected from import competition. Thus an arbitrary assumption had to be made that if all crop protection and land-use restrictions were removed, the most profitable use for land other than rice would yield a return equal to the private profitability of land in rice deflated by the average nominal protection coefficient for all major crops.

All intermediate inputs used in growing rice and barley are assumed to be tradable and their prices undistorted except for seed. Korean seed prices are converted to world prices by dividing by the nominal protection coefficient on output. Fertilizer prices are converted into world prices assuming that the ratios of domestic to world prices for all fertilizers are the same as for urea, for which data are available (Anderson, 1981).

It is assumed throughout that the official exchange rate approximates the shadow price of foreign exchange. Since for all distortions to be removed the Korean won would probably have to be devalued as well, this assumption will cause the DRC to be overestimated somewhat. This is not judged to be a serious problem, however, since this study is concerned with the direction of change in DRCs more than with their absolute magnitude. The extent of overvaluation has probably grown little because, even under free trade, agriculture's share of imports would have declined, thus offsetting the effect on the exchange rate of the growth in agricultural protection.

[3] Strictly speaking, this residual goes to management as well as land, but since most farm land in Korea is managed by the owners it is not necessary for present purposes to distinguish between these two factors.