INTERNATIONAL GRAIN TRADE, 1950-80

BY ERIC A. MONKE
DEPARTMENT OF AGRICULTURAL ECONOMICS

June 1983

The University of Arizona
College of Agriculture
Agricultural Experiment Station, Technical Bulletin 247

International Grain Trade, 1950-80*

by

Eric A. Monke*

* I would like to thank Jimmye S. Hillman, Clifford Lewis and Scott R. Pearson for many helpful comments and Mary Shelley and Barbara Sears for assistance in preparation of the manuscript.

June 1983

College of Agriculture
The University of Arizona
Tucson, Arizona 85721

Table of Contents

List of Tables

List of Figures

I. Introduction

Few aspects of the post-war development of the grain economy have received more attention than international trade. While few would argue with the need to trade grain within national borders, international trade in such basic commodities appears to many as a sign of political fallibility or a faltering agricultural economy. The patterns of trade have also led to controversy. The prominence of developed countries on the export side of the market and less-developed countries on the import side has targeted international grain trade as a prime example of the dependency in North-South relations. Patterns of trade have also thrust grain into the East-West conflict, if not as a political weapon, then as an economic one in which export cartels would fix prices to maximize benefits to Western grain producers and governments. How has international trade come to occupy such a controversial position in the world grain economy? While the patterns of trade are readily observable and well understood, the same cannot be said of the economic forces that are responsible for those patterns. As Johnson (1973), Josling (1974) and others have observed, international trade and policy can be no more than an extension of production and consumption policy at the domestic level, a connection that is frequently forgotten or misrepresented in the shrillness of political debate. This survey of the international grain market focuses on these relationships.

Part of the reason for the interest in trade has been its extraordinary rate of growth, described in Section 2. Annual trade in grains increased from about 40 to 210 million metric tons (mt) over the 1950-80 period, a rate of about 5.7 percent per year, while total production increased at an annual rate of only 2.6 percent. Much of the growth in import demand emanated from the less-developed countries (LDCs), and this pattern has fueled the popular belief that population and floundering production performance were principal forces behind trade expansion. As the third section demonstrates, however, these factors can explain only a small portion of the increase in import volume (principally in Africa and the Far East). Estimates of the relationships between income, direct and indirect demand for grain implicate income growth as a far more significant factor and suggest that the international market has served largely to augment consumption rather than supplant domestic production.

A salient feature of the international market is the overwhelming dominance of governments as economic agents. The fourth section of the paper describes the pattern of government controls over international trade and implicates trade policy as a cornerstone of domestic grain policy in almost all countries. Government monopolies or quantitative controls on imports/exports mean that international prices are of only limited relevance to most consumers and producers. Thus price behavior on international markets, described in section five, says as much about government policy

actions as about consumer-producer response. Many of the concerns about international trade, such as the substantial degree of price fluctuation and availabilities of foreign exchange to purchase imports are voiced by government policy-makers rather than domestic consumers and producers, as the vagaries of the international market complicate the management of domestic grain policies. The sixth section investigates the empirical validity of some of the complaints about trade. Conclusions are provided in the final section.

II. Growth of the Grain Trade, 1950-80

Data for total cereal trade confirm two popular conceptions about trade--its rapid growth and the dominance of the developed market economies in both imports and exports. Table 1 provides estimates of exports and imports of total cereals, wheat, maize and rice for the period 1948/52 through 1979/80.[1/] The latter three grains comprise about 85 percent of total cereal trade and 80 percent of total cereal production, shares that have remained relatively stable throughout the survey period. Barley, rye, oats, sorghum and millet account for the remainder. Total trade volume increased from 42 to 210 million mt over the three decades, with most of the increases occurring since 1960. World grain trade grew more rapidly than trade in most other categories of agricultural products during the post-war era. Food and Agriculture Organization (FAO) trade indices, for example, indicate that total agricultural trade doubled during the 1961-80 period, while grain trade volumes more than tripled.

Developed market economy exporters, primarily the US, Canada, France and Australia, accounted for 150 million of the 170 million mt increase. By 1980, these four countries were providing nearly 85 percent of total cereal exports.[2/] The developed countries also dominate the import side of the market, although their trade share has declined from 68 to 57 percent over the period. This decline would have been much more substantial were it not for the increase in imports by the USSR and Eastern Europe. In absolute terms, the greatest increases in imports were registered by the developing market economies (58 million mt), followed by the developed market economies (46 million mt), the developed centrally-planned economies (CPEs) (approximately 45 million mt) and the developing CPEs (19.5 million mt).

[1/] FAO data are usually based on official statistical reports from individual countries. Estimates for the early periods and the centrally-planned economies are the least reliable among the data represented in Table 1. Estimates of year-end in-transit shipments represent an additional difficulty for the preparation of calendar year data. Totals of exports and imports are reasonably consistent, however, and differ rarely by more than two or three percent.

[2/] Exports in 1980 by the US, Canada, France and Australia were 113, 22, 20 and 19 million mt, respectively.

TABLE 1. ANNUAL AVERAGE WORLD GRAIN TRADE, 1948/52 - 1979/80. [a]

Year	EXPORTS					IMPORTS				
	Developed		Developing		Total	Developed		Developing		Total
	Market	CPEs	Market	CPEs		Market	CPEs	Market	CPEs	
	(million metric tons)									
	TOTAL CEREALS									
1948/52	30.7	0.5	10.2	0.2	41.5	28.2	na	12.9	0.1	41.2
59/61	49.4	8.1	11.8	-	69.3	37.8	7.9	21.5	-	67.2
69/71	79.8	10.3	18.2	1.8	110.1	57.9	11.0	33.0	6.8	108.7
79/80	179.1	6.0	23.3	2.0	210.4	74.6	46.3	71.1	19.6	211.6
	WHEAT									
1948/52	22.4	na	2.9	na	25.3	16.9	na	7.8	na	24.7
59/61	31.5	5.9	2.6	-	40.0	16.7	6.2	14.6	-	37.5
69/71	44.2	8.0	2.5	-	54.7	18.6	6.8	22.9	5.3	53.6
79/80	79.8	4.8	6.1	-	90.7	20.0	18.9	40.6	12.9	92.4
	MAIZE									
1948/52	2.8	0.2	1.5	0.1	4.6	4.4	na	0.5	na	4.9
59/61	7.6	0.6	3.4	-	11.6	10.6	0.6	0.6	-	11.8
69/71	19.1	1.2	9.0	-	29.3	24.2	1.6	2.4	0.6	28.8
79/80	69.7	0.7	7.4	0.2	78.0	37.8	19.6	15.1	5.1	77.6
	RICE									
1948/52	0.8	na	3.8	na	4.6	1.0	na	3.2	0.1	4.3
59/61	1.2	0.1	4.3	-	5.6	0.9	0.8	4.6	-	6.3
69/71	2.9	-	3.8	1.7	8.4	0.9	0.6	6.1	0.7	8.3
79/80	4.6	-	5.9	1.8	12.3	1.6	1.0	9.2	0.6	12.0

Sources: Food and Agriculture Organization, Trade Yearbook, 1959, 1963, 1972, 1975, 1978, 1980.

- less than 50,000 mt

na not available

[a] The country classification follows that currently used by FAO, with earlier data adjusted to maintain consistency. The developed market economies include the countries of Western Europe, Canada, the United States, Australia, New Zealand, Japan, Israel and South Africa. Developed CPEs are the countries of Eastern Europe and the USSR. Developing CPEs include the PRC, Vietnam, the Khmer Republic, Laos, and North Korea. Developing market economies comprise the remaining countries.

Table 1 also demonstrates the significant changes that occurred in the commodity composition of cereal trade. Wheat was the dominant traded grain at the onset of the period, accounting for 60 percent of total trade volume. By 1980, however, maize trade had grown almost as large as that of wheat, increasing from five to 78 million mt. More than 50 million mt of the increase in maize imports was due to demands of the developed countries, reflecting the importance of increased meat consumption. The slower growth in wheat trade was due largely to the stagnant demand among the developed market economies. Low or negative income elasticities of direct demand, the limited use of wheat as an animal feed and policies to promote domestic production were significant factors in forestalling substantial growth in imports within this category. In contrast, wheat imports in the developing economies increased sharply, and by 1980 this group of countries accounted for nearly 60 percent of total wheat imports.

Rice remained a minor grain throughout the period, and the share of rice in total cereal trade declined from 10 to 6 percent. Although aggregate production is roughly equal among the three grains, only about three percent of rice production enters world trade, while about 20 percent of wheat and maize production are traded. Changes in rice trade volumes followed the pattern of wheat; developing countries registered the largest increases in imports, while developed countries accounted for most of the increase in exports.

III. Causes of Increased Trade

Changes in the patterns and volume of trade can only be understood in the context of changes in consumption and production. Population growth is perhaps the most obvious factor behind increased consumption. World population increased by about 75 percent during the 1950-80 period, as annual growth rates averaged about two percent in the developing countries and one percent in the developed countries. While population growth rates were unprecedented, the growth of cereal production was even more extraordinary, doubling over the period. In part, unprecedented rates of population growth are themselves responsible for production growth, due to the dominance of agriculture as an economic activity. Estimated agricultural population increased from 1.38 to 2.04 billion between 1950 and 1980,3/ and thus population growth alone can explain as much as half of the increase in world cereal production.

The realization of production potentials depended on a host of factors, such as availability of uncultivated land, substitution for other crops, expansion of multiple cropping and yield increases. Land expansion appears a

---

3/ FAO data. Early estimates of Chinese agricultural population are particularly uncertain. FAO estimates for 1950 of 377 million (FAO, Production Yearbook, 1963, p. 18) are close to the estimates of Tang and Stone (1980, p. 43) of 373 million.

less important factor, as harvested area of cereals increased by only 25 percent between 1950 and 1980, from 595 to 743 million hectares (ha). Most of this increase appears due to the substitution of cereals for other crops and increases in multiple cropping, rather than increased utilization of uncultivated land. FAO data for the 1970-80 period, for example, indicate that total agricultural cropped area increased by only 28 million ha, while harvested area of cereals increased by nearly 70 million ha.

Yield increases were roughly three times as important as land area expansion in the determination of increased production. Average cereal yields grew from 1.2 to 2.1 mt/ha, with most of the increase occurring since 1960. The principal factors responsible for these increases are well-known--increased chemical and fertilizer use (nitrogen fertilizer production, for example, increased from less than five to 60 million mt), expansion of irrigated area and the development and dissemination of fertilizer-responsive seed varieties. However, the global average conceals a substantial diversity in experience, both among regions and among particular cereal crops. Table 2 provides regional yield data for wheat, maize and rice. The developed economies (both market and CPEs) achieved yield increases equal to or greater than global averages for each of the grains. The developing CPEs (primarily China) have also achieved high growth rates, particularly in wheat and rice. The experience of the developing market economies provides a stark contrast, as yield increases were below global average for all three crops.

This generalization extends to individual regions as well, with the exception of rice in the Near East and wheat in the Far East. Wheat and rice yields increased by about 65 percent, while maize yields increased by about 45 percent. These figures highlight the rather limited impact of the Green Revolution on global food production. By 1980, high-yielding varieties of wheat and rice had been adopted on less than 60 million ha, or about 40 percent of rice and wheat area in the developing market economies. Maize was largely unaffected, and the share of improved varieties in total cereal production of the developing market economies is only about 20 percent.

The diversity in production growth rates among countries provides a supply-side explanation for the growth in international trade. Table 3 provides regional data for cereal production, imports and exports in per capita terms. Relatively high rates of yield increase and low rates of population growth in the developed countries resulted in substantial increases in per capita production and potential export availabilities. In contrast, low rates of yield increase and high rates of population growth resulted in virtual stagnation or declines in per capita production in the developing market economies, particularly since 1960. This effect is particularly significant in Africa and Latin America, where per capita production declined during the last decade by 30 and 10 kilograms (kgs), respectively; net imports per capita increased by 21 and 36 kgs. The regional data of Table 3 conceal even more diverse experiences among countries. Bachman and Paulino (1979), for example, found that per capita staple food production declined in 53 of 93 developing market economies during the 1961-76 period. Increased imports were thus necessary to maintain per capita grain availabilities in many developing market economies.

TABLE 2. CROP YIELDS, 1948/52 - 1979/80.

	1948/52	1961/65	1969/71	1979/80	Percent Change
			mt/ha		
			WHEAT		
WORLD	1.01	1.21	1.58	1.87	85
DEVELOPED					
Market	1.30	1.74	2.13	2.34	80
CPEs	0.84[a]	1.06	1.55	1.78	87
DEVELOPING					
Market	0.87	0.98	1.14	1.43	64
Africa	0.60	0.70	0.79	0.85	42
Latin America	1.05	1.43	1.40	1.47	40
Near East	0.91	1.00	1.07	1.43	57
Far East	0.79	0.84	1.20	1.51	91
CPEs	0.69	0.88	1.48	2.02	193
			MAIZE		
WORLD	1.58	2.17	2.54	3.16	100
DEVELOPED					
Market	2.31	3.50	4.35	5.48	137
CPEs	1.30[a]	2.15	2.81	3.71	185
DEVELOPING					
Market	0.97	1.13	1.28	1.39	43
Africa	0.76	0.91	1.01	0.90	18
Latin America	1.06	1.23	1.43	1.68	58
Near East	1.52	1.90	2.33	2.65	74
Far East	0.77	1.00	1.11	1.21	57
CPEs		2.43	2.57	2.98	23
			RICE (paddy)		
WORLD	1.61	2.04	2.38	2.71	68
DEVELOPED					
Market	3.27	4.91	5.39	5.40	65
CPEs	1.45[a]	2.48	3.43	3.98	174
DEVELOPING					
Market	1.42	1.62	1.84	2.10	48
Africa	0.97	1.28	1.35	1.35	39
Latin America	1.68	1.73	1.72	1.95	16
Near East	2.37	3.41	3.71	4.36	84
Far East	1.40	1.60	1.84	2.12	51
CPEs	2.17	2.61	3.29	3.84	77

Source: Food and Agriculture Organization, Production Yearbook, 1963, 1976, 1980.

[a] USSR only.

TABLE 3. CEREAL PRODUCTION AND TRADE, 1948/52 - 1979/80.

	CEREAL PRODUCTION				GROSS IMPORTS				GROSS EXPORTS				NET TRADE (- = exports, + = imports)			
	1948 -52	1960 -61	1969 -71	1979 -80	1948 -52	1960 -61	1969 -71	1979 -80	1948 -52	1960 -61	1969 -71	1979 -80	1948 -51	1960 -61	1969 -71	1979 -80
	(Kgs/capita)				(Kgs/capita)				(Kgs/capita)				(Kgs/capita)			
DEVELOPED																
Market Economies	508	548	582	692	59	69	80	95	64	90	110	229	-5	-21	-30	-134
CPEs	407	579	665	684	na	26	32	123	2	26	30	16	na	0	2	107
DEVELOPING																
Market Economies	178	199	212	207	11	14	19	32	8	8	11	11	3	6	8	21
Africa	144	143	153	123	6	11	15	34	8	7	3	1	-2	4	12	33
Latin America	192	218	246	236	20	22	29	60	26	25	41	36	-6	-3	-12	24
Near East	223	241	257	262	16	30	38	87	11	5	6	6	5	25	32	81
Far East	177	204	212	215	8	12	14	14	5	5	5	7	3	7	9	7
CPEs	270	233	257	302	na	9[a]	8	19	-	1	2	2	na	8	6	17
WORLD	286	308	339	357	16	22	30	48								

Sources: Appendix Table 1; Food and Agriculture Organization, Trade Yearbook 1959, 1963, 1972, 1975, 1978, 1980. Rome, Italy. Tang and Stone, 1980, Food Production in the People's Republic of China, International Food Policy Research Institute Research Report N. 15, Washington, D.C.

