INTERNATIONAL DIMENSION OF AGRICULTURAL PRICES

Arthur B. Mackie

Events of the past two years, specifically the agricultural price explosion of 1973, have strongly emphasized the growing interdependency of countries in the production, consumption and trade in agricultural products. The illusion of a closed agricultural economy has been dealt a series of severe blows. The world monetary crisis, the dollar devaluations, and sharply increased foreign demand for U.S. commodities have suggested that there is a single world market for basic commodities.

High food prices and food shortages have: (1) raised for the sixth time during this century the spectre of a Malthusian catastrophe in many developing countries, (2) created the prospect for a return to the free market by the American farmers as a result of the largest reduction in world grain stocks in 20 years, and (3) posed the prospect of a return to an extended period of price instability, fluctuations and uncertainty that characterized the world's agricultural economy around 1950. I shall discuss here the importance of supply in the determination of world prices and the impact of fluctuations in supply on import demand and prices of agricultural commodities.

Specifically, I shall review the: (1) record on world prices for all primary products and then for wheat, maize, cotton, soybeans, and rice which, as a group, accounted for about 60 percent of U.S. agricultural exports since 1950; (2) U.S. producers' growing dependency on world markets (specifically the growth in the foreign demand component in the total U.S. demand for the above commodities), and (3) importance of supply and stocks of wheat on world prices under fluctuating world import demand conditions. I will then briefly review the various hypotheses used to explain the recent explosion in agricultural prices in 1972-1973 and present some arguments supporting one of these hypotheses. Finally, I will present some problems and implications of supply and price uncertainty in an interdependent world, and some possible alternative research and policy programs for dealing with these uncertainties.

INTERNATIONAL COMMODITY PRICES – A PERSPECTIVE

The most notable features of international commodity markets in 1972 and 1973 were the extraordinary upsurge in prices of a large number of agricultural products and an increase in their within-year price stability. The price increase of primary products since mid-1972 was the steepest in recent years. Since 1968, when the overall United Nations' price index of primary products was at its 1963 base of 100, the price index has moved continuously upward. The price index increased by 4 percent in 1969 and 1970, by 6.5 percent in 1971, and by an accelerated rate of 13 percent in 1972 (Table 1). Between the second quarter of 1972 and 1973 the price index jumped 34 percent. It is estimated to have increased by another 12 percent in the third quarter of 1973.

The movement in the overall price index for primary products conceals large discrepancies between individual products. From 1968 to 1971 the largest increases were accounted for by minerals and

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Table 1. RECENT WORLD EXPORT PRICES, 1968-1973*

Commodity	1968	1969	1970	1971	1972	1972 Q1	1972 Q2	1972 Q3	1972 Q4	1973 Q1	1973 Q2	1973 Q3 est.	2nd qt. 1972 to 2nd qt. 1973	Average 1971 to average 1972
	Indices, 1963 = 100												Percent change	
All primary	100	104	108	115	130	125	128	131	137	153	172	192	34	13
Food	100	104	111	117	132	124	128	135	141	158	179	203	40	12
Wheat	97	94	90	96	110	95	97	106	140	150	166		71	15
Maize	89	98	110	108	111	102	106	113	123	139	163		54	3
Rice	127	113	100	97	108	103	105	108	118	126	142		35	11
Beef	120	129	148	186	226	206	235	247	215	252	288		23	22
Pork	114	126	143	128	146	140	141	151	153	178	190		35	14
Butter	81	80	89	106	118	128	126	111	106	104	106		-16	11
Oilseeds	99	101	118	118	116	113	115	114	118	144	183	234	59	-2
Oilseed cake	106	103	112	112	140	119	125	134	182	239	300		140	25
Fish	118	120	151	176	194	184	196	197	201	229	236		20	10
Sugar	56	66	68	75	97	104	92	90	99	119	124		35	29
Coffee	112	117	153	134	150	136	140	161	160	176	185		32	12
Cocoa	133	174	126	99	117	100	110	123	135	142	206		87	18
Tea	79	76	84	83	81	81	88	79	76	78	81		-8	-2
Agricultural raw material	96	101	101	105	126	113	119	120	129	151	170	193	43	17
Cotton	102	98	103	113	142	138	145	140	146	155	164		13	26
Wool	74	73	63	57	88	66	76	87	120	185	174	189	129	54
Rubber	73	96	77	62	63	60	60	59	71	92	105		75	2
Hides & skins	108	133	118	126	223	170	207	238	284	263	239		15	77

*Source: [3, 6].

forestry products and to a lesser extent by a few agricultural products, notably beef, fish, butter, and oilseeds. However, since the last quarter of 1972, increases in the overall index have been concentrated primarily in agricultural products. Between the second quarters of 1972 and 1973 the largest increases were for oilseed cake and meal (140 percent), wool (129 percent), cocoa (87 percent), rubber (75 percent), wheat (71 percent), oilseeds (59 percent), maize (54 percent), and rice, pork, and sugar (35 percent). Prices of butter and tea declined (Table 1).

Even if a maximum allowance is made for the effect of the monetary factors, the price increase of primary products in 1972 and agricultural products in 1973 appears to be larger than during the immediate post-World War II period or in the Korean War commodity price boom. It appears useful, therefore, to place this recent inflation in commodity markets in an historical perspective. After a sharp rise of 45 percent between the first quarters of 1950 and 1951, prices of primary products drifted almost continuously downward except for temporary recoveries in 1954 and 1957 – until 1962 when, according to the U.N. index, they were lower by some 5 percent than in the first quarter of 1950, i.e., their pre-Korean War level [3].