[a] Estimates for 1961 (Tang and Stone, 1980, p. 31).

Estimates of cereal production in individual countries and population growth can be used to provide rough approximations of the contribution of these two factors to the growth in import demand for cereals over the 1950-80 period. The contribution of production declines to increased imports can be estimated as

$$\sum_i POP_i^{1980} \left(Q_{si}^{1950} - Q_{si}^{1980}\right) ,$$

where the subscript i refers to importing countries that experienced declines in per capita cereal production during the period, POP refers to population and Qs represents per capita production. Appendix Table 2 provides data on per capita cereal production. Fifty-one countries demonstrated declines during the 1950-80 period. Africa accounts for 24 of the countries with declining per capita production.Only two developed countries (Japan and Portugal) and one CPE (Kampuchea) experienced declines in per capita cereal production over the 30 year period.

The impact of population growth can be estimated in a similar fashion, as

$$\sum_j M_j^{1950} \left(POP_j^{1980} - POP_j^{1950}\right) ,$$

where Mj represents gross imports in the jth region.

Sources of growth estimates are dependent on the selection of time frame, and a decade-by-decade perspective would undoubtedly produce some difference in estimates of the importance of particular factors. The countries with declining production identified by Bachman and Paulino for the 1961-76 period, for example, differ slightly from those that experienced declines in the 1950-80 period. The ceteris paribus assumption should also be emphasized. The impact on cereal imports of production declines in non-cereal staples are ignored, for example, and thus the effect of declines in per capita production will be understated. This source of bias is probably small, however, as total cultivated area of roots and tubers in LDCs was only about 35 million has in 1980. Total production in LDCs increased from 146 to 341 million mt during the period.

In spite of these shortcomings, some useful generalizations emerge from the results, presented in Table 4. Declines in per capita production can account for a substantial proportion of the growth in imports in Africa and the Far East. For Latin America and the Near East, however, these factors cannot explain very much. In the developing market economies as a whole, maintenance of per capita cereal availabilities at their 1948/52 levels would have required only 30 million mt of increased imports, or about half of the observed change in import demands. For the CPEs, these factors account for only ten percent of the growth in imports. In total, 63 percent of the increase in import demand remains as an unexplained residual.

TABLE 4. SOURCES OF GROWTH IN IMPORT DEMAND FOR CEREALS, 1948/52 - 1979/81.

Region	Total Growth	Effects on Import Demand of: Declines in Per Capita Production	Population Growth	Residual
		(million mt)		
DEVELOPED				
Market Economies	46.02	9.33	17.83	18.86
CPEs	46.30	0	1.74[a]	44.56
DEVELOPING				
Market Economies	58.34	19.02	10.80	28.52
Africa	(11.50)	(9.66)	(1.11)	(0.73)
Latin America	(18.59)	(1.90)	(4.04)	(12.65)
Near East	(17.04)	(2.34)	(1.80)	(12.90)
Far East	(11.21)	(5.12)	(3.83)	(2.26)
CPEs	19.58	1.38	3.14[a]	15.06
TOTAL	170.24	29.73	33.51	107.00

Sources: See Appendix Tables 1,2.

Notes: [a] Calculations for CPE's are made for the 1960-80 period, due to lack of data on intra-CPE trade for the 1948/52 period. Trade between market economies and CPE's was extremely small during this period, but increased substantially during the 1950's. If per capita imports by CPE's during the 1948/52 period were assumed equal to those of 1960, the effects of population growth on trade would increase to 2.77 and 4.15 million mt for the developed and developing CPE's, respectively. These calculations yield overestimates, and do not alter the conclusions presented in the text.

The residual column of Table 4 comprises a potpourri of effects--increases in per capita production, and consumption effects induced by changes in real prices and incomes. Most importing countries demonstrated increases in per capita cereal production, and these production increases reduced import requirements. Since the residuals are positive in all regions, however, this category of production effects must be dominated by demand forces. While real grain prices declined during the 1950s, most of the increases in trade volume occurred after 1960, a period in which real grain prices were constant (see below). Thus relative price changes for consumers are not likely to provide a significant factor in the explanation of the residual of Table 4.[4/] Income growth emerges as a principal force in increased import demand.

Two empirical generalizations--Engel's Law and Bennett's Law--are useful to elucidate the role of income growth in increased demand and world trade. Engel observed that the expenditure elasticity of demand for food is less than one and declines as incomes increase. A key implication of this result is that income growth in LDCs will have a larger proportional impact on food demand than an equivalent growth rate among consumers in developed countries. In the case of cereals, this generalization extends to absolute quantities as well, since income elasticities of direct demand are zero or negative in the DCs. Mellor (1960) and Heady (1962) provide estimates of -0.2 to -0.5 for DC consumers for the 1950s and 1960s. At higher income levels, elasticities probably tend toward zero. US expenditure data for the 1965-1981 period, for example, show no significant change in the per capita consumption of cereals (USDA, 1981).

Income elasticities of direct demand appear low in most developing economies as well, although significantly greater than zero. Studies by Mellor (1960), Timmer (1971) and Timmer and Alderman (1979), for example, suggest a range of elasticities for cereal demand between 0.1 and 0.7. These elasticities usually are based on expenditure data, and quantity elasticities are probably somewhat lower. But even with low elasticities, the income growth of the developing world during the post-war period was substantial enough to cause major increases in per capita grain demand. Real incomes roughly doubled during the 1950-75 period (see Morawetz, 1977) and even if the average quantity elasticity was as low as 0.2, per capita grain consumption would increase by about 20 percent (at constant real prices). The data of Table 2 indicate an increase in per capita consumption of about this magnitude.

4/ Section four demonstrates that world prices have no necessary implications for domestic consumers, due to government monopolization of international trade. Thus a necessary condition for the elimination of real price change as a determinant of increased trade is that the rate of protection of domestic consumers is constant or declining over time. Such a presumption is probably reasonable in the aggregate, but is clearly not accurate for all countries. In the USSR, for example, nominal prices of flour were held constant throughout most of the 1960-80 period.

Engel's Law is of little use in explaining increased demand in the developed countries, however, as income elasticities are near zero or negative. This group of countries accounted for about 90 of the 170 million mt increase in imports between 1950-80. Bennett's Law identifies the linkages between income and increased grain demand in these countries. Bennett's Law states that as incomes increase the share of the food budget devoted to starchy staples will decline. As a result, the budget shares devoted to animal products (and other non-cereals) will increase. Thus total grain demand may increase indirectly via the use of grains in the production of meat, eggs, milk and milk products. Income elasticities of demand for these products appear significantly positive at all income levels. Mellor (1966) provides data for 1960 which show meat demand elasticities in developed countries ranging from 1.7 to 0.4, generally varying inversely with respect to income level. Since the ratios of grain input to animal production are well above unity for most animal products, these income elasticities will exert a magnified impact on grain demand.

Cross-sectional data for feed grain consumption in 1978 are used to estimate a relationship between income and grain for feed. Cross-sectional estimates are complicated by a number of factors. Government policies frequently influence both prices and availabilities of animal feeds. Pasture may substitute for grains in the production of most meat products. Meats vary substantially in the efficiency of grain conversion, and cross-country differences in preferences for types of meat can create substantial variation in feed grain consumption. Relative prices and availabilities of animal products vary substantially across countries. Finally, observations at the national level reflect a particular income distribution within the country. While these differences are probably not systematically correlated with income level, the resulting left-out variable problem causes high standard errors and reduces the probability of statistically-significant estimates.

In spite of these drawbacks, significant relationships appear between income level and indirect grain use. Equation (1) presents the results of a double logarithmic estimation of feedgrain consumption in 1978 in 36 countries. The data are presented in Appendix 3.

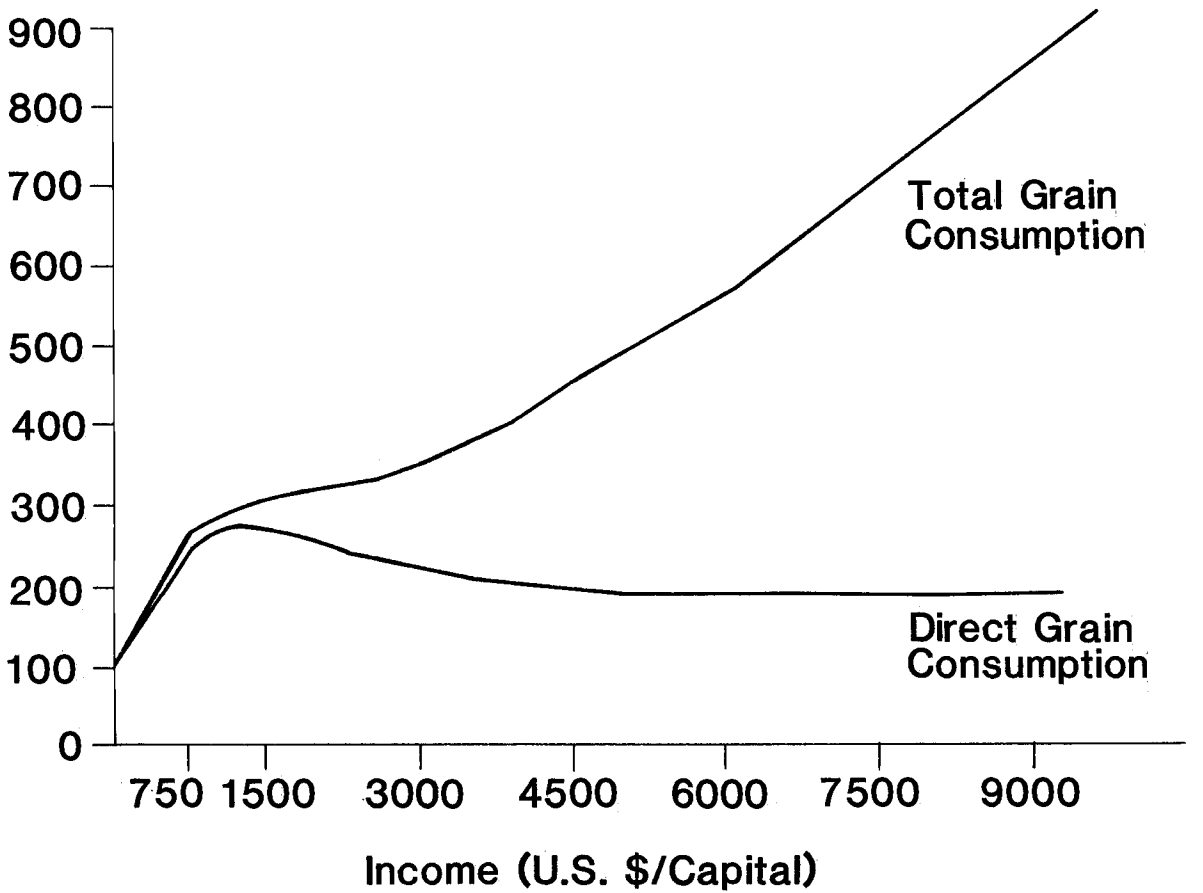
$$\ln C_{Feed} = -6.57 + 1.43 \ln Y \qquad (1)$$

$$(-5.96)\ (8.91)$$

$$\bar{R}^2 = 0.69 \qquad F_{(1,34)} = 79.42 \qquad DW = 1.83$$

As expected, the intercept is negative, because feedgrain consumption is zero at the lowest income levels. The demand for feedgrains is income-elastic, a result of the magnified effect of income elasticities for meat demand. The results of equation (1) are presented graphically in Figure 1, together with data on direct grain consumption. Feedgrain consumption becomes

Figure 1.
Income and Grain Consumption, 1978



positive at per capita incomes of $100[5/] and remains fairly small in absolute quantities until per capita incomes surpass the $2000 range. At incomes of about $3,800, indirect demand for grain reaches 185 kgs, roughly equivalent to direct consumption, and increases rapidly thereafter. At the highest income level ($9,500), indirect grain consumption is nearly four times as large as direct grain consumption.

Income thus provides the key to understanding increases in grain imports by the developed as well as the developing economies. In spite of major increases in per capita cereal production in nearly all developed economies, consumption and imports increased even more rapidly. Net imports in the developed CPEs, for example, rose from zero to 107 kgs per capita between 1960 and 1980, in spite of per capita production increases of 105 kgs per capita during the same period. In sum, the data suggest that the growth of international grain trade served primarily as a means to augment per capita consumption levels rather than as a substitute for lagging domestic production in particular countries. As the following section demonstrates, government domestic price policies for consumers and producers are largely responsible for the prominent role of the international market in facilitating consumption growth.

IV. Government Policy and International Trade

One indication of the importance of government policy for the growth and price behavior of the international grain market is provided by a comparison of domestic wholesale prices with cif or fob prices. With free trade, domestic grain prices would equal border prices, and differences between the two thus indicate the presence of imperfect competition in production or marketing or gax/subsidy distortions created by government policy. Since large numbers of firms are involved in grain production and processing in most countries, price divergences invariably reflect the presence of government tax/subsidy policies. Table 5 and Appendix Table 4 list estimates of domestic nominal protection coefficients (the ratio of the domestic wholesale price to the cash, insurance and freight (cif) or free on board (fob) price) for a number of countries in the late 1970s. The list is drawn from a number of sources and comprises about 95 percent of world wheat and maize consumption and 92 percent of world rice consumption.

When multiple estimates of coefficients are available, the extreme values of the coefficients are indicated. In only six cases do studies disagree over the issue of subsidization or taxation of consumers--wheat in Australia, maize in Thailand, Malawi and South Africa, and rice in Senegal and Argentina. Rather, differences among the studies occur mainly in the estimation of the

---

[5/] This effect is undoubtedly a reflection of intra-country income distribution. Even the countries with the lowest average income levels have sizable populations with incomes sufficiently large to allow for the consumption of meat.

TABLE 5. CONSUMPTION AND NOMINAL PROTECTION COEFFICIENTS FOR CEREALS, 1975-80.

Region	WHEAT			MAIZE			RICE		
	NPC < 0.95	0.95 < NPC < 1.05	NPC > 1.05	NPC < 0.95	0.95 < NPC < 1.05	NPC > 1.05	NPC < 0.95	0.95 < NPC < 1.05	NPC > 1.05
	Share of World Consumption (percent)								
DEVELOPED									
Market Economies	1.72	5.87	13.48	0	36.29	11.79	0.07	0.75	4.41
CPEs	31.76	0	0	10.51	0	2.12	0.81	0	0
DEVELOPING									
Market Economies									
Africa	1.55	0.34	0.44	1.29	0.03	0.81	0.25	0.16	0.79
Latin America	3.73	0.22	0.74	9.84	0.37	1.24	0.18	3.15	0
Near East	5.42	1.59	0.11	0.99	0.16	0.39	0.56	0.04	0.10
Far East	11.01	0.16	0.86	3.40	0.46	1.32	39.20	2.55	2.95
CPEs (China only)	16.00	0	0	14.16	0	0	35.98	0	0
TOTAL [a]	71.19	8.18	15.68	40.19	37.31	17.67	80.02	3.68	8.25

Sources: See Appendix Table 4.

Notes: [a] Coefficient values are not known for 4.95, 4.83 and 8.05 percent of wheat, maize and rice consumption, respectively.

magnitude of subsidization or taxation. This variation is expected, given the differences in choice of base year and hence world prices. Official exchange rates of many countries have also changed significantly during the 1970s. Some of the estimates utilize shadow rather than official rates of exchange, because currencies in many developing and centrally-planned economies are believed overvalued. In this case, nominal protection coefficients will be smaller when estimated at the shadow rate of exchange than when measured at the official rate. Universal application of shadow prices of foreign exchange will thus shift the observed distribution of nominal protection coefficients toward values less than one.6/ Finally, errors may result if estimates do not compare identical qualities of grain. White corn, for example, commands approximately a 20 percent premium to yellow corn on international markets, and comparison of domestic white corn prices to international prices for yellow corn could suggest taxation of consumers where none exists. Most information sources appear well aware of this potential problem, however.

The results suggest major differences between grain policies of the developed market economies and those of the rest of the world. In the first group, only eight percent of wheat consumption and one percent of rice consumption takes place under conditions in which domestic prices are less than world prices. The remainder of developed country consumers pay domestic prices for the major grains that are equal to or greater than world prices. Among the remaining country categories, consumers are generally subsidized. In only a few countries--Ghana, Nigeria, Zaire, Colombia, Guatemala, Taiwan and Korea--do consumers face grain prices that are above world price levels. Particular grains are taxed in some countries--wheat in Thailand and the Philippines, for example--but these cases do not usually involve the primary staple of the particular country. In all developing country regions except Africa, the vast majority of countries subsidize consumption of the primary staple.

6/ No theoretical considerations mandate the use of shadow rather than official rates of exchange. First, foreign exchange accounts are not out of balance in most countries, as foreigners are unwilling to accumulate the relevant domestic currency. Thus the official exchange rate reflects an equilibrium in foreign balances. Second, the use of shadow prices ignores the tax (subsidy) on consumption that is caused by an overvalued (undervalued) exchange rate. Finally, foreign exchange rates do not have to be altered to reflect the opportunity costs of commodities and resources. The only requirement of equilibrium is that the relative prices of nontraded and traded commodities reflect a particular ratio. This equilibrium can be achieved at fixed exchange rates, domestic commodity price adjustments or by alteration of the prices of domestic factors of production. Factor price changes may occur in addition to, or in complete substitution for, changes in the domestic currency prices of tradable goods. Changes in factor prices will affect factor incomes and the quantity consumed of tradable goods, but given the small shares of most countries in total consumption of cereals, these income-induced changes in demand will have no effect on world prices or the net protection coefficient. See Bruno (1976) and Dornbusch (1973).

The aggregate results are presented in the final row of Table 5, and indicate the dominance of subsidy policies in world grain consumption. The results are particularly striking for wheat and rice; more than 70 percent of wheat consumption and 80 percent of rice consumption takes place at prices below world market levels. In contrast, only 40 percent of maize consumption appears subsidized, reflecting the much larger shares of the developed market economies in world consumption (48 percent), and its widespread use as an animal feed rather than as a staple for human consumption. Only 16 percent of wheat, 18 percent of maize and eight percent of rice consumption is taxed. The developed market economies account for more than two-thirds of the wheat and maize totals and half of taxed rice consumption.

The patterns of nominal protection coefficients reflect substantial differences in domestic objectives across countries. In the developed market economies, high consumer prices have been utilized as a means of effecting income transfers to domestic producers and attaining a substantial degree of price stability for both groups (Johnson, 1973; Josling, 1974). The variable levy is particularly well-suited to the stability objective in this circumstance, since world price fluctuations result only in fluctuations in tariff revenues. Further, these policies are recognized by some as a means of exerting monopoly power in trade (Carter and Schmitz, 1979; Sarris and Schmitz, 1981), because the protectionist policies of Western Europe and Japan are seen capable of changing the terms of trade with grain exporting countries by decreasing world market prices.

The data of Table 5 show, however, that protectionist policies are far from dominant in world markets. Low consumer prices have been the principal objective in most countries. In both the developing and developed centrally-planned economies, price subsidies are critical policies to maintain low-cost wage goods in the industrial sector and to ensure nutritional adequacy for low income consumers (Timmer and Falcon, 1971; Chibber, 1979; Parker and Coyle, 1981). Unless production is equally subsidized, reliance on international markets is larger than under free trade and world market prices are artificially high.

Production subsidy programs are not much more common than consumer tax programs; government budget constraints usually dictate trade monopoly policies that force domestic producers to provide part of the subsidy to consumers. In a study of rice in nine Asian countries, for example, Timmer and Falcon (1975) find an average ratio of producer prices of rice to fertilizer of about 0.5, while world price incentives would dictate a ratio two or three times as large (Falcon and Monke, 1979-80). A cross-section time-series production function, estimated in the former study, suggested that changes of this magnitude in prices would alter the net trade position of the sample of countries from zero to exports of ten-fifteen million mt. These amounts are roughly equal to total world trade of rice. Similar studies are not available for wheat and maize, but surveys of grain policies (Food and Agriculture Organization, 1973, 1976) indicate that producers are rarely subsidized with respect to world prices.

A second circumstance in which world market prices might not decline under free trade arises if rationing constrains consumption. Perhaps the most

significant programs in this regard include grain consumption in the developed CPEs, where meat rations may artificially constrain feedgrain demands. These constraints have become less important in recent years, however, as increases in meat supplies have been a principal objective of consumer policies in these countries (Poleman, 1975). In developing countries, such as China, Egypt and India, direct grain consumption does not appear constrained in most years, and both free market and ration shop prices are below world market prices (Timmer, 1976; Chibber, 1979; Parker and Coyle, 1981).

Price stability is also an objective of consumer-oriented policies, and government monopolies on foreign trade create the potential for maintenance of domestic stability in the face of world price fluctuations. In this case, however, increases in world prices or shortfalls in domestic production increase government expenditures rather than reduce government revenues as in the case of variable levies, and budget constraints may occasionally limit the extent to which imports can be increased. In addition, the government must predict quantities of domestic production and required consumption, an empirical task avoided by the use of a variable levy. As a result, stability under subsidized price levels has proven a more difficult task than stability under high price regimes.

Four alternative policy instruments are available to maintain divergences between domestic consumer prices and world market prices. Government monopolies could directly handle all grain imports and exports. Quantitative restrictions could be imposed, in which the private sector handles trade subject to quota or licensing arrangements. A third instrument involves trade tax/subsidy policies, such as tariffs or variables levies. A final alternative policy comprises free trade, in which divergences between domestic and world prices are maintained by the provision of direct taxes/subsidies to domestic consumers and producers.

Table 6 and Appendix Table 5 categorize the trade policies of countries in which domestic prices deviate substantially from world market prices. Government monopolies are the most common policy, accounting for 75 percent of distorted wheat consumption, 86 percent of distorted rice consumption and 63 percent of distorted maize consumption. These ratios reflect the importance of the CPEs, as foreign trade in almost all products is state-controlled. China and the USSR alone account for 40, 20, and 37 percent of world wheat, maize and rice consumption, respectively. In the developing market economies, government monopoly policies again predominate. Trade taxes and quantitative restrictions are the dominant instruments only in the developed market economies, with the variable levy systems of the European Economic Community (EEC) and other European countries of particular importance. In almost all countries where consumer prices differ from world prices, direct tax/subsidies on consumption are not utilized. Saudi Arabia and Guyana represent the only exceptions.

Three factors help to explain the reliance on trade policies rather than direct interventions in producer and consumer markets. First, alternative policies differ in their impact on the government budget. The theory of optimal taxes and subsidies (see, for example, Corden, 1974) suggests that trade interventions are never optimal ways to distort world prices, as trade

TABLE 6. GRAIN TRADE POLICIES. [a]

	Government Monopoly	Trade Quotas and Licenses	Trade Taxes/ Subsidies	Free Trade
	Shares of World Consumption (percent)			
		WHEAT		
Developed Market Economies	1.00	1.71	12.90	0
Developed CPEs	28.01	2.40	1.10	0
Developing Market Economies	20.53	1.39	1.80	0.30
Developing CPEs	16.00	0	0	0
TOTALS	65.55	5.58	15.23	0.30
		MAIZE		
Developed Market Economies	2.43	0.37	9.36	0
Developed CPEs	8.61	3.71	3.71	0
Developing Market Economies	13.87	3.13	2.93	0
Developing CPEs	14.16	0	0	0
TOTALS	39.07	7.21	16.00	0
		RICE		
Developed Market Economies	4.06	0	0.35	0
Developed CPEs	0.78	0	0	0
Developing Market Economies	37.54	8.75	3.29	0
Developing CPEs	35.94	0	0	0
TOTALS	78.36	8.75	3.64	0

Sources: See Apppendix Table 5.

Note: [a] Only those countries with net protection coefficients different from unity are included in this Table.

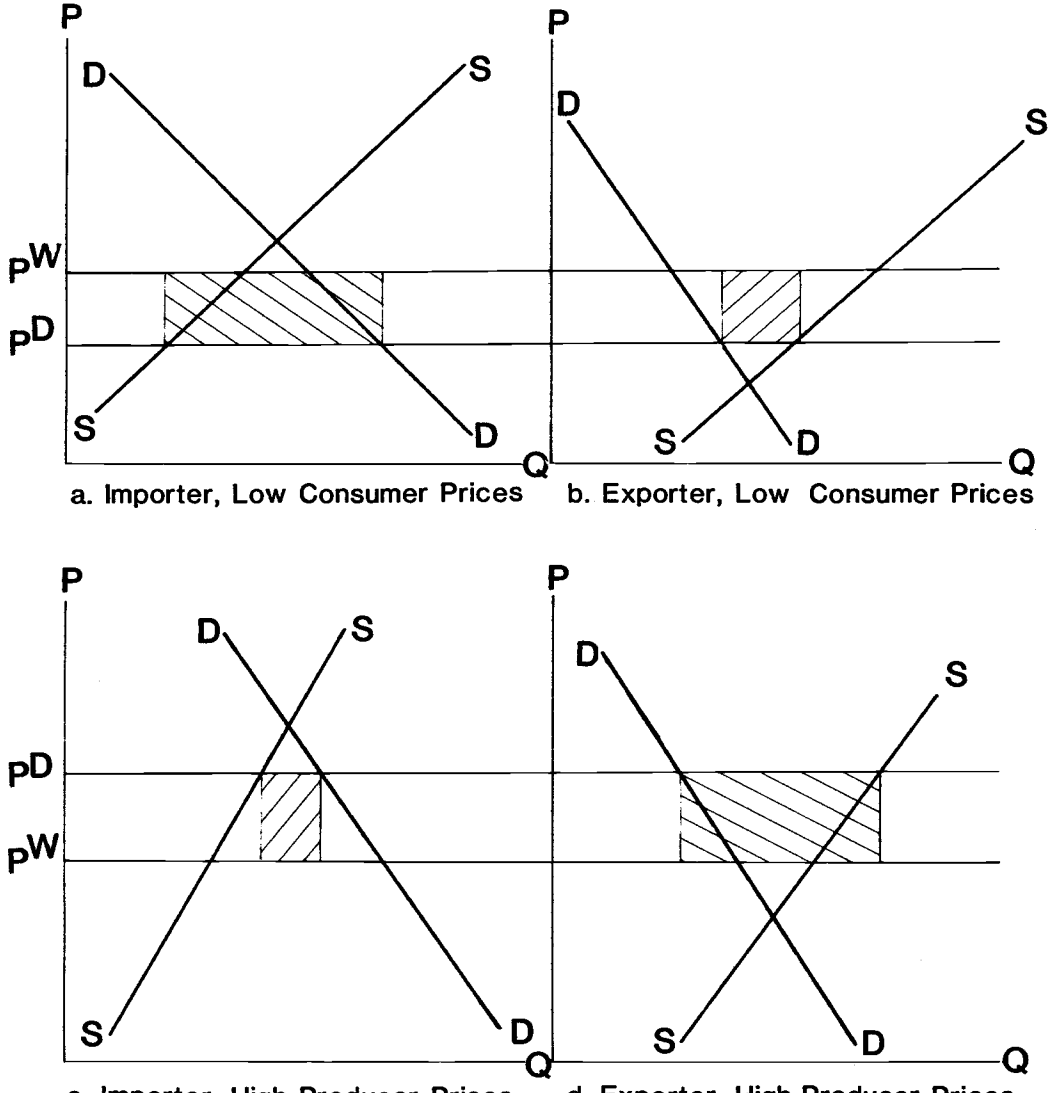
interventions impose unnecessary efficiency losses on consumers or producers in the process of providing the desirable tax/subsidy to the remaining group. From the perspective of the government treasury, however, trade interventions will always be preferable methods to distort world prices. Figure 2 illustrates the relationship between domestic objectives and the revenue effects of trade policies. In two circumstances, the use of trade policy generates government revenues. Exporting countries that desire low consumer prices (2b) can collect the revenues from export taxes while importing countries that desire high producer prices can collect import tariffs. The alternative policy (consumer or producer subsidies) represents a burden on the treasury. In the remaining two cases, the treasury burden is less for a trade intervention than for a direct subsidy. An import subsidy in an importing country that desires low consumer prices (2a) and an export subsidy in an exporting country that desires high producer prices (2d) allow domestic producers and consumers to pay some of the costs of distortions.

A second reason for the reliance on trade controls involves the implementation costs of domestic tax/subsidy programs. These administrative costs can be substantial, especially in developing countries, where the dominance of grain production and consumption in aggregate output and expenditure, limitations on the revenue base and an underdeveloped infrastructure make the establishment of universal subsidy programs costly and often impossible to administer. Trade policy, in contrast, requires minimal administrative manpower, and operates usually through well-established marketing channels in the major port areas (although, in some countries, smuggling represents an important constraint on the administration of trade policy).

Finally, and related to the previous points, trade controls are usually a necessary component of rationing programs. Consumer prices that are held below world prices do not necessarily imply that consumption levels are larger than they would be under free trade, if quantitative limits may constrain individual demands. The maintenance of such restrictions, however, requires the prohibition of access to international markets by domestic producers, since higher world prices would attract all of domestic production. Logistical considerations may also mandate the use of imports to supply ration shops, particularly when the urban-oriented programs are located nearer to port facilities than to rural production areas. In China, for example, wheat imports are utilized primarily to supply urban areas on the coast (International Wheat Council, 1976-77).

The data of Tables 5 and 6 reinforce the view of the international grain markets as a means to augment domestic consumption levels. The maintenance of low consumer prices and shifts in the demand curve induced by population and income growth were not matched by compensatory shifts in the domestic supply curve. Whatever the reasons for lagging production response--low producer prices, lagging rates of technological change, constraints on potential grain area--government trade policies have translated net demand increases into international market demands. The prominence of consumer subsidy and producer tax policies across countries suggests that importer reliance on the international market is larger than under free trade and that world market prices are above their free-trade levels.