As for prices of agricultural products, they increased by 11 percent in 1948, and declined by 9 percent in 1949 before increasing by 4 percent in 1950 and by 26 percent in 1951. From 1952 they then declined rather continuously until 1968, when they turned slowly upward until the explosion in 1972-1973.

The price movements since 1948 for wheat, maize, soybeans, rice, and cotton are shown in Table 2 and graphically in Figure 1. These five commodities were chosen to illustrate the historical price

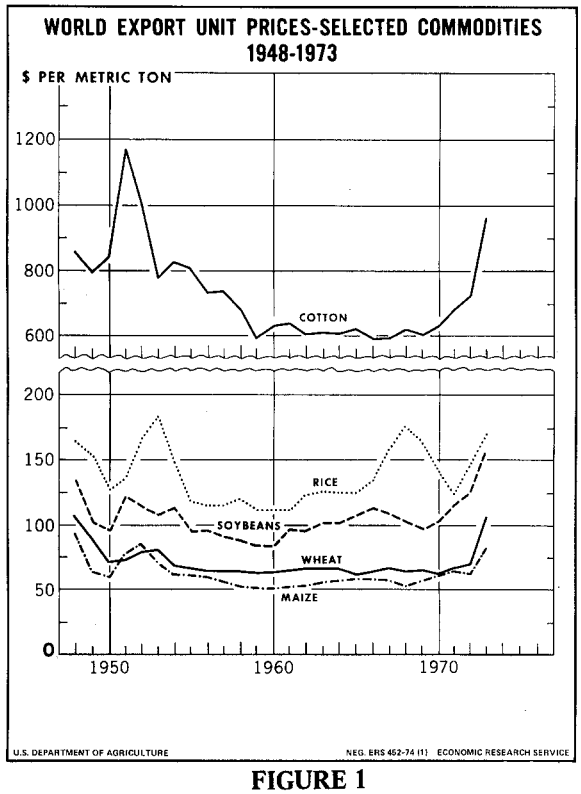

FIGURE 1

movements of agricultural products because of: (1) their importance in U.S. agricultural exports (accounting for 57 percent in 1972), (2) the general representativeness of these commodities of the various temperate zone commodities entering world trade, and (3) the growing importance of exports in total demand of these commodities in the U.S. which makes U.S. price more dependent upon fluctuations in foreign supply and demand.

The dependency on foreign markets (share of production exported) was greatest in fiscal year (FY) 1973 for wheat (77 percent), rice (70 percent), soybeans (56 percent), and cotton (34 percent). Corn and grain sorghum were least dependent on exports (21 and 23 percent, respectively) [8].

Prices of these five commodities were highly unstable during the 1948-1955 and 1972-1973 periods, relative to their behavior during the intervening years, particularly for wheat and maize. The overall price movements in these commodities closely correspond with those for all U.S. agricultural exports as reflected in the index of export unit values and quantities for 1947-1973 in Figure 2.

From 1953 to 1971 changes in the value of U.S. agricultural exports resulted primarily from increases in volume. However, in FY 1973, approximately 40 percent and in calendar 1973 about 60 percent of the increase in value of U.S. agricultural exports were due to higher prices. Current estimates suggest that this proportion will rise to 90 percent for FY 1974.

SPECULATION ABOUT FACTORS AFFECTING PRICE RISES

The rapid rise in world prices since mid-1972 for primary and agricultural commodities after two decades of price stability has raised questions as to the factors affecting the level of commodity prices. Behind the recent price increases lie such diverse factors as supply shortages, shifts in demand due to the quickening pace of economic activity in Western Europe and Japan, exchange rate changes and uncertainty about international monetary conditions.

Speculation about causes of recent sharp increases in price has focused upon both demand and supply factors. One hypothesis holds that the rapid growth in world demand in 1972-1973 was the direct result of a rapid rise in affluence around the world which sharply shifted the demand curve to the right and changed the nature and structure of demand – i.e., the price and income elasticities.