Figure 2.
Domestic Objectives and the Revenue Effects of Trade Policy



V. Price Behavior on the International Market

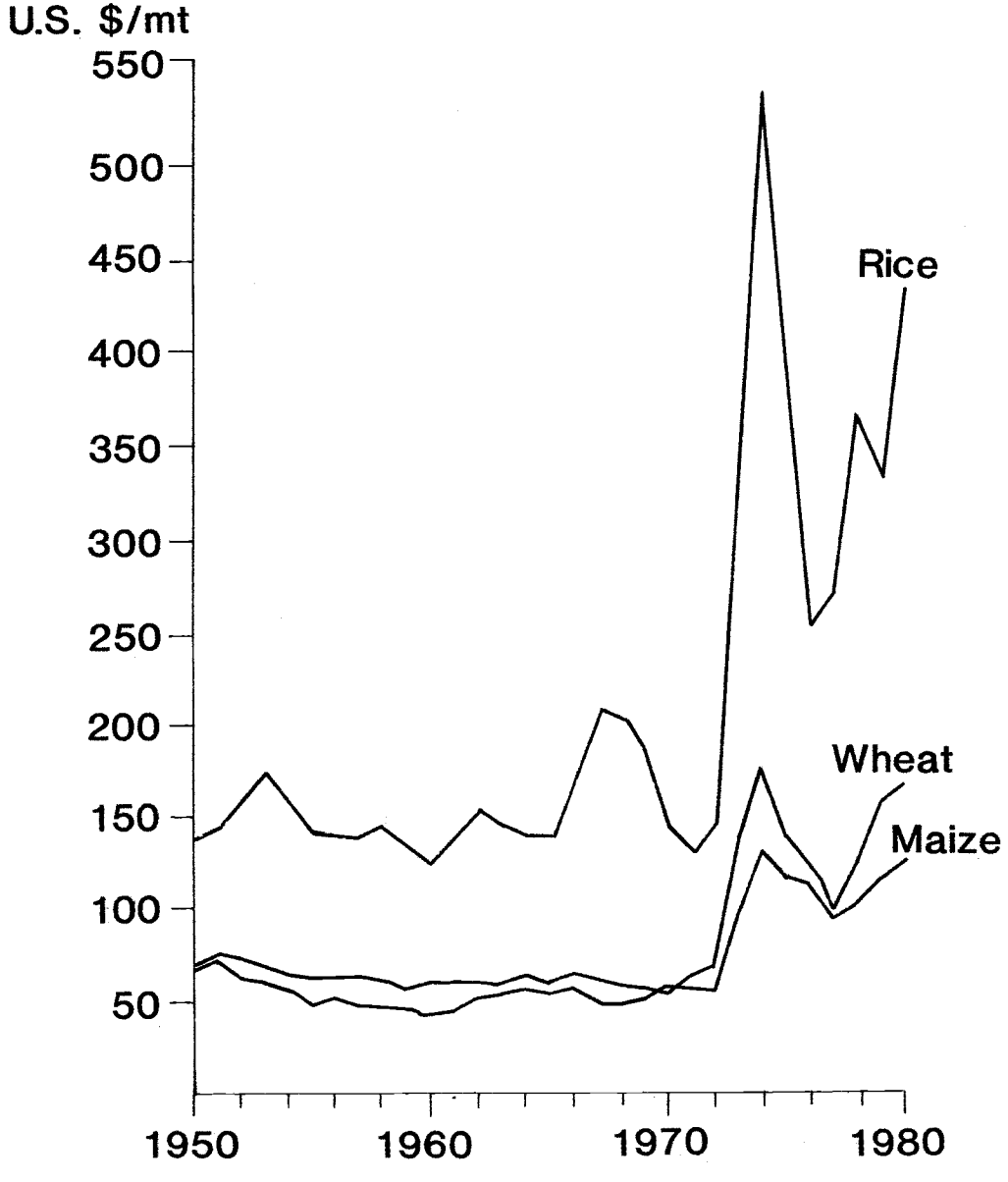
The dominance of the instruments of government monopolies and quantitative restrictions imply that movements in world prices have only indirect relevance for most consumers and producers. This result is particularly significant for rice and wheat, where world prices equal domestic market prices for only four and eight percent of world consumption of the two grains, respectively. Even in countries where domestic prices are held above world prices, trade taxes and subsidies are used only rarely. Further, most trade taxes involve variable levy policies, and domestic consumers and producers again have latitude to alter behavior without regard to world prices. Thus international market behavior becomes a reflection of the impact of government policies aggregated across countries rather than a direct consequence of the actions of consumers and producers.

The low price elasticity of demand for grains suggests that prices provide a more sensitive barometer of changes in international market conditions than quantities. Figure 3 illustrates the movement of nominal international prices of wheat, maize and rice during the 1950-80 period. Data are provided in Appendix Table 6. The prices represent widely-traded varieties and thus may not be representative of changes in the markets for special varieties of these grains. Prices of round-grain rice (Petzel and Monke, 1979-80), hard wheats and white corn, for example, may represent commodity markets that perform independently of the markets for more widely traded varieties. Such varieties, however, do not account for a substantial share of cereal production or trade.

Nominal grain prices demonstrated little change throughout the 1950s and '60s, indicative of market conditions in which available export supplies were able to balance increases in import demands. The price movements of individual commodities show some differences, roughly synchronized with the relative growth rates of production in the exporting countries. Coarse grain prices trended downward in the 1950s, caused initially by foreign exchange constraints among importers in the immediate post-war period as absolute trade volumes fell below pre-war levels. Subsequent price declines reflected major increases in coarse grain production, due largely to the spread of hybrid corn in the US and Canada. By the early 1960s, these two countries accounted for more than half of world corn production and three-fourths of world trade. Similar conditions prevailed in the wheat market, as developed country yields increased throughout the 1950-70 period. Rice prices showed somewhat greater fluctuations, reflecting the concentration of 90 percent of world production within a single climatic zone, the monsoon region of Asia. In addition, the small size of world trade relative to world production made the international rice market more sensitive than the wheat and corn markets to production variations.

Producer price policies in the U.S. and Canada were of particular importance to the stability of world prices during the 1950s and 1960s. Domestic prices remained consistently above world prices, and the inability to restrain production via acreage controls resulted in rapid increases in government-owned stocks of wheat and corn. As a result, stocks were well in excess of world trade during most of the 1950-70 period. Wheat stocks in the

Figure 3.
Nominal Grain Prices, 1950–80



major exporting countries, for example, increased from 18 to 55 million mt between 1951 and 1957; four-fifths of the total was held by the US and Canadian governments. By 1960, total wheat trade was only 40 million mt. Under these conditions, declines in world prices were not needed to encourage increases in annual carryover, and increases in world prices were not needed to encourage a reduction in annual carryover. Rather, the difference between domestic and world prices and governmental willingness to subsidize exports appeared as critical determinants of stock changes. With stocks well in excess of trade volumes during most of 1950-70, government actions maintained an effective ceiling on world prices. Major increases in import demands, such as USSR and South Asian wheat imports in the mid-1960s, were met without substantial changes in price.

Government stock accumulation also encouraged the growth of concessional exports. The growth of maize imports by developed countries and wheat imports by LDCs represent the most significant categories of increased trade in individual grains during the 1950-70 period. Almost all of the increase in LDC wheat imports (from 8 to 23 million mt) is accounted for by concessional exports. Table 7 provides data on the growth of concessional trade and shows the continual upward trend in aid shipments until the mid-1960s. The US dominated the trade until this period, and wheat was the principal commodity traded, accounting for 75 to 85 percent of total cereal aid during the 1960s. After 1966, US sales terms were made increasingly strict and the grant component of food aid declined. Payments were made in US dollars (with varying credit terms), rather than in local currency, and availabilities were conditioned on recipient country efforts to increase food production. By the late 1960s, aid levels had peaked at about 13 million mt. Declines in US availabilities were particularly significant after 1972 and more than offset subsequent increases in aid from other areas, such as the EC. Aid shipments ranged between seven and nine million mt during the 1973-80 period, or four to six percent of world trade.[7/]

Two exceptions to the scenario of stable or declining prices in the 1950-70 period are of particular historical interest as they reflected events which were to become important in the 1970s. The first case involves the increase in wheat prices in 1964-65, when the USSR attempted to offset partially a 21 million mt production decline with nine million mt of increased imports. This magnitude represented about 20 percent of world trade volume and was the first major attempt by Soviet planners to use the international market as a way to offset variability in domestic production. The second event concerns the increases in rice prices in 1966 and 1967, a consequence of consecutive years

---

7/ Johnson (1973, Chapter 8) provides a concise summary of the possible effects of these aid programs on the developing countries. The effect of aid programs on international market prices is not clear. Certainly if elimination of aid caused increases in commercial export availabilities of ten or fifteen percent, world market prices would have fallen. But continued retention of stocks or destruction of the commodities may have been preferable ways to manage domestic production surpluses.

TABLE 7. CONCESSIONAL EXPORTS OF CEREALS, 1955-80.

Year[a]	US	Canada	EEC	Total	Share of World Trade
		(million metric tons)			
1955	0.80				
56	3.22				
57	7.14				
58	6.22				
59	7.89				
60	10.09				
61	11.12	0.19			
62	12.18	0.05			
63	12.84	0.07			
64	12.32	0.26			
65	13.16	0.40			
66	12.26	1.17			
67	9.50	0.80			
68	7.81	0.78			
69	10.01	0.66	1.36	12.77	13.2
70	9.10	1.61	0.98	12.83	11.4
71	9.26	1.09	0.98	12.56	10.6
72	7.02	0.89	0.99	10.11	7.7
73	3.20	0.49	1.21	7.85[c]	5.0
74	4.71	0.59	1.41	8.38	5.6
75	4.28	1.03	0.93	6.86	4.3
76	6.15	1.18	1.13	9.11	5.3
77	5.99	0.88	1.49	9.34	5.8
78	6.24	0.74	1.24	9.57	5.1
79	5.44	0.55	1.29	9.00	4.5
80[b]	5.73	0.60	1.65	9.39	4.2

[a] July/June shipments before 1979. For 1979/80 and 1980/81, data relate to budget year of each country.

[b] Commitments or allocations.

[c] Includes shipments by USSR of 2.2 million mt to India and Bangladesh.

Sources: 1969-80 FAO, Food Aid Bulletin, Rome

1955-68 USDA, ERS, 1974, US Agricultural Exports under Public Law 480 ERS-Foreign 395, Washington, D.C.

1961-68 Canada FAO, National Grain Policies, 1972.

of unfavorable weather and political turmoil in Asia. Similar events were to recur in 1972-73, with far more serious consequences for prices.

In the 1970s, world prices became much more sensitive to variations in world production, as new stock and production policies of the developed countries reduced the capacity of supply-side adjustments to limit market price increases. Particularly important was the reorientation of US and Canadian production towards world market incentives. Export subsidies from the US government were suspended in late 1972, and government grain stocks were largely eliminated. Wheat stocks held by the Commodity Credit Corporation, for example, declined by 19 million mt in 1972/73. In addition, producer price policy was altered. The Agricultural and Consumer Protection Act of 1973 replaced cost-of-production parity prices with a target price system. These prices were set well below world prices, and for most of the 1970s target prices served as floor prices rather than market prices. While the bill maintained governmental authority to adjust production, set-asides were given reduced priority and not utilized after January, 1973. This policy shift increased potential crop area by six million ha and reduced the potential of acreage adjustments to limit market price increases.

The result of this policy change was that exogenous shocks to production or consumption could no longer be accomodated without price adjustments on the international market. Grain exporters that maintain low consumer prices will attempt to compensate for shortfalls in domestic production with export restrictions, while importers with a similar objective will attempt to increase imports. The result is the creation of excess demand without compensatory availabilities of excess supplies from exporters with high producer prices, and prices must adjust to resolve the temporary conflicts between the trade policies of different countries. The magnitude of price adjustment will depend on the size of the international market relative to total production, since government trade monopolies can attempt to transmit the entire deviation in production or consumption to the international market.

The most dramatic indication of this new policy environment appeared in 1972/73, as bad weather in North America, the USSR and Asia caused declines in the production of all cereal grains. Import demands increased as production declined in exporting countries, resulting in unprecedented increases in grain prices. International market prices for wheat, maize and rice increased in 1973 and 1974 by 158, 136 and 270 percent, respectively. These changes reflected to a large extent the inelastic demand of government importers, since world cereal production declined by only three percent, and the declines were no larger than six percent among the individual grains. Trade volume increased by 30 million mt between 1972 and 1973, and price responsive storage behavior in the US caused export shares to climb to 70 percent in coarse grains and 50 percent in wheat. A similar production scenario recurred in 1974/75, as world production of wheat, coarse grains and rice fell by four, three and one percent, respectively. In this case, however, income declines in many importing countries and decreases in feedgrain use in the U.S. and Canada prevented a repetition of the 1973 price increases (Johnson, 1977).

Nominal prices remained at a relatively constant level through the latter half of the 1970s, although price variability remained substantially greater

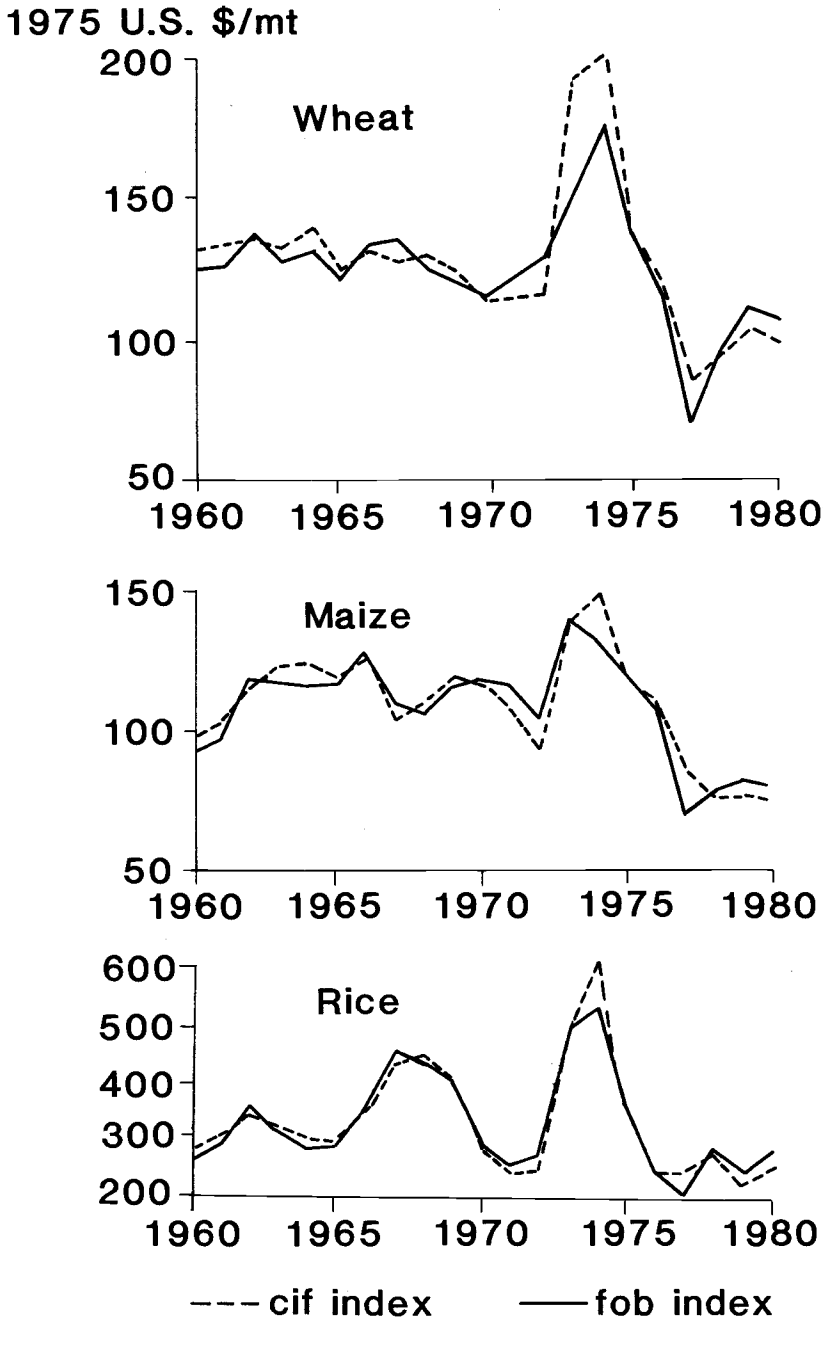
than in the earlier decades. As in the 1950-70 period, rice prices demonstrated the greatest variability. Trade in rice remained between three and four percent of world production, and the production of major exporting and importing countries continued to demonstrate positive correlation. In addition, rice stocks comprised less than ten percent of consumption in most years, and the dominance of human consumption in total utilization gave the rice market particularly inelastic price behavior. Coarse grain stock levels were comparable to those of rice, ranging from nine to fourteen percent of utilization. Prices, however, showed more stability than those of wheat and rice prices due to the greater price elasticity of meat demand and the presence of non-grain substitutes for feed, such as pasture and starches.

The emergence of incompatibilities among international market policies provides only a part of the explanation of market behavior during the 1970s. The international market remained dominated by government policy, but the behavior of the principal actors became increasingly erratic. Particularly important were the policies of the CPEs, which accounted for nearly half of the 100 mt increase in cereal trade during the decade. In the USSR and Eastern Europe, limited data indicate increases of 15-30 percent in numbers of cattle, hogs and poultry during the first half of the 1970s (International Wheat Council, 1978/79). Increased numbers were largely supported by wheat and maize imports, as domestic cereal production increased by only 10 percent during this period. This increase in trade participation rates was accompanied by increased variability, reflecting the commitment to maintain herd sizes in the face of domestic production shortfalls (Poleman, 1975). Grain imports of the USSR, for example, increased by 16 million mt in 1972/73 and by 20 million mt in 1975/76, relative to the previous year. The PRC has followed similar policies, although of a lesser magnitude. Cereal imports increased by about 12 million mt during the 1970s, becoming increasingly variable toward the end of the decade. Wheat imports, for example, increased from 3.2 to 8.6 million mt between 1976/77 and 1977/78 and from 8.8 to 12 million mt between 1979/80 and 1980/81. This change was accompanied in each case by an increase of only 250,000 - 300,000 mt in rice exports.

Two estimates of real prices for each of the grains are provided in Figure 4. One deflator is the World Bank index of cif unit values of developing country imports of manufactured goods; it provides an indication of the relative cost of grain imports in LDCs. The second deflator is the FAO index of fob unit values of developing market economy exports of agricultural products, which provides an indication of purchasing power of LDC grain importers. The latter index is not seriously biased by the inclusion of cereal exports, as cereals accounted for only a small percentage of the value of agricultural exports by market LDCs (6.7 percent in 1980, for example). Both indexes suggest similar patterns of real price movements.

The real price estimates provide two additional insights into the international grain economy. First, increases in per capita cereal imports of the CPEs and LDCs have been met at constant or declining real costs. While prices became more variable in the 1970s, the overall trend in real prices was negative (but not significantly different from zero at the 95 percent

Figure 4.
Grain Prices, 1960–80



confidence level).8/ This result is surprising, given the increases in the volume of trade in all three grains since 1960 and the reductions in developed country producer price support programs during the 1970s.

Second, international prices for the three grains move largely in concert, pointing to the importance of linkages between the three markets. Table 8 provides correlation coefficients for the various price series. All the coefficients are significantly different from zero. Substitution possibilities in production are fairly limited, at least in the short run, and price linkages are thus due to adjustments in consumption or stocks. Relationships among the grains, which are most significant for wheat and rice and wheat and corn, suggest that wheat plays the central role in the linkage of the various grain markets.

The linkage between wheat and corn reflects the use of both grains as animal feeds. The corn trade is directed primarily toward animal feed uses and competed traditionally with barley and other coarse grains. Wheat has become increasingly important as a feedgrain, however. By 1980, about 20 percent of world wheat production was used as feed (85 million mt). Wheat provided between 1.4 and 5 percent of total feedgrain use in the US during the 1970s, and use of wheat as a feed by major wheat exporters increased from 10 to more than 20 million mt over the last two decades. While this volume is small relative to total wheat consumption and total feedgrain use, it represents 20 percent of world wheat trade and thus provides substantial latitude for adjustment among exporters should maize prices deviate significantly relative to wheat. Importing countries may also engage in substitution. The USSR, for example, uses about 50 million mt of wheat for feed. Further substitution effects result when the domestic wheat crop is of poor quality for human consumption. This circumstance will result in increased use of wheat as feed, decreases in corn imports and increases in wheat imports for bread. Eastern Europe appears the most significant region to arbitrage the markets in this fashion (International Wheat Council, 1980/81).9/

Critically important to the wheat-rice linkages is the willingness of rice consumers to substitute wheat, particularly in Asia. Popular beliefs that rice consumers were intransigent with respect to staple food consumption are belied by both econometric demand analyses and trade statistics. Timmer

---

8/ Regressions of real prices (FAO index) against a time trend for 1960-80 indicated average annual price declines of 0.7 percent, 1.0 percent and 0.4 percent for wheat, maize, and rice, respectively. Regressions based on the World Bank index indicated average annual declines of 0.9, 1.2, and 0.5 percent.

9/ Johnson (1977) points out that the growth of feedgrain use has increased the capacity of the international market to meet global food shortages even more rapidly than is suggested by changes in the share of trade in world production.

TABLE 8. CROSS-PRICE CORRELATION COEFFICIENTS FOR GRAINS, 1960-80.

a. Grain prices deflated by World Bank import index [a]

	Wheat	Maize	Rice
Wheat	1		
Maize	0.84	1	
Rice	0.83	0.71	1

b. Grain prices deflated by FAO export index [a]

	Wheat	Maize	Rice
Wheat	1		
Maize	0.81	1	
Rice	0.79	0.65	1

Source: See Appendix Table 6.

Notes: [a/] Correlation coefficients greater than 0.44 are significantly different from zero at the 95 percent confidence level.

(1971) and Timmer and Alderman (1979), for example, provide evidence of high cross-price elasticities for Bangladesh and Indonesia. Elasticities appear particularly high among low income consumers, and in Indonesia, substitution extends to starchy staples (cassava) as well. The expression of consumer preferences depends to a large degree on the international buying habits of government marketing agencies. While these agencies may bring quite inelastic demands to the market in terms of total cereal requirements, trade data suggest that governments are willing to substitute among grains. Examples of this behavior include increases in wheat and wheat flour imports among traditional rice consuming areas, particularly during periods of high rice prices. In 1974, for example, Indian imports of wheat increased by two million mt while rice imports declined by 200,000 mt.

A second way in which government policy links international prices of rice and wheat involves the trade policy of the PRC. Chinese rice exports and wheat imports are related to relative international prices of the grains rather than changes in domestic production. Rice exports of China have consistently remained between 0.8 and one million metric tons (mmt) during the last two decades, with the exception of 1966-67 (1.24 mmt) and 1973-75 (1.9 mmt). In both exceptional periods, international rice prices were high relative to wheat prices. Such arbitrage maximizes net foreign exchange earning from agriculture while maintaining per capita calorie availabilities for consumers. In addition, the policy appears logistically feasible, since most wheat imports are directed to urban coastal areas, which are also relatively large rice producing areas (Timmer, 1976; International Wheat Council, 1976/77). Chinn (1979) provides statistical confirmation of this relationship.

VI. Policies and Instability in Trade[10/]

On average, governments have been able to utilize international markets at constant or declining real costs throughout the 1960s and 1970s. But stagnation in the availabilities of concessional aid and the increased instability in the international markets have spawned new criticisms of the grain trade. Two problems have been mentioned most frequently. The first difficulty involves the availability of foreign exchange among LDC importers. The foreign exchange requirements for food imports are believed large, and export earnings are seen as constraints on cereal imports and consequently on the ability to maintain desired consumption levels (Abbott, 1979; Siamwalla and Valdes, 1980). A second problem, somewhat related to the first, involves instability on the international markets. Even if countries are able to pay for grain imports at average prices, the extreme fluctuations

---

10/ Much of the data presented in this section are taken from Salah Abdelsalam, 1982, Food Self-Sufficiency and International Grain Trade, unpublished M.S. Thesis, Department of Agricultural Economics, University of Arizona.

in the international market create temporary foreign exchange constraints. As a result, desired levels of domestic price stability cannot be attained.

Table 9 provides data on the costs of cereal imports relative to commodity export earnings for 15 of the 16 largest importers (data for China were not available). A more comprehensive list of 65 LDCs is presented in Appendix Table 7. The results suggest that, on average, LDC importers do not spend a particularly large share of commodity export earnings on cereals. While petroleum imports in the late 1970s accounted for about 30 percent of export earnings of LDCs (excluding petroleum exporters), Bangladesh and Egypt are the only major cereal importers that spent a similar share of export earnings on cereals. No other countries spent more than 15 percent of earnings on cereals during the 1970-80 period. Similar results hold for the 65 country sample; 56 countries spent less than 15 percent of export earnings, forty-seven countries spent less than ten percent, and 29 countries spent less than five percent of export earnings. The list is further reduced when other sources of foreign exchange are considered. Repatriated earnings are particularly important sources of foreign exchange in Egypt, Upper Volta, Jordan and the Yemen Arab Republic. In sum, only five countries--Senegal, Somalia, Haiti, Bangladesh and Sri Lanka--devoted more than fifteen percent of foreign exchange earnings to cereal imports during the 1970s.

The choice of 15 percent as a 'large' number is arbitrary, since there is no way to determine a critical value for the ratios presented in Table 9 and Appendix 7. But whatever value may be perceived as large, the efficacy of policies that attempt to reduce its value via import substitution for cereals is not clear. This uncertainty arises because area expansion in cereals must come at the expense of other crops, and these crops are usually dominated by agricultural exports. Thus reductions in cereal imports may be accompanied by reductions in foreign exchange earnings, and the direction of change of the expenditure-income ratio is not clear. The reductions in export earnings from crop substitution are likely to be significant. Excluding the oil-exporting countries, agricultural exports comprise one-third or more of total export revenues among all the countries of Table 9 except Chile and Korea (Valdes and Huddleston, 1977). For the developing countries as a whole, exports of agricultural commodities accounted for 42 percent of commodity export in the late 1970s (excluding petroleum; World Bank, Commodity Trade and Price Trends). In addition, where land is a constraint, crop substitution will have a magnified negative impact on foreign exchange earnings, since cereal crops generally have substantially lower values per unit area. While cereals have per hectare values of $150-210 (1975 prices), coffee, cocoa, tea, tobacco and sugar, for example, generate from two to seven times as much revenue per hectare (Hillman, 1981).

Another notable feature of the data is the lack of trend in the import/export ratios. Only seven of the sixty-five countries--Brazil, Egypt, Madagascar, Mauritania, Morocco, Somalia and Sudan--demonstrated statistically significant increases in the ratios over time. Increases in the value of commodity exports or, less commonly, declines in cereal imports, kept constant

TABLE 9. RATIO OF TOTAL CEREAL IMPORT COSTS TO TOTAL COMMODITY EXPORT EARNINGS IN SELECTED COUNTRIES, 1970-80.

Country	Selected Years					Average, 1970-80	Standard Deviation	Coefficient of Variation
	1970	1973	1974	1975	1980			
Algeria	.034	.056	.071	.094	.053	.062	.014	.22
Bangladesh	NA	.819	1.114	1.543	.815	.722	.397	.55
Brazil	.059	.051	.069	.044	.109	.058	.021	.36
Chile	.039	.083	.135	.088	.066	.073	.028	.38
Egypt	.092	.153	.442	.523	.374	.326	.142	.44
India	.173	.176	.213	.296	.004	.116	.096	.83
Indonesia	.169	.177	.062	.056	.040	.090	.048	.53
Iran	.002	.025	.024	.027	.058	.026	.013	.50
Iraq	.009	.045	.040	.027	.024	.035	.022	.63
Korea	.292	.126	.137	.135	.061	.130	.085	.65
Mexico	.046	.20	.170	.206	.072	.089	.066	.74
Nigeria	.021	.016	.009	.013	.019	.024	.015	.62
Peru	.040	.104	.097	.141	NA	.085	.030	.35
Saudi Arabia	.029	.010	.005	.007	.010	.012	.007	.58
Venezuela	.023	.021	.022	.021	.026	.024	.004	.17

Source: See Appendix Table 7.

the share of export earnings devoted to cereal imports in most LDCs.11/ Hence the ability to pay for imports remained relatively constant in the vast majority of LDCs.

If imports of cereals reflect foreign exchange constraints, the constraint must arise from the variability over time in the ratio. Coefficients of variation of the import/export ratios are presented in the last column of Table 9. Coefficients of variation for world prices of wheat, maize and rice were 0.34, 0.28 and 0.41, respectively, for the 1970-80 period. For most countries, relative foreign exchange requirements were substantially more variable than world prices. Only Algeria and Venezuela demonstrate greater stability in the import/export ratio. This result shows the effects of additional variations present in the ratios. Prices and quantities of commodity exports and quantities of cereal imports varied over time, and these variations were not perfectly synchronized with movements in world grain prices. These numbers suggest a role for foreign exchange reserves or short-term international borrowing (through such institutions as the International Monetary Fund (IMF) compensatory financing facilities for exports and food) in the management of the balance of payments positions of the importing LDCs.

Although relative foreign exchange requirements varied during the 1970s, the contribution of world grain prices to the observed variability does not appear particularly dominant. Even during the high price period of 1973-75, only one-fourth of LDC importers spent more than 15 percent of export revenues on cereals. Five of the countries were major importers--Bangladesh, Egypt, India, Indonesia and Mexico.12/ In every case in which the ratios exceeded 0.15, however, import volumes were equal to or larger than for previous years. In seven of the 18 countries--Egypt, Morocco, Tanzania, Upper Volta, Mexico, India and Indonesia--import volumes increased by at least 50 percent above the previous year. Thus a substantial portion of the increase in foreign exchange shares was due to increases in the volume of cereal imports rather than increases in world prices. Valdes and Konandreas (1981) have estimated that price variability accounts for only 25 percent of the variability in the cost of food imports during the 1961-76 period.

Nevertheless, concerns about variability in international trade have generally focussed on price, as quantity variability is a necessary consequence of policies to offset domestic production shortfalls and stabilize domestic consumer prices. If world prices had not increased in the 1973-75 period, for example, imports might have increased further and domestic price

---

11/ This conclusion is in contrast to earlier studies (Valdes and Huddleston, 1977) that suggested that foreign exchange constraints became increasingly severe during the 1970s.

12/ The remaining countries were Madagascar, Mauritius, Morocco, Senegal, Somolia, Tanzania, Upper Volta, Haiti, Cyprus, Jordan, Pakistan, Sri Lanka and Yemen Democratic Republic.

stabilization efforts would have been more effective. Sheer availabilities on the international market are not generally considered a problem, since traded quantities respond positively to increases in demand. In 1973-75, for example, cereal trade increased to 156 million mt, about 30 percent above the 1970-72 average of 120 million mt. Paarlberg (1980) has described the implausibility of quantitative limits on cereal imports to a particular country, because the number of cereal exporters and transshipment were sufficient to negate almost entirely attempts by the U.S. to limit cereal imports of the USSR in 1980.