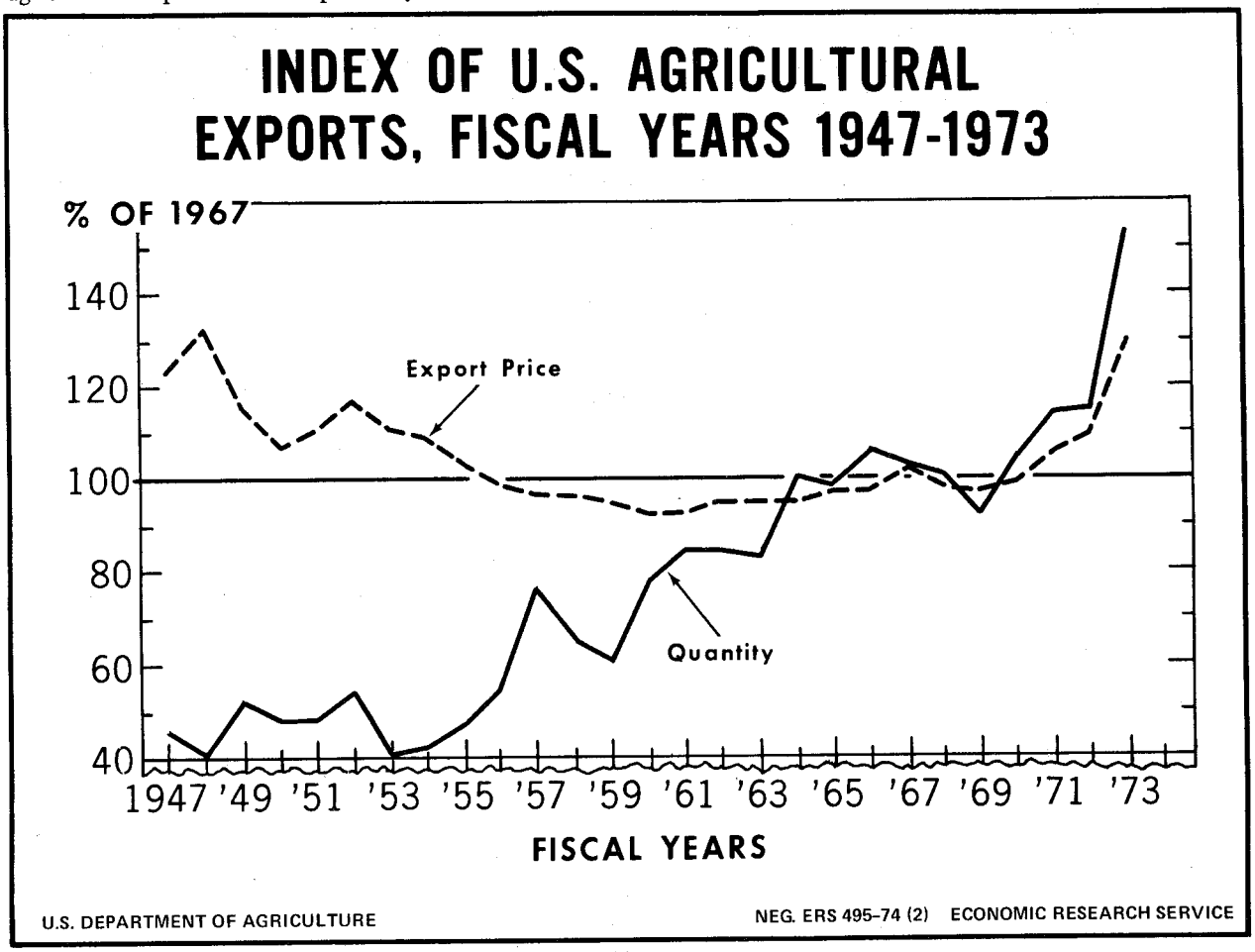

FIGURE 2

Table 2. HISTORICAL WORLD EXPORT UNIT VALUES FOR SELECTED COMMODITIES, 1948-1973*

Year	Wheat	Maize	Milled rice	Soybeans	Cotton	Barley	Raw sugar	Bananas	Tea	Coffee	Cocoa
	Dollar per metric ton										
1948	106	93	164	134	856	105	99	100	1,200	510	707
1949	89	64	152	101	797	65	98	105	1,112	581	461
1950	71	60	127	95	838	59	104	104	986	959	558
1951	74	78	135	122	1,170	72	116	101	1,043	1,075	711
1952	79	85	167	114	1,003	77	110	97	948	1,104	668
1953	80	70	183	108	771	63	97	100	998	1,141	660
1954	68	61	147	113	828	53	99	100	1,327	1,401	1,070
1955	66	61	118	95	805	56	95	100	1,414	1,076	818
1956	63	60	115	96	740	55	96	103	1,255	1,048	581
1957	63	55	115	91	742	51	117	102	1,228	1,025	563
1958	63	51	120	87	681	51	100	93	1,209	918	845
1959	62	50	111	84	593	53	95	87	1,194	747	739
1960	62	50	111	83	630	53	90	81	1,243	720	593
1961	64	51	111	97	637	47	110	82	1,138	674	475
1962	66	51	123	95	605	57	97	78	1,101	648	452
1963	66	55	126	101	607	57	133	75	1,127	643	488
1964	66	56	125	101	604	57	142	83	1,106	830	499
1965	61	58	125	107	615	63	99	92	1,073	800	381
1966	63	58	134	114	588	69	99	91	1,047	768	406
1967	67	57	158	109	587	67	95	92	1,034	712	542
1968	64	52	175	103	618	64	95	86	941	753	604
1969	65	56	164	98	601	58	102	89	884	721	782
1970	62	60	140	103	623	53	113	85	934	937	767
1971	65	64	123	115	688	60	126	83	949	826	629
1972	69	62	146	126	727	58	147	88	982	902	594
1973 est.	104	83	169	162	968	86	161	90	775	1,157	775

*Source: [1].

Table 3. WORLD TRADE AND STOCKS OF MAJOR EXPORTERS OF WHEAT AND FLOUR (GRAIN EQUIVALENT) 1948-1973*

Year	World	Total 4 countries	United States	Canada	Argentina	Australia	Stocks/exports	
	Exports	Stocks	July 1	August 1	December 1	December 1	World	United States
	Million metric tons						Ratio	
1974 Projected	70.0	18.0	6.8	10.0	0.5	0.5	.26	.10
1973 Preliminary	75.0	22.4	11.6	10.0	0.5	0.3	.30	.15
1972	63.8	41.4	23.5	16.0	0.5	1.4	.65	.37
1971	58.5	44.1	19.9	20.0	0.7	3.5	.75	.34
1970	57.1	59.6	24.1	27.5	0.8	7.2	1.04	.42
1969	48.6	53.0	22.2	23.2	0.3	7.3	1.09	.46
1968	53.3	35.2	14.7	18.1	1.0	1.4	.66	.28
1967	52.9	29.7	11.6	15.7	0.2	2.2	.56	.22
1966	62.7	26.6	14.6	11.4	0.2	0.4	.42	.23
1965	56.4	40.3	22.3	14.0	3.3	0.7	.71	.39
1964	59.2	39.8	24.5	12.5	2.2	0.6	.67	.41
1963	49.7	46.9	32.5	13.3	0.5	0.6	.94	.65
1962	44.9	47.3	36.0	10.6	0.2	0.5	1.05	.80
1961	46.1	56.4	38.4	16.5	0.8	0.7	1.22	.83
1960	39.6	55.3	35.8	16.3	1.6	1.6	1.40	.90
1959	36.5	54.4	35.2	16.0	1.4	1.8	1.49	.96
1958	32.3	43.4	24.0	17.6	1.3	0.5	1.34	.74
1957	35.6	47.3	24.7	19.9	1.6	1.1	1.33	.69
1956	33.7	47.5	28.1	15.8	1.2	2.4	1.41	.83
1955	37.4	47.8	28.2	14.6	2.4	2.6	1.74	1.03
1954	24.2	46.4	25.4	16.8	1.6	2.6	1.92	1.05
1953	25.5	29.9	16.5	10.4	2.0	1.0	1.17	.65
1952	27.7	13.5	7.0	5.9	0.1	0.5	.49	.25
1951	29.4	22.0	10.8	6.3	2.3	2.6	.75	.37
1950	21.2	21.3	11.6	3.7	2.7	3.3	1.00	.55
1949	26.2	18.1	8.4	3.7	3.4	2.6	.69	.32
1948	26.2	14.6	5.3	2.9	3.5	2.9	.55	.20

*Source: [1].

A second hypothesis holds that the world has suddenly lost its ability to feed itself and to expand output relative to demand because of limited land and limited production technology that will continue to hold food supplies below world demand for many years. A third hypothesis is that current world food shortages and high prices were caused primarily by currency realignments and subsequent speculation in commodities because of unstable conditions of the major currencies.

A fourth hypothesis is that the current world food shortage and high prices were most directly related to crop shortfalls, which suddenly added to total world import demand at a time when world grain stocks were inadequate, thereby increasing uncertainty, hoarding, and speculation in commodities. This speculation was aided by the unsettled nature of the international monetary situation and the developing energy crisis.

ARGUMENTS IN SUPPORT OF HYPOTHESIS

While all of the factors mentioned above have played a part in the recent explosion in agricultural prices, I believe that the most important factor has been supply shortages. I believe that the rapid growth in world import demand for U.S. commodities was more directly related to shortfalls in production and low level of stocks in the rest of the world than to rapid shifts in demand resulting from income growth or dollar devaluations. Furthermore, I believe that the prospect for a return to surplus supply conditions, as a result of a combination of increased production in response to current high prices and reduced world demand growing out of the current energy crisis, raises an additional spectre of a "cobweb-type" reaction resulting in declining farm prices and incomes at a time when prices of many commodities and farm income have reached historic levels.

While I do not discount the influence of factors other than supply on price for U.S. agricultural commodities, I maintain that these have played a supporting rather than leading role. It seems evident to me, and apparently to others, that the lagged and more permanent adjustments in prices that would be attributable directly to currency realignments were not the main factor in the general increase in price levels of the magnitude experienced in 1972 and early 1973 [1, 3].

According to the U.N.'s Food and Agriculture Organization (FAO), the net effect of exchange rate uncertainties is not clear, even on short-term price movements. "There is little evidence for attributing the widespread price increases in agricultural commodities during 1972 to speculative activity associated with the currency realignments in December 1971, although the disturbed monetary situation later prevailing played a part in the increases for certain commodities in 1973. For 1972 however, analysis of price movements of storable commodities and available data on monthly stock movements in individual countries indicate that currency uncertainties exercised no systematic effects on prices" [1, 2].

Rises in general price levels in industrial countries appeared to be more a result than a cause of inflation in international commodity markets [1, 4]. The factors supporting the rise in primary commodity price differ in important respects from the causes of general inflation. Because of the nature of price and income elasticities of demand for food and raw materials, rapid shifts in their total demand are not likely to result from stepped-up economic activity in industrial countries or rapid changes in tastes altering the demand elasticities.

Rather sudden shifts in world import demand are more likely to result from production shortfalls in some major producing countries causing them to go into world markets to meet their needs. Although an acceleration in income growth in industrial countries was certainly a contributory factor in 1972-1973, especially in feeds and protein meal, the sharp price increases for agricultural products resulted mainly from supply shortages which were associated with both an increase in import requirements and a reduction in production and export supplies outside the United States.[1] The grain situation is one clear example. The setback in 1972 in world grain production and the purchases of large quantities of grains and other commodities by the USSR and Mainland China, as well as the more critical balance of supply and consumption in Asia and developing regions elsewhere, caused exceptionally large increases in prices [1, 3].

The shortages in field crops, particularly grain, seem to be short-run in nature, essentially reflecting stock shortages. International wheat trade expanded more slowly than wheat production, consumption, or trade in other agricultural products between 1965-1971. As grain production in the traditional importing countries grew more rapidly than world

[1] Production of most major agricultural commodities in 1972 either declined or fell short of the trend rate of growth over the 1960's. These shortfalls represented a much larger proportion of world exports since, for many commodities, exports constitute only a small fraction of world output [2].

grain import requirements, imports became more marginal and more residual in terms of total demand in these countries. Consequently, the impact that fluctuations in agricultural output in some of the main producing and exporting areas, such as the USSR, can have on world markets is magnified by this marginal role of world import requirements and export availabilities as compared to world production. This fact helps to explain the striking instability of world agriculture markets, i.e., the fast transition, in a period of two to three years, from situations of embarrassing surpluses to acute shortfalls of supplies or vice versa [3].

The level of wheat stocks in the four major exporting countries, primarily the United States and Canada (Figure 3), has tended to be a function of both the level and rate of growth of world exports, rising during periods of slow growth (1954-1962) or negative growth (1966-1969), and falling during periods of rapid export growth (1950-1951, 1955-1957, 1960-1966, and 1972-1973). The relation of wheat stocks to exports also is shown in Figure 4 by the ratio of stocks to exports in 1948-1974. These data suggest that there may be some critical level of stocks in relation to export demand. The critical or threshold level of stocks to exports for triggering a price change is about 50 percent or six months' free world reserves.