While most importing countries would prefer perfect price stability in international markets, the conditions of the 1950s and 60s depended largely on the willingness of the governments of major exporters to support large stocks. Barring a return to these subsidization programs or similar stockpiling schemes, price variability on international markets is likely to remain in the future. In this event, importing countries will have an interest in the development of alternative strategies of production and consumption.

Food self-sufficiency represents one alternative that has attracted increasing attention in the latter half of the 1970s (see, for example, Lappe and Collins, 1977). A preliminary evaluation of the effectiveness of a food self-sufficiency policy can be made by comparison of world price variability to the price variability generated by an exclusive reliance on domestic production. The latter effect is simulated by estimation of the impact on prices of deviations from trends in yield in the fifteen major importers. This assumption presumes that yield fluctuations are the only source of production variability, and thus ignores difficulties in the expansion of cereal area and variabilty in harvested area caused by unfavorable weather or changes in relative prices of alternative outputs. The assumption thus results in an underestimation of the variability in domestic prices that will result from a self-sufficiency program.

The magnitude of price fluctuation depends on the shape of the domestic demand schedule, and only scattered estimates of demand elasticities are available. Most studies suggest low own-price elasticities for cereals, in the range of -0.1 - -0.4, reflecting the importance of cereals as a basic foodstuff. Self-sufficiency programs are likely to further constrain demand elasticities. Access to international grain markets increases the substitution possibilities for consumers, because domestic production in many countries is limited to a single staple. In this case, cross-price elasticities will approach zero, and the own-price elasticity will equal the negative of the income elasticity (by the homogeneity condition). An elasticity of -0.3 is used in the simulations of price instability under self-sufficiency.

Table 10 provides estimates of the coefficients of variation of domestic prices under hypothetical self-sufficiency programs in the sixteen largest importing countries. Deviations from trend in yields for the 1960-80 period are used to simulate quantity variations, and 1961 world prices are used as a basing point for the generation of the domestic price series. If world price variation for the 1970-80 period is used as the standard of comparison, Egypt

TABLE 10. COEFFICIENTS OF VARIATION OF PRICES UNDER HYPOTHETICAL DOMESTIC SELF-SUFFICIENCY PROGRAMS, 1960-80.

World/Countries	Coefficients of Variation of Prices		
	Wheat	Maize	Rice
Algeria	0.41	0.62	0.70
Bangladesh	0.86	0.32	0.27
Brazil	0.70	0.35	0.19
Chile	0.77	0.80	0.40
China	1.84	0.29	0.13
Egypt	0.31	0.28	0.19
India	1.11	0.67	0.44
Indonesia	-	0.18	0.35
Iran	1.38	0.90	-
Iraq	0.66	0.61	0.77
Korea	1.23	0.87	0.89
Mexico	1.04	0.30	0.30
Nigeria	0.36	0.70	0.39
Peru	0.43	0.27	0.23
Saudi Arabia	0.49	-	0.73
Venezuela	0.38	0.38	0.84
World Prices (1960-80)	0.22	0.17	0.30
World Prices (1970-80)	0.34	0.28	0.41

Sources: Food and Agriculture Organization, Production Yearbook, various years; World Bank, Commodity Trade and Price Trends.

and Indonesia are the only countries that would expect greater stability in the prices of all domestically produced grains, while Peru would demonstrate greater stability in the prices of maize and rice. These results reflect the importance of irrigated production in these countries. Rice is the only commodity in which prices under self-sufficiency appear more stable than world prices for a substantial number of countries; nine countries (seven of them are importers) demonstrate coefficients less than 0.41. In total, only 13 of a total of 45 cases demonstrate price variability under self-sufficiency that is lower than world prices. In most cases, the differences are not large, suggesting the importance of the constant acreage assumption to the results. On balance, domestic self-sufficiency programs do not appear likely to generate more stable prices than those that prevail on international markets. Furthermore, given that governments currently reduce domestic price variability below that which prevails on world markets, there appears little prospect that average price variability under domestic self-sufficiency programs will be below that which prevails under current policies.[13/]

VII. Conclusion

International trade in cereals represents one of the fastest growing segments of agricultural trade. While causes of growth are frequently presumed to hinge around production problems in importing countries (particularly LDCs), examination of the data suggest a contrary view. Declines in domestic production can explain only 18 percent of the total growth in cereal trade. Instead, trade expanded in response to positive real growth in population and income. Income growth appears particularly important in developed countries, but is the dominant factor in the developing countries as well.

That the international market should prove the barometer of affluence is due largely to the conduct of government policies. Developed countries comprise both the principal importers and exporters of cereal grains, but these patterns reflect the objectives and price policies of the developing countries, which dominate aggregate production and consumption to a similar degree. Low domestic prices have accentuated the reliance of the LDCs on cereal imports and largely forestalled increased export availabilities. Government policies also explain price movements in the international market. In the 1960s, domestic producer price policies of the developed countries were particularly important in the maintenance of constant nominal prices on international, as increases in the demands of importing countries were met by drawdowns in government stocks. Large declines of these stocks in the 1970s brought substantial changes in the behavior of the international grain markets. Government policies in the importing countries largely dictated world price behavior. Importing countries were forced to compete for

---

13/ Price stability can also be generated by domestic stock policies to increase annual carryovers. Such policies are equally viable under self-sufficiency or international trade and thus represent a separate issue.

supplies, and price served as the allocative mechanism. Thus price variability on the international markets reflected attempts to maintain price stability on domestic markets.

Changes in international market behavior and increased instability in prices have created new problems for participants, particularly the LDCs. The magnitude of these difficulties should not be exaggerated, because foreign exchange requirements remained a relatively small proportion of availabilities throughout the 1970s. But perhaps the greatest irony surrounding the instability issue is that the policies of the LDCs themselves are at least partly responsible for the magnitude of price instability. Clearly, shifts in policies toward freer trade would substantially increase price stability in the international markets, as global production declines of a few percent could no longer generate increases of 100-200 percent in world prices. Yet as long as countries continue to subsidize domestic consumption, international market controls are likely to remain as key components of grain policy. The treasury costs and logistical difficulties of simultaneous producer and consumer subsidies are critical constraints for the relaxation of trade controls in most countries. How to cut the Gordian knot? Return to subsidized stock programs? Develop new ways to reach low income consumers in LCDs and producers in DCs? Rely on economic growth to shift government objectives? Resolution of this issue will continue to occupy center stage in future discussions of the world grain economy.

REFERENCES

Abbot, Philip C., 1979, Modeling International Grain Trade with Government-Controlled Markets, American Journal of Agricultural Economics 61(1): 22-31.

Bachman, Kenneth L. and L.A. Paulino, 1979, "Rapid Food Production Growth in Selected Developing Countries: A Comparative Analysis of Underlying Trends, 1961-76", International Food Policy Research Institute Research Report No. 11, Washington, D.C.

Bruno, Michael, 1976, "The Two-Sector Open Economy and the Real Exchange Rate," American Economic Review, 66: 566-577.

Carter, Colin and Andrew Schmitz, 1979, "Import Tariffs and Price Formation in the World Wheat Market," American Journal of Agricultural Economics, 61: 517-522.

Chibber, Ajay, 1979, "Optimal Public Policy and Decision Analysis: A Case Study of the Indian Public Distribution System," Working Paper, Food Research Institute, Stanford University.

Chinn, Dennis L., 1979, "A Calorie-Arbitrage Model of Chinese Grain Trade," Working Paper, Food Research Institute, Stanford University.

Corden, W.M., 1974, Trade Policy and Economic Welfare, (Oxford: Clarendon Press).

Dornbusch, Rudiger, 1973, "Devaluation, Money and Nontraded Goods," American Economic Review, 63: 871-880.

Falcon, Walter P. and Eric A. Monke, 1979-80, "International Trade in Rice," Food Research Institute Studies 17(3): 279-306.

Food and Agriculture Organization, 1973, 1976, National Grain Policies, 1972, 1975, (Rome: Food and Agriculture Organization).

Heady, Earl O., 1962, Agricultural Policy Under Economic Development, (Ames, Iowa: University of Iowa Press).

Hillman, Jimmye S., 1981, "The Role of Export Cropping in Less Developed Countries," American Journal of Agricultural Economics 63(2): 375-383.

International Wheat Council, various years, Review of the World Wheat Situation, London.

Johnson, D. Gale, 1973, World Agriculture in Disarray, (London: Fontana/Collins.

Johnson, D. Gale, 1977, "The Soviet Impact on World Grain Trade," British-North American Committee, Washington, D.C.

Josling, Tim, 1974, "Agricultural Policies in Developed Countries: A Review," Journal of Agricultural Economics, 25: 229-264.

Josling, Tim, 1977, "Government Price Policies and the Structure of International Agricultural Trade, Journal of Agricultural Economics, 28: 261-277.

Knudsen, Odin K. and P.L. Scandizzo, 1982, "The Demand for Calories in Developing Countries," American Journal of Agricultural Economics 64: 79-86.

Lappe, Frances Moore and Joseph Collins, 1977, Food First, (Boston: Houghton Mifflin).

Mellor, John W., 1966, The Economics of Agricultural Development (New York: Cornell University Press).

Morawetz, David, 1977, Twenty-five Years of Economic Development, 1950 to 1975 (Washington, D.C.: The World Bank).

Paarlberg, Robert L., 1980, "Lessons of the Grain Embargo," Foreign Affairs, 59(1): 144-162.

Parker, John B. and J.R. Coyle, 1981, "Urbanization and Agricultural Policy in Egypt," United States Department of Agriculture, Economic Research Service, Foreign Agricultural Economic Report No. 169, Washington, D.C.

Petzel, Todd E. and Eric A. Monke, 1979-80, "The Integration of the International Rice Market," Food Research Institute Studies 17(3); 307-326.

Poleman, Thomas T., 1975, "World Food: A Perspective," in Philip H. Abelson, ed., Food: Politics, Economics, Nutrition and Research, (Washington, D.C.: American Association for the Advancement of Science), 8-16.

Sarris, Alexander H. and Andrew Schmitz, 1981, "Toward a U.S. Agricultural Export Policy for the 1980s," American Journal of Agricultural Economics, 63(5): 832-839.

Siamwalla, Ammar and Alberto Valdes, 1980, "Food Insecurity in Developing Countries, Food Policy.

Tang, Anthony M. and Bruce Stone, 1980, "Food and Agriculture in China," International Food Policy Research Institute Research Report No. 15, Washington, D.C.

Timmer, C. Peter, 1971, Estimating Rice Consumption, Bulletin of Indonesian Economic Studies VII(2): 70-88.

Timmer, C. Peter, 1971, "Wheat Flour Consumption," Bulletin of Indonesian Economic Studies, 7: 88-95.

Timmer, C. Peter, 1976, "Food Policy in China," Food Research Institute Studies, 15(1): 53-69.

Timmer, C. Peter and Henry Alderman, 1979, "Estimating Consumption Parameters for Food Policy Analysis," American Journal of Agricultural Economics, 61: 982-987.

Timmer, C. Peter and Walter P. Falcon, 1975, "The Political Economy of Rice Production and Trade in Asia," in Lloyd G. Reynolds, ed., Agriculture in Development Theory, (New Haven: Yale University Press), 373-408.

United States Department of Agriculture, 1982, "Handbook of Agricultural Charts," Agriculture Handbook No. 609, Washington, D.C.

Valdes, Alberto and Barbara Huddleston, 1977, "Potential of Agricultural Exports to Finance Increased Food Imports in Selected Developing Countries," Occasional Paper No. 2, International Food Policy Research Institude, Washington, D.C.

Valdes, Alberto and Panos Konandreas, 1981, "Assessing Food Insecurity Based on National Aggregates in Developing Countries," in Alberto Valdes, ed., Food Security for Developing Countries, (Boulder, Colorado: Westview Press), 25-52.

APPENDICES

APPENDIX TABLE 1. ESTIMATES OF POPULATION (millions) AND TOTAL CEREAL PRODUCTION (million mt).

	1948–52		1960–61		1969–71		1979–80	
	Production	Population	Production	Population	Production	Population	Production	Population
DEVELOPED								
Market	244.31	480.71	299.62	546.49	422.48	725.72	542.26	782.94
CPEs	109.90	269.77	179.17	309.52	231.52	347.93	257.84	376.46
DEVELOPING								
Market	213.59	1202.67	299.13	1,503.34	363.15	1,713.17	452.40	2,185.02
Africa	26.96	186.93	33.78	236.23	43.26	282.73	45.84	371.32
Latin America	30.96	161.58	46.11	211.85	69.51	282.70	85.68	363.63
Near East	22.80	102.22	31.44	130.30	42.61	165.89	56.15	214.71
Far East	132.87	751.95	187.80	921.74	207.74	977.80	264.68	1,230.29
CPEs	154.4[a]	569.9	159.0	682.0	228.59	889.88	310.98	1,030.76
WORLD TRADE	722.20[b]	2,523.05	936.92	3,038.51	1,245.73	3,676.69	1,563.49	4,375.18

Sources: Food and Agriculture Organization Production Yearbook, 1963, 1972, 1976, 1979, 1980. Chinese data taken from Anthony M. Tang and Bruce Stone, Food Production in the People's Republic of China, International Food Policy Research Institute Research Report #15, May, 1980.

[a] Data are for China and for 1952 only.

[b] China and USSR are excluded from the FAO estimates for 1948–52.

APPENDIX TABLE 2. DECLINES IN CEREAL PRODUCTION PER CAPITA, 1948/52 - 1979/81.

	Aggregate Production Decline	Per Capita Production		Population 1979/81
		1948/52	1979/81	
	('000 mt)	(kgs)		('000)
AFRICA				
Algeria	2,081	221	111	18,919
Angola	248	86	51	7,078
Benin	85	148	124	3,530
Chad	468	254	149	4,455
Ethiopia	1,133	174	138	31,468
Gambia	20	160	126	603
Ghana	105	69	60	11,679
Guinea	341	162	94	5,014
Guinea-Bissau	49	162	77	573
Lesotho	202	313	162	1,341
Liberia	153	198	120	1,967
Mali	666	259	163	6,940
Mauritania	47	60	31	1,634
Mauritius	4	5	1	959
Morocco	2,517	299	175	20,296
Mozambique	335	78	46	10,473
Reunion	3	33	27	525
Senegal	108	151	132	5,661
Sierra Leone	38	156	145	3,474
Togo	24	123	114	2,625
Uganda	264	117	97	13,201
Upper Volta	83	183	171	6,908
Zaire	538	47	28	28,291
Zambia	150	189	163	5,766
	9,661			
LATIN AMERICA				
Barbados	0.3	5	4	263
Chile	433	196	157	11,104
Ecuador	64	91	83	8,021
Guatemala	7	162	161	7,262
Haiti	314	122	68	5,809
Honduras	299	195	114	3,691
Jamaica	22	14	4	2,188
Nicaragua	131	172	124	2,733
Panama	110	180	123	1,927
Peru	483	109	81	17,625
Puerto Rico	29	9	1	3,675
Trinidad and Tobago	10	35	26	1,168
	1,903			

	Aggregate Production Decline	Per Capita Production		Population
		1948/52	1979/81	1979/81
	('000 mt)	(kgs)		('000)
NEAR EAST				
Cyprus	6	199	189	620
Egypt	420	200	190	41,963
Iraq	1,307	272	172	13,072
Jordan	402	154	30	3,244
Lebanon	133	67	17	2,658
Saudi Arabia	36	36	32	8,960
Syria	36	348	344	8,977
	2,340			
FAR EAST				
Bangladesh	1,146	251	238	88,164
Hong Kong	92	18	0	5,106
Japan	8,875	199	123	116,782
Kampuchea	1,376	366	162	6,747
Korea	577	223	208	38,455
Nepal	2,866	452	250	14,288
Yemen AR	413	208	137	5,812
	15,366			
WESTERN EUROPE				
Portugal	452	169	123	9,836
	29,722			

Sources: Food and Agriculture Organization, Production Yearbook, various years.