Since 1948, wheat reserve stocks of the four major exporters have fallen near or below this level only four times (1948, 1952, 1966-1967, and 1972-1973, Table 3). In each period there were observed increases in prices. The ratio of stocks to exports fell below the critical level in 1952 during the Korean commodity price boom, in 1966 during the extensive shortfalls in crop production because of droughts in India, the USSR and China which resulted in increased imports by these countries, and in 1972-1973 during rather widespread shortfalls in production of a number of agricultural commodities – especially in the USSR – which resulted in unusually large surges in world import demand (exports) [2].

The ratio of stocks to exports is expected to fall even further by July 1, 1974, under current projections. At this projected level, reserve stocks would be only about 25 percent of world exports or equivalent to three months' supply relative to

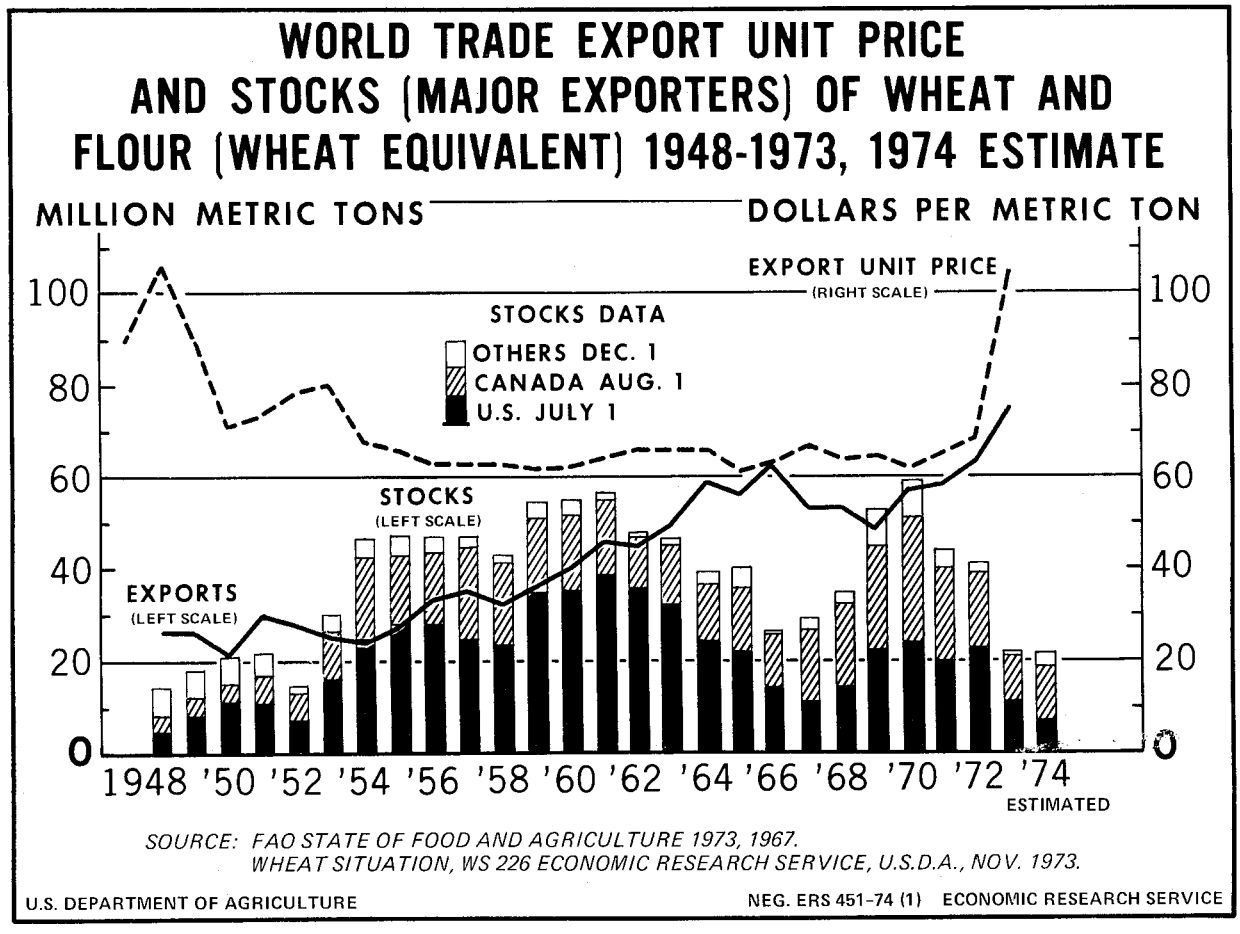

FIGURE 3

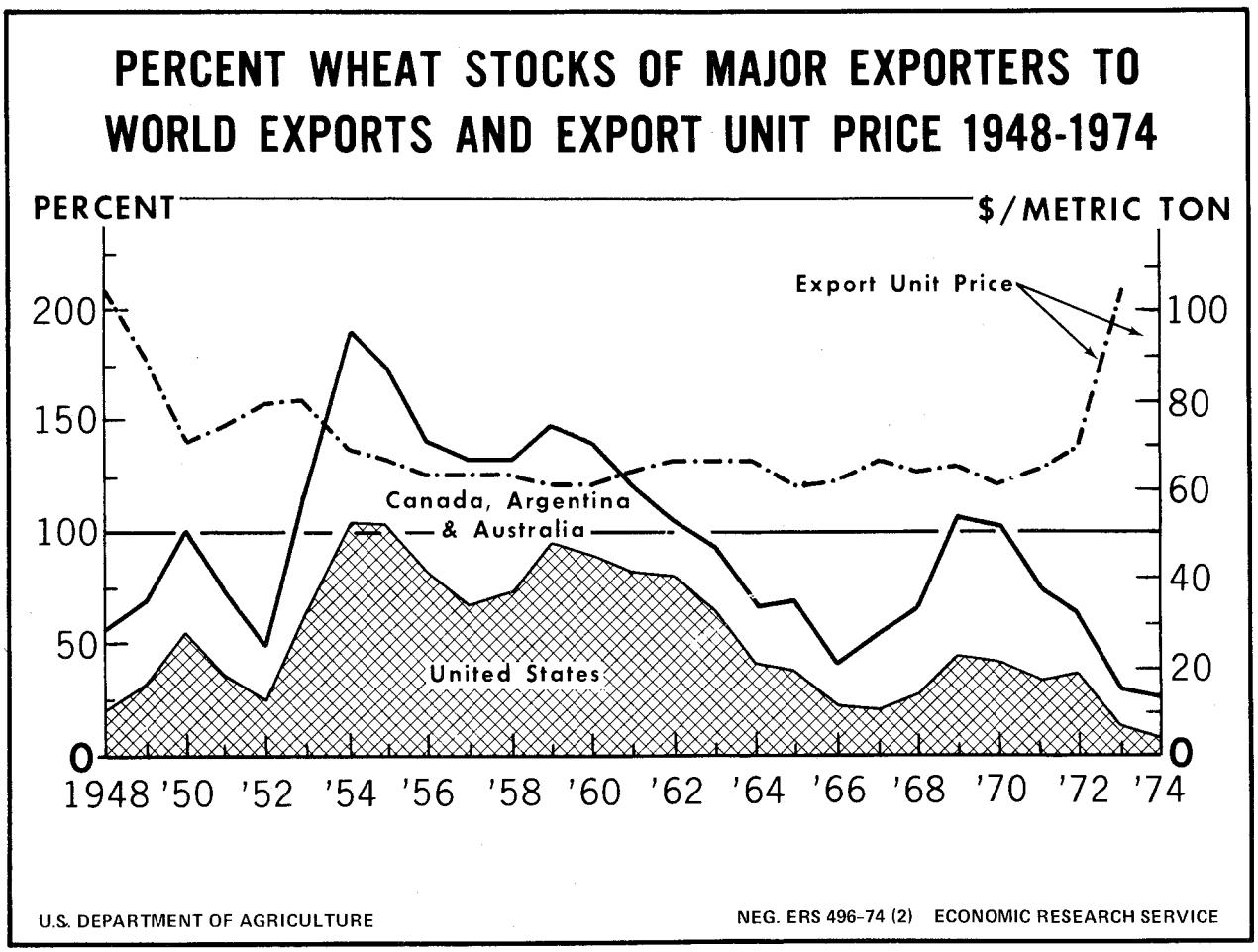

FIGURE 4

exports.

What is suggested here by the historical level of stocks of wheat to exports is that there are large fluctuations in world import demand about the long-term trend that directly affect the level of stocks and prices. It might be useful at this juncture to examine the sources of import demand growth and fluctuation in this demand for the period 1962-1973. The data shown in Figure 3 suggest that this period would be a useful period to observe these effects.[2]

The data on world imports by regions reveal that for FY 1962-1973 about a third of world import demand for wheat was accounted for by Western Europe and Japan (Figure 5 and Table 4) and about one-half by developing countries. While developed countries showed an absence of wide fluctuations in import demand and a slow, but steady growth in demand, developing countries, South Asia excluded, exhibited a more rapid growth trend in import demand, primarily because of a higher income elasticity of demand, but also a noticeable fluctuation in demand around the long-term trend.