APPENDIX TABLE 3. GRAINS: DIRECT AND FEED CONSUMPTION, 1978.

Country	GNP per Capita ($US)	Population (millions)	Grain Consumption[a] (mmt)		
			Rice	Wheat & Coarse Grains	Feed
MARKET ECONOMIES					
Bangladesh	90	84.7	13.158	1.622	0
Mali	120	6.3	0.126	1.115	0
Somalia	130	3.7	0.024	0.365	0.290
India	180	643.9	50.389	62.890	2.280
Sri Lanka	190	14.3	1.458	0.722	0
Sierra Leone	210	3.3	0.330	0.036	0
Niger	220	5.0		1.502	0
Pakistan	230	77.3	2.118	11.524	0
Tanzania	230	16.9	0.199	2.314	0.076
Sudan	320	17.4		3.037	0
Kenya	330	14.7	0.004	2.233	0.085
Senegal	340	5.4	0.316	0.940	0.025
Indonesia	360	136.0	18.714	4.557	0.645
Egypt	390	39.9	1.377	9.868	1.656
Thailand	490	44.5	8.304	0.432	0.790
Philippines	510	45.6	4.280	2.690	1.350
Colombia	850	25.6	1.112	1.542	0.608
Paraguay	850	2.9	0.045	0.546	0
Syria	930	8.1	0.087	1.989	0.909
Tunisia	950	6.0		1.523	0.270
Malaysia	1,090	13.3	1.457	0.405	0.551
Turkey	1,200	43.1	0.200	13.702	5.373
Mexico	1,290	65.4	0.360	14.702	4.955
Argentina	1,910	26.4	0.120	4.862	6.840
Venezuela	2,910	14.0	0.339	1.818	1.235
Spain	3,470	37.1	0.223	5.691	14.200
UK	5,030	55.8	0.151	10.032	12.243
Japan	7,280	114.9	10.299	8.426	15.805
Australia	7,990	14.2	0.060	2.817	2.900
Canada	9,180	23.5	0.089	5.245	17.325
US	9,590	221.9	1.686	38.345	141.673

APPENDIX TABLE 3 (Cont).

Country	GNP per Capita ($US)	Population (millions)	Grain Consumption[a] (mmt)		
			Rice	Wheat & Coarse Grains	Feed
CENTRALLY PLANNED ECONOMIES					
China	230	952.2	92.218	144.246	0
Cuba	810	9.7	0.499	1.460	0
USSR	3,700	261.0	1.981	100.520	119.177
Czechoslovakia	4,720	15.1	0.070	4.220	7.596
GDR	5,710	16.7	0.040	4.630	7.672

Sources: Population and income data taken from World Bank, 1980. World Development Report (Baltimore: Johns Hopkins). Grain consumption data are taken from US Department of Agriculture, 1981, Reference Tables on Wheat, Corn and Total Coarse Grains Supply--Distribution for Individual Countries, Foreign Agriculture Circular FG-4-81, and US Department of Agriculture, 1980, Reference Tables on Rice Supply--Utilization for Individual Countries, Foreign Agriculture Circular FG-38-80.

Notes:

[a] Consumption data for feed includes wheat and coarse grain use only. Rice is not widely used as a livestock feed. Direct grain consumption estimates include use for seed and industrial purposes, as well as spoilage and losses.

APPENDIX TABLE 4. ESTIMATES OF NET PROTECTION COEFFICIENTS FOR CEREALS, 1975-80[a]

Region/Country	Net Protection Coefficients			Percentage Shares of World Consumption, 1980			Sources
	Wheat	Maize	Rice	Wheat	Maize	Rice	
DEVELOPED MARKET ECONOMIES							
Australia	0.91-1.13	1-1.07		0.65	0.03		4, 5, 9, 10
Austria	1.15-1.48	1.37-1.82		0.18	0.29		4, 9, 11
Canada	0.77-0.84	1.03	1.0	1.24	1.45	0.03	4, 5, 10
EEC[b]	1.15-1.97	1.15-1.72	1.5-1.86	9.97	7.33	0.34	2, 5, 10, 12
Finland	1.28-1.95			0.09			4, 11
Israel	0.80[c]	1.0		0.15	0.06		9, 10, 11
Japan	1.18-2.90	1.06	2.03-3.70	1.39	3.34	4.06	2, 3, 5, 10, 12
New Zealand	1.0	1.0		0.08	0.04		4, 11
Norway	0.64[c]	2.65		0.08	0.02		4, 10
Portugal	0.83-0.84	1.02-1.2	0.6-0.7	0.25	0.75	0.07	6, 8, 9, 12
South Africa	1.22-1.58	0.86-1.43	1.0	0.43	1.66	0.05	5, 9, 11
Spain	1.34	1.67		1.12	1.65		5
Sweden	1.38	1.18	1.18	0.16	0.01	0.01	4, 10
Switzerland	2.69	3.03		0.14	0.08		10
U.S.	1.0	1.0	1.0	5.14	31.37	0.67	10
Subtotal							
NPC < 0.95				1.72	0	0.07	
0.95 < NPC < 1.05				5.87	36.29	0.75	
NPC < 1.05				13.48	11.79	4.41	
DEVELOPED CPEs							
Czechoslovakia	0.6	<1	0.6	1.34	0.31	0.03	9, 10
German Dem. Rep.	0.67	0.74		0.86	0.58		9, 10
Hungary	0.50	1.13		1.10	1.43		4, 9, 10
Poland	0.65[c]	1.70		1.73	0.69		10, 11
Romania	0.50	0.56	0.64	1.33	2.74	0.03	4, 9
USSR	0.88	0.81	<1	24.1	4.60	0.75	9, 10
Yugoslavia	0.54	0.71		1.30	2.28		2

APPENDIX TABLE 4 (Cont).

Region/Country	Net Protection Coefficients			Percentage Shares of World Consumption, 1980			Sources
	Wheat	Maize	Rice	Wheat	Maize	Rice	
Subtotal							
NPC < 0.95				31.76	10.51	0.81	
0.95 < NPC < 1.05				0	0	0	
NPC > 1.05				0	2.12	0	
DEVELOPING MARKET ECONOMIES							
Africa							
Algeria	0.86[c]			0.71			4
Cameroon			0.5			0.03	12
Ghana	1.27	1.50	1.13	0.03	0.10	0.03	4
Ivory Coast		0.8	1.0-1.38		0.07	0.20	7, 12
Kenya	1.12-1.29	0.81-0.96	1.30	0.06	0.47	0.01	6, 10, 11, 12
Liberia			1.29			0.09	7
Malawi		0.51-1.5			0.03		4,12
Mali			0.61			0.05	7
Mauritius			<1			0.03	4
Morocco	0.35[c]	1.17		0.77	0.11		11
Nigeria	2.26	1.4-1.6	2.5-2.69	0.32	0.46	0.39	10, 11, 12
Senegal			0.7-1.25			0.16	7, 12
Sierra Leone			1.36			0.14	7
Tanzania	0.72	0.73	0.3	0.02	0.24	0.09	4, 12
Tunisia	1.0	0.41		0.31	0.04		9, 12
Zaire	1.0	1.46	6.69	0.03	0.14	0.07	9
Zambia	1.99	0.6-0.75		0.03	0.14		9, 12
Zimbabwe	0.89	0.55		0.05	0.33		9
Subtotal							
NPC < 0.95				1.55	1.29	0.25	
0.95 < NPC < 1.05				0.34	0.03	0.16	
NPC > 1.05				0.44	0.81	0.79	

APPENDIX TABLE 4 (Cont).

Region/Country	Net Protection Coefficients			Percentage Shares of World Consumption, 1980			Sources
	Wheat	Maize	Rice	Wheat	Maize	Rice	
Latin America							
Argentina	0.54-0.94	0.49-0.94	0.81-1.1	0.90	0.82	0.05	2, 5, 6, 12
Bolivia	<1			0.07			9
Brazil	0.58-0.64	0.76-0.92	0.6	1.69	5.57	2.56	5, 10, 12
Chile	<1.12	1.0-1.1		0.44	0.18		9, 10
Colombia	1.37	1.34	0.9	0.11	0.25	0.45	10, 12
Costa Rica	1.0	1.64-1.73	0.56	0.02	0.02	0.03	9, 10, 11
Dominican Republic	1.07	1.20	1.0	0.05	0.05	0.10	9, 10
Ecuador	0.68	1.0	0.81	0.07	0.04	0.06	9, 11
El Salvador		1.0			0.12		10
Guatemala	1.45	1.33		0.03	0.30		10
Guyana	0.84	1.0		0.01	0.004		11
Honduras	1.15	0.81	1.0	0.02	0.10	0.02	9
Mexico	0.79	0.86		0.79	3.29		5, 10, 11
Nicaragua		0.88			0.06		10
Panama		1.52	0.72		0.03	0.05	9
Peru	0.46[c]	1.4		0.20	0.22		9, 10, 11
Uruguay	1.3	1.0	1.0	0.09	0.03	0.01	9, 10, 11
Venezuela	1.0	1.14		0.20	0.37		10, 11
Subtotal							
NPC < 0.95				3.73	9.84	0.18	
0.95 < NPC < 1.05				0.22	0.37	3.15	
NPC > 1.05				0.74	1.24	0	

APPENDIX TABLE 4 (Cont).

Region/Country	Net Protection Coefficients			Percentage Shares of World Consumption, 1980			Sources
	Wheat	Maize	Rice	Wheat	Maize	Rice	
Near East							
Egypt	0.29-0.57	0.52-0.7	0.37	1.68	0.99	0.56	2, 5, 6, 12
Iran	0.98	1.03		1.46	0.12		10
Jordan	0.70			0.08			4
Lebanon	0.59	1.0		0.09	0.04		10
Saudi Arabia	<1			0.29			4
Syria	0.44[c]	1.13	1.0	0.47	0.08	0.04	9, 10, 11
Sudan	1.0			0.13			12
Turkey	0.71-0.9	1.2-1.36	1.5	2.81	0.31	0.10	10, 12
Yemen Ar. Rep.	1.2			0.11			12
Subtotal							
NPC < 0.95				5.42	0.99	0.56	
0.95 < NPC < 1.05				1.59	0.16	0.04	
NPC < 1.05				0.11	0.39	0.10	
Far East							
Bangladesh	0.6		0.64-0.7	0.50		5.16	3, 12
Burma			0.13			2.32	3
Hong Kong	1.0		1.0	0.04		0.14	10
India	0.84	0.81	0.52-0.85	7.66	1.43	19.81	3, 5, 10, 12
Indonesia	0.73-0.87	0.84	0.80-0.83	0.31	0.88	7.84	3, 5, 10, 11
Korea (Rep).	1.05-1.8	1.10-1.67	1.75-2.30	0.54	0.67	2.21	1, 3, 5, 12
Malaysia	1.03	1.02		0.10	0.15		10, 11
Pakistan	0.58-0.84	0.94	0.40-0.97	2.54	0.19	0.81	2, 3, 5, 6, 10, 12
Philippines	1.43	0.7-1.0	0.7-1.16	0.16	0.81	1.78	3, 10, 12
Singapore	1.0	1.0		0.02	0.12		11
Sri Lanka			0.98			0.63	3
Taiwan	1.11-1.18	1.06-1.43	1.29	0.16	0.65	0.74	3, 5, 10
Thailand	1.22	0.8-1.02	0.63-0.76	0.05	0.28	3.26	2, 3, 5, 9, 10, 11, 12

APPENDIX TABLE 4 (Cont).

Region/Country	Net Protection Coefficients			Percentage Shares of World Consumption, 1980			Sources
	Wheat	Maize	Rice	Wheat	Maize	Rice	
Subtotal							
NPC < 0.95				11.01	3.40	39.20	
0.95 < NPC < 1.05				0.16	0.46	2.55	
NPC > 1.05				0.86	1.32	2.95	
DEVELOPING CPEs							
China	0.72	0.73	0.56	16.00	14.16	35.98	3, 11
World Totals							
NPC < 0.95				71.19	40.19	80.02	
0.95 < NPC < 1.05				8.18	37.31	3.68	
NPC > 1.05				15.68	17.67	8.25	
Unknown				4.95	4.83	8.05	

APPENDIX TABLE 4. (Cont.)

Sources: Consumption shares are estimated from 1980 data provided in United States Department of Agriculture, Foreign Agriculture Service, 1980, Reference Tables on Rice Supply—Utilization for Individual Countries, FG-38-80, and 1981, Reference Tables on Wheat, Corn, and Total Coarse Grains Supply—Distribution for Individual Countries, FG-4-81. Net protection coefficients are drawn from the following sources:

1. Ahn, In-Chan and Kym Anderson, 1982, Korean Comparative Advantage, Agricultural Protection and Domestic Resource Cost of Rice Production, 1965 to 1980, manuscript, Department of Economics, Research School of Pacific Studies, Australian National University.

2. Bale, Malcolm D. and Ernst Lutz, 1979, Price Distortions in Agriculture and Their Effects: An International Comparison, World Bank Staff Working Paper No. 359, Washington, D.C.

3. Falcon, Walter P. and Eric A. Monke, 1979-80, International Trade in Rice, Food Research Institute Studies XVII(3):279-306.

4. Food and Agriculture Organization, 1975, National Grain Policies, Rome, Italy.

5. Jabara, Cathy L., 1981, Trade Restrictions in International Grain and Oilseed Markets: A Comparative Country Analysis, United States Department of Agriculture, Economics and Statistics Service, Foreign Agricultural Economic Report No. 162.

6. Lutz, Ernst and Pasquale Scandizzo, 1980, Price Distortions in Developing Countries: A Bias Against Agriculture, European Review of Agricultural Economics 7(1):5-27.

7. Pearson, Scott R., J.D. Stryker, C.P. Humphreys and others, 1981, Rice in West Africa: Policy and Economics (Stanford, CA: Stanford University Press).

8. Policy and Economic Studies Team of PROCALFER, 1982, Comparative Advantage of Policy Choices in Portuguese Agriculture, mimeo, Department of Agricultural Economics, University of Arizona, Tucson, Arizona.

9. United States Department of Agriculture, Foreign Agriculture Service, Foreign Agricultural Attache Reports, Washington, D.C.

10. United States Department of Agriculture, Foreign Agriculture Service, 1979, Foreign Agriculture Circular, Wheat and Corn Prices for Selected Countries, FG-6-79,

11. ibid, 1981, FG-21-81.

12. World Bank, 1982, World Development Report (New York: Oxford University Press)

APPENDIX TABLE 4. (Cont).

Notes:

a) Calculated as the ratio of domestic consumer price to fob export or cif import price. If country-specific cif-fob prices were unavailable, prices were taken from World Bank, Commodity Trade and Price Trends, adjusted upward by 20-30 perent to approximate insurance and freight costs. The percentage share of each country in world consumption for 1980 is provided in parentheses.

b) Protection rates vary for individual member countries, primarily due to green rate exchange policies.

c) Reflects subsidies on flour or bread.