In contrast to the other less developed countries (LDC's) as a group, South Asia exhibited little or no trend growth in demand despite the large imports in 1965-1968 resulting from extensive and prolonged droughts and the subsequent reduction in imports because of the Green Revolution. Like South Asia, the People's Republic of China and Eastern Europe have exhibited zero or negative growth trends but definite year-to-year fluctuations in import demand. As for the USSR, its import demand consists primarily of abnormally large increases in imports in FY 1964, FY 1966, and FY 1973, years of crop shortfalls.

In summary, these data suggest both a trend growth in world import demand for wheat, attributable to income growth, and a large fluctuation in import demand, attributable to fluctuations in supply, i.e., a large residual demand component centered especially in the Central Plan or Communist countries.

Import trends were computed for each of the 11 regions plus the world as shown in Table 4 and Figure 5 to determine the nature of the contributions of each region to the trend in world wheat imports. These results in FY 1963-1974 are summarized in Table 5.

[2] For this examination I found it necessary to resort to fiscal year rather than calendar year data in Figure 3 because of availability of data by regions. This modification, however, should not present any great difficulties.

These data verify the findings suggested by Figure 5, i.e., that the regions contributing to the 1963-1974 growth in world wheat imports were the developed (36 percent) and the less developed countries (64 percent). On the other hand, the Central Plan countries contributed practically nothing to the trend growth. The question arises about their contribution to the fluctuations in import demand.

To answer this question, two additional analyses were made: (1) an analysis of the sources of the deviations about the world trend, and (2) a first difference analysis or analysis of year-to-year changes in world imports. In the first analysis it was hypothesized that the major contributors to the deviations in world import demand were the Central Plan countries, i.e.:

Deviations about world import trend = f (imports by USSR, imports by China, and imports by East Europe).

The results suggested that these three regions were responsible for 93 percent of the deviation about the trend of world wheat imports between 1963-1974. In the second analysis it was hypothesized that the year-to-year changes in world import demand were dependent upon the year-to-year changes in the Central Plan countries, i.e.:

World imports_{FD} = f (USSR imports_{FD}, China imports_{FD}, East Europe_{FD}). These results were almost identical, explaining 93 percent of the year-to-year changes in world imports of wheat. In both analyses the USSR alone was responsible for 80 percent of the fluctuation in world wheat imports.

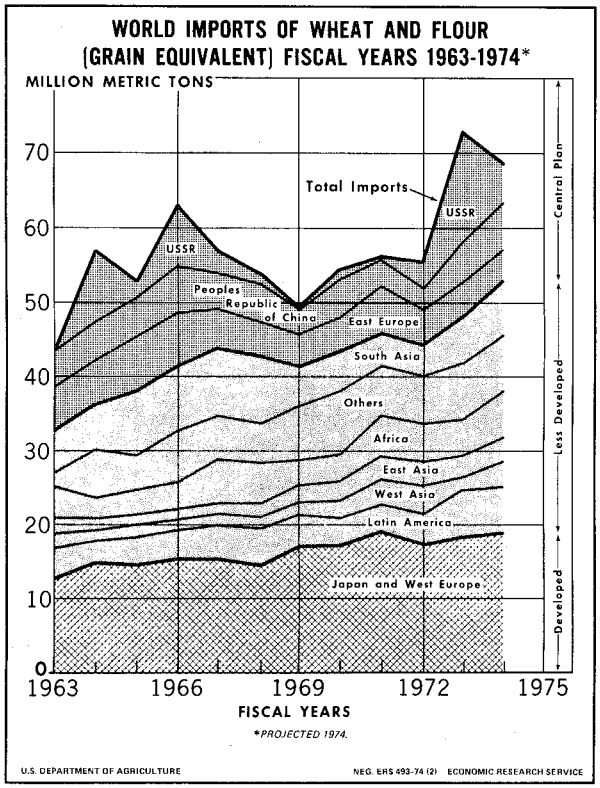

FIGURE 5

It is clear from these analyses that the world market for wheat would be a rather stable and slowly growing one if the import demand of the Central Plan countries were excluded. The impact of this fluctuating demand upon the world's wheat exports and exporters, especially the United States and Canada, can be observed in Figure 6. These data suggest that, while somewhat erratic, the individual and combined exports of West Europe, East Europe, the USSR, Argentina and Australia have tended upward until 1971 when exports fell. In 1972 and 1973 exports increased only in West Europe. The outstanding feature of a regional breakdown of wheat exports is that the United States and Canada have accounted for a major portion of the fluctuation in world wheat exports since 1963, primarily because of their reserve grain stocks.

To test the residual nature of exports from these two countries on world wheat trade, the year-to-year fluctuations in world exports were analyzed by making them dependent upon year-to-year changes in exports by the United States and Canada, i.e.:

World exports_{FD} = f (United States exports_{FD}, Canada exports_{FD}).

These results indicate that the fluctuation in United States exports accounted for 83 percent of the fluctuation in world exports for FY 1963-1974. Canada and the United States together accounted for 92 percent. These fluctuations in exports were directly related to the fluctuations in import demand that grew out of crop shortfalls in the USSR, China, East Europe and South Asia.

In other words, the United States and Canada have supplied, largely from their reserve stocks, most of the increased import requirements resulting from crop shortfalls in these areas.

These analyses suggest that the major factors affecting the price of wheat have been the level of stocks in the United States and Canada and fluctuation of supplies in the rest of the world, especially the Central Plan countries. The question still remains as to the effect of currency realignments and monetary uncertainty on recent price increases in agricultural products.

Unfortunately, we do not yet have data adequate for analysis of these factors. It may be years before the data needed for such an analysis becomes available and before appropriate techniques are developed for measuring the separate effects of currency realignments and speculation in

Table 4. WORLD TRADE IN WHEAT AND FLOUR (GRAIN EQUIVALENT) FISCAL YEAR 1963-1974*[a]