APPENDIX TABLE 5. GRAIN TRADE POLICIES IN SELECTED COUNTRIES, 1970s.

Country	Commodities with NPC Different From Zero		Government Monopoly	Trade Quotas, Licences	Trade Taxes/ Subsidies	Free Trade	Sources
DEVELOPED MARKET ECONOMIES	(W=wheat, M=maize, R=rice)						
Austria	WM			WM	WM[a]		5
Canada	W				W[b]		5
EEC	WMR				WMR[a]		1, 5
Finland	W		W		W		1
Israel	W		W				5
Japan	WR		R	W			1, 5
Norway	WM		WM				1, 5
Portugal	WMR		WMR				1, 5
South Africa	WM		WM				5
Spain	WM				WM[a]		1, 5
Sweden	WMR				WM[ab]R		1, 5
Switzerland	WM			WM	WM[a]		1, 5
	% of world cons	W	1.00	1.71	12.90	0	
		M	2.43	0.37	9.36	0	
		R	4.06	0	0.35	0	
DEVELOPED CPEs							
Czechoslovakia	WMR						na
German Dem. Rep.	WM		WM				5
Hungary	WM			WM	WM		1
Poland	WM		WM				5
Romania	WMR		WMR				1, 5
USSR	WMR		WMR				2, 5
Yugoslavia	WM			WM	M		1, 5

APPENDIX TABLE 5 (Cont).

Country	Commodities with NPC Different From Zero		Trade Policies: Government Monopoly	Trade Policies: Quotas, Licences	Trade Policies: Trade Taxes/ Subsidies	Free Trade	
	% of world cons	W	28.02	2.40	1.10		
		M	8.61	3.71	3.71		
		R	0.78	0	0		
DEVELOPING MARKET ECONOMIES							
Africa							
Algeria	W		W				1
Cameroon	R						na
Ghana	WMR					WMR	1
Ivory Coast	MR		MR				3
Kenya	WMR		WMR				1, 5
Liberia	R			R			1, 3
Malawi	M(?)			M			1
Mali	R			R			3
Mauritius	R		R				1
Morocco	WM		WM				1, 5
Nigeria	WMR			WMR	M		1, 5
Senegal	R(?)			R			1
Sierra Leone	R		R				3
Tanzania	WMR		WMR				1
Tunisia	M		M				1
Zaire	MR						na
Zambia	WM		WM				1
Zimbabwe	WM						na
		W	1.59	0.32	0.03		
		M	1.07	0.49	0.56		
		R	0.47	0.69	0.03		

APPENDIX TABLE 5 (Cont).

Country	Commodities with NPC Different From Zero	Trade Policies: Government Monopoly	Trade Policies: Quotas, Licences	Trade Policies: Trade Taxes/ Subsidies	Trade Policies: Free Trade	
Latin America						
Argentina	WMR(?)	WMR (1974-76)		WM (1976-80)		5
Bolivia	W	W				1
Brazil	WMR	WM				5
Chile	W		W			1
Colombia	WMR	WMR		M		1
Costa Rica	MR	MR				5
Dominican Republic	M	M				4
Ecuador	WR		W			5 (R na)
Gautemala	WM	M	W			1, 5
Guyana	W				W[c]	5
Honduras	WM	WM				4
Mexico	WM	WM				1, 5
Nicaragua	M					na
Panama	MR					na
Peru	WM	WM				1, 5
Uruguay	W		W	W		1, 5
Venezuela	M			M[b]		5
% of world cons	W	2.88	0.37	0.99	0.01	
	M	9.80	0	1.44	0	
	R	0.47	0	0	0	
Near East						
Egypt	WMR	WMR				1, 2, 5
Jordan	W		W			1
Lebanon	W	W				5
Saudi Arabia	W				W	1
Syria	WM	WM				5
Turkey	WMR	WMR				5
Yemen Ar. Rep.	W					na

APPENDIX TABLE 5 (Cont).

Country	Commodities with NPC Different From Zero	Trade Policies: Government Monopoly	Trade Policies: Quotas, Licences	Trade Policies: Trade Taxes/ Subsidies	Trade Policies: Free Trade	
	W	5.05	0.08	0	0.29	
	M	1.38	0	0	0	
	R	0.66	0	0	0	
Far East						
Bangladesh	WR	WR				1, 2, 5
Burma	R	R				2
India	WMR	WMR				1, 2, 5
Indonesia	WMR	WR	M			2, 5
Korea	WMR		WMR			1, 2, 5
Pakistan	WMR	WMR (high grades)	R (lower grades)			1, 2
Philippines	WMR(?)		WMR			5
Taiwan	WMR			WM		5 (R na)
Thailand	WMR		MR	WMR		1, 2, 5
% of world cons	W	11.01	0.70	0.21	0	
	M	1.62	2.64	0.93	0	
	R	35.94	8.06	3.26	0	
DEVELOPING CPEs						
China	WMR	WMR				2, 5
% of world cons	W	16.00				
	M	14.16				
	R	35.98				
TOTALS	% Share of World Cons					
	Wheat	65.55	5.58	15.23	0.30	
	Maize	39.07	7.21	16.00	0	
	Rice	78.36	8.75	3.64	0	

APPENDIX TABLE 5 (Cont).

Sources:

1. Food and Agriculture Organization, 1973, 1976, National Grain Policies 1972, 1975, Rome, Italy.

2. Food and Agriculture Organization, Intragovernmental Group on Rice, 1973, 1977, Compendium of National Rice Trade Policies, Rome, Italy.

3. Pearson, Scott R., J.D. Strykery, C.P. Humphreys and Others, 1981, Rice in West Africa: Policy and Economics (Stanford, CA: Stanford University Press).

4. United States Department of Agriculture, Foreign Agriculture Service, Foreign Agricultural Attache Reports, Washington, D.C.

5. United States Department of Agriculture, Foreign Agriculture Service, 1979, 1981, National Wheat and Corn Prices and Summary of National Grain Marketing Systems, Foreign Agriculture Circular, FG-6-79, FG-21-81.

Notes:

na information not available.

a) Variable levy policy

b) Government marketing board acts as intermediary for commercial firms.

c) Domestic producer monopoly on wheat flour.

APPENDIX TABLE 6. GRAIN PRICES, 1950-80
(US $/metric ton)

	Rice[a]	Maize[b]	Wheat[c]	Price Deflators 1975=100 A[d]	B[e]
1950	136.7	68.1	66.9		
51	144.4	72.0	72.4		
52	156.3	62.6	72.0		
53	174.7	60.2	68.0		
54	157.9	58.3	62.8		
55	141.5	48.8	61.7		
56	136.9	51.6	62.8		
57	137.2	47.6	63.2		
58	142.3	47.6	61.4		
59	132.2	46.1	58.1		
60	124.7	43.3	59.2	43.9	
61	136.5	45.9	59.5	44.2	47
62	152.8	51.4	59.9	43.7	43
63	143.3	54.7	59.2	43.9	46
64	137.7	55.8	63.6	44.5	48
65	136.3	55.0	58.1	46.0	47
66	163.2	59.4	62.1	46.4	46
67	205.8	49.9	61.7	47.1	45
68	201.6	49.1	58.4	44.1	46
69	186.9	53.9	56.2	44.5	46
70	144.0	58.4	57.0	49.1	49
71	129.0	58.4	62.1	53.1	50
72	147.0	56.0	69.1	58.4	53
73	350.0	98.0	136.8	69.8	70
74	542.0	132.0	178.0	86.9	100
75	363.1	119.6	138.4	100.0	100
76	254.5	112.4	122.7	101.9	104
77	272.2	95.3	95.5	109.4	135
78	367.5	100.7	124.9	125.9	129
79	334.2	115.5	156.3	142.7	139
80	434.0	126.0	168.0		154

Sources: World Bank Commodity Price Trends; FAO, Trade Yearbook.

Notes:
[a] Thai 5% brokens, fob Bangkok
[b] US No. 2 yellow, fob Gulf ports
[c] US No. 1, soft red winter, fob Atlantic, prior to 1974, No. 2
[d] Index of US Dollar unit values (cif) of manufactured exports to developing countries
[e] Index of US dollar unit values (fob) of agricultural product exports from developing countries

APPENDIX TABLE 7. RATIO OF CEREAL IMPORT COSTS TO TOTAL COMMODITY EXPORT EARNINGS FOR SELECTED DEVELOPING COUNTRIES, 1970-80.

Country	Year											
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	Average
Africa												
Algeria	.034	.061	.06	.056	.071	.094	.065	.059	.069	.059	.053	.062
Cameroon	.037	.037	.035	.025	.04	.036	.029	.034	.033	.027	.024	.032
Congo	.058	.064	.053	.053	.062	.089	.091	.055	.099	.03	NA	.065
Ethiopia	.048	.032	.006	.014	.004	.003	.012	.071	.06	.03	.162	.040
Ghana	.038	.020	.022	.036	.055	.025	.049	.062	.062	NA	NA	.041
Ivory Coast	.033	.024	.028	.045	.037	.012	.014	.029	0.32	.040	NA	.029
Liberia	.046	.036	.028	.042	.043	.042	.037	.051	.053	.059	.065	.046
Libya	.010	.011	.009	.011	.019	.025	.017	.013	.015	.012	.008	.014
Madagascar	.032	.064	.054	.029	.168	.117	.127	.082	.135	.135	NA	.094
Mauritania	.086	.104	.086	.077	.101	.145	.143	.155	.226	.194	.184	.136
Mauritius	.165	.156	.128	.115	.177	.129	.176	.095	.118	.107	.129	.136
Morocco	.060	.112	.056	.140	.109	.180	.163	.131	.158	.145	.143	.127
Nigeria	.021	.020	.020	.016	.009	.013	.021	.033	.068	.024	.019	.024
Senegal	.139	.252	.125	.323	.237	.113	.147	.153	.223	.163	.223	.191
Tanzania	.024	.017	.040	.023	.2695	.291	.030	.064	.064	.032	.208	.097
Tunisia	.162	.091	.076	.086	.059	.062	.064	.089	.094	.082	.079	.086
Upper Volta	.173	.341	.139	.336	.310	.149	.153	.173	.419	.186	.302	.244
Zaire	.025	.026	.024	.022	.043	.081	.096	.068	.089	.044	.055	.052
Zambia	.009	.049	.017	.018	.010	.026	.021	.015	.019	.028	.074	.026

APPENDIX TABLE 7 (Cont).

Country	Year 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	Average
Latin America												
Bolivia	.082	.081	.077	.066	.072	.089	.044	.059	.063	.072	.099	.073
Brazil	.059	.047	.039	.051	.069	.044	.056	.026	.064	.078	.109	.058
Chile	.039	.060	.061	.083	.135	.088	.106	.035	.069	.057	.066	.073
Colombia	.032	.057	.038	.078	.073	.041	.054	.036	NA	NA	NA	.051
Costa Rica	.039	.049	.033	.048	.056	.050	.046	.018	.021	.025	.039	.039
Dominican Republic	.016	.037	.037	.071	.110	.064	.086	.062	.062	.039	.068	.059
Ecuador	.035	.044	.034	.034	.030	.056	.040	.031	.030	.030	.030	.037
El Salvador	.017	.023	.015	.051	.037	.028	.033	.021	.029	.020	.028	.027
Guatemala	.026	.020	.019	.034	.039	.042	.038	.015	.025	.024	.030	.028
Guyana	.030	.029	.030	.055	.044	.035	.063	.040	.029	.040	.041	.040
Haiti	.107	.107	.123	.219	.229	.239	.226	.246	.201	.204	NA	.190
Honduras	.029	.024	.024	.023	.037	.078	.045	.023	.032	.033	.045	.036
Jamaica	.076	.079	.086	.119	.131	.106	.123	.070	.089	.098	.106	.098
Mexico	.046	.012	.048	.200	.170	.206	.036	.072	.061	.057	.072	.089
Panama	.026	.079	.046	.070	.034	.043	.045	.044	.034	.045	.064	.048
Paraguay	.070	.059	.043	.080	.066	.026	.051	.020	.019	.028	.036	.045
Peru	.040	.061	.064	.104	.097	.141	.119	.094	.076	.058	NA	.085
Suriname	.023	.014	.014	.025	.023	.023	.019	.025	.018	.019	.015	.020
Trinidad etc.	.030	.030	.029	.031	.024	.029	.024	.019	.019	.020	.015	.025
Uruguay	NA	.039	.042	.056	.0005	.002	.004	.002	.027	.047	.007	.022
Venezuela	.023	.022	.022	.021	.022	.021	.032	.032	.027	.021	.026	.024

APPENDIX TABLE 7 (Cont).

Country	Year											Average
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
Near East												
Cyprus	.106	.064	.077	.289	.181	.135	.114	.092	.098	.104	.105	.124
Egypt	.092	.206	.144	.153	.442	.523	.371	.399	.466	.421	.374	.326
Iran	.002	.027	.030	.025	.024	.027	.017	.020	.028	.024	.058	.026
Iraq	.009	.099	.020	.045	.040	.027	.022	.029	.039	.029	.024	.035
Jordan	.455	.517	.495	.373	.243	.210	.325	.295	.250	.275	.176	.329
Kuwait	.010	.010	.009	.008	.004	.009	.007	.005	.007	.005	.007	.007
Lebanon	.200	.150	.091	.097	.046	NA	NA	NA	NA	NA	NA	.117
Oman	NA	NA	NA	NA	.013	.012	.001	.019	.026	.016	.007	.015
Saudi Arabia	.029	.020	.015	.010	.005	.007	.007	.006	.012	.011	.010	.012
Somalia	.188	.209	.254	.277	.221	.356	.232	.480	.390	.467	.576	.332
Sudan	.057	.047	.045	.038	.079	.053	.064	.029	.100	.132	.145	.072
Syria	.217	.331	.100	.085	.128	.084	.051	.077	.079	.065	.097	.120
UA Emirates	NA	NA	NA	NA	.001	.002	.002	.004	.006	.009	.005	.004
Yemen AR	2.852	1.874	2.205	1.826	2.734	5.262	12.577	3.623	11.143	5.065	NA	4.898
Yemen DR	.132	.081	.101	.136	.175	.138	.135	.153	.271	.158	NA	.148
Far East												
Afghanistan	.151	.364	.165	.059	NA	.062	.007	.026	.071	.052	.028	.099
Bangladesh	NA	NA	.610	.819	1.114	1.543	.671	.185	.474	.267	.815	.722
India	.173	.119	.024	.176	.213	.296	.197	.034	.017	.020	.004	.116
Indonesia	.169	.141	.114	.177	.062	.056	.063	.067	.059	.045	.040	.09
Korea RP	.292	.283	.174	.126	.137	.135	.055	.082	.038	.050	.061	.130
Pakistan	.028	.033	.079	.112	.146	.212	.155	.056	.092	.172	.040	.102
Philippines	.043	.067	.085	.061	.052	.069	.056	.033	.029	.025	.033	.050
Singapore	.041	.032	.036	.030	.029	.027	.0195	.019	.017	.016	.014	.026
Srilanka	.290	.209	.192	.289	.484	.559	.301	.311	.221	.187	.174	.292
Thailand	.008	.007	.007	.007	.009	.007	.091	.004	.006	.009	.005	.014

Sources: Data for the cost of cereal imports are taken from Food and Agriculture Organization Trade Yearbook, various years. Commodity exports earnings data are taken from International Monetary Fund, International Financial Statistics Yearbook, 1981.