Region and country	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	Preliminary 1973	Forecast 1974
	Million metric tons											
Exports												
United States	17.3	23.1	19.3	23.4	20.0	20.2	14.7	16.5	19.8	16.9	32.0	31.0
Canada	9.0	15.0	11.9	14.9	14.8	8.9	8.7	8.9	11.5	13.7	15.7	13.7
Australia	5.0	7.8	6.4	5.7	6.9	7.0	5.3	7.4	9.3	8.4	5.4	6.8
Argentina	1.8	2.8	11.3	7.8	3.1	1.4	2.7	2.1	1.7	1.2	3.3	1.3
Sub-total	33.1	48.7	41.9	51.8	44.8	37.5	31.4	34.9	42.3	40.2	36.4	52.8
Western Europe	4.5	4.8	6.8	6.9	5.8	7.7	9.2	11.1	6.4	8.6	12.0	12.0
East Europe	0.0	0.3	0.3	0.9	1.7	2.3	2.0	1.3	0.1	0.2	0.5	0.7
USSR	5.3	2.7	2.2	2.6	4.4	5.3	5.8	6.4	7.1	5.5	2.5	4.0
Others	0.5	0.9	1.3	1.0	0.7	0.7	0.8	0.8	0.4	1.0	2.1	0.8
World total	43.4	57.4	52.5	63.2	57.4	53.5	49.2	54.5	56.3	55.5	73.5	70.3
Imports												
Japan	2.7	3.9	3.5	3.5	4.3	4.0	4.2	4.4	4.8	5.0	5.5	5.5
Western Europe	9.8	10.9	11.1	11.7	10.9	10.3	12.8	12.7	13.8	12.2	13.0	13.5
Developed	12.5	14.8	14.6	15.2	15.2	14.3	17.0	17.1	18.6	17.2	18.5	19.0
East Europe	5.9	6.0	7.4	7.2	5.4	4.9	4.3	4.7	6.5	4.8	4.7	4.0
USSR	0.0	9.7	2.2	8.5	3.1	1.5	0.2	1.1	0.3	3.4	14.9	5.5
China, P. Rep.	4.9	5.2	5.0	6.3	5.0	4.2	3.5	5.1	3.5	3.0	5.4	6.5
Central plan	10.8	20.9	14.6	22.0	13.5	10.6	8.0	10.9	10.3	11.2	25.0	16.0
Africa b/	4.2	2.8	3.3	3.8	6.0	5.6	3.6	3.7	5.6	5.2	4.9	6.4
Latin America c/	4.0	3.0	3.7	3.9	4.6	5.1	4.3	3.9	3.7	4.3	6.3	6.1
West Asia d/	2.0	1.4	1.7	1.2	1.8	1.6	1.7	2.3	3.5	3.8	1.7	3.6
South Asia e/	5.8	6.2	8.8	8.7	9.1	9.3	5.4	5.4	4.7	4.2	6.4	8.3
East Asia f/	2.1	1.7	1.2	1.4	1.3	1.8	2.0	2.7	3.0	3.1	3.0	3.3
Others	2.0	6.6	4.6	7.0	5.9	5.2	7.2	8.5	6.9	6.5	7.7	7.6
Less developed	20.1	21.7	23.3	26.0	28.7	28.6	24.2	26.5	27.4	27.1	30.0	35.3
World total	43.4	57.4	52.5	63.2	57.4	53.5	49.2	54.5	56.3	55.5	73.5	70.3

[a]Data include intra-EC-9 trade, but exclude products other than flour in grain equivalent; U.S. data also adjusted for transhipments through Canada.

[b]Algeria, Egypt, Libya, Morocco, Nigeria, South Africa, Sudan, and Tunisia.

[c]Mexico, Brazil, Chile, Colombia, Peru, and Venezuela.

[d]Iran, Iraq, Israel, Jordan, Lebanon, Saudi Arabia, Syria, and Turkey.

[e]Bangladesh, Ceylon, India, Indonesia, and Pakistan.

[f]Philippines, Taiwan, and South Korea.

*Source: [7].

commodities. However, we have undertaken some work in ERS in an attempt to evaluate the effects of the 1971 and 1973 dollar devaluations on the demand for United States exports of wheat, corn and soybeans [9].

In this study we selected those countries that accounted for the major proportion of United States exports of these commodities in 1972. The variables included in these cross section analyses were indices of changes in the: (1) exchange rate, (2) growth in per capita income, (3) growth in population, (4) consumer price index, (5) production and stocks outside the United States, (6) trends in imports from the United States, (7) trends in imports from rest of the world, (8) actual change in imports from the United States between 1971 and 1973 and between 1971 and 1972, and (9) actual imports from the rest of the world between 1971 and 1973 and between 1971 and 1972.

These results of these analyses suggest that the changes in exchange rates did not have a significant effect upon the level of imports from the United States between 1971 and 1973, and 1971 and 1972. Changes in exchange rates, if significant, soon

Table 5. ANALYSIS OF REGIONAL CONTRIBUTION TO WORLD WHEAT IMPORT DEMAND

Region	Trend coefficient (b)	Percent of import demand explained by trend (R^2)	t-value	Standard error of estimate
World	1.4486	39	2.51*	6.8884
Developed countries	0.5188	--	--	--
Japan	0.2192	89	8.99**	0.2915
Western Europe	0.2996	69	4.73**	0.7569
Central Plan	0.005	--	--	--
East Europe	-0.1993	41	2.654*	0.8976
USSR	0.2357	03	0.589 NS	4.7810
China, Peoples Rep.	-0.0314	01	0.33 NS	1.1269
Less Developed	0.9248	--	--	--
Africa	0.1975	37	2.410*	0.9802
Latin America	0.1857	46	2.94*	0.7563
West Asia	0.1682	44	2.81*	0.7158
South Asia	-0.1325	07	0.84 NS	1.8830
East Asia	0.1769	69	4.75**	0.445
Others	0.329	47	2.97*	1.325

*Significant at the .05 level

**Significant at the .01 level

dropped out of the stepwise regression for corn and wheat. The equations for soybeans were not significant, suggesting a need for a reformulation of these equations to include other variables. In summary, these results do not support the hypothesis that devaluation or other kinds of exchange rate changes were responsible for the rapid changes in the United States agricultural exports and commodity prices between 1971 and 1973 or between 1971 and 1972.

PROBLEMS AND IMPLICATIONS OF SUPPLY AND PRICE UNCERTAINTY

The world appears to have entered a new era of uncertainty with respect to the availability of basic supplies of foods and raw materials. Uncertainty itself is familiar, but what is new is the high degree of interdependency of nations attained in recent years in production, consumption, and trade of agricultural products combined with low levels of stocks. This interdependency creates instantaneous disequilibrium in international commodity markets when either demand or supply of basic commodities is radically altered. The purpose of this paper is to emphasize this growing interdependency and the implications of recent fluctuation in world grain production on world import demand and prices. Some of the problems created by this new international economic dependency are:

1. Prices and supply uncertainties become crucial to individual economies when dependency on foreign supplies (interdependency of producers and consumers) increases. For example, Western Europe and Japan, who are short on protein feeds needed for modern livestock production methods, are presently dependent on the United States for most of their protein feeds. In 1970, the United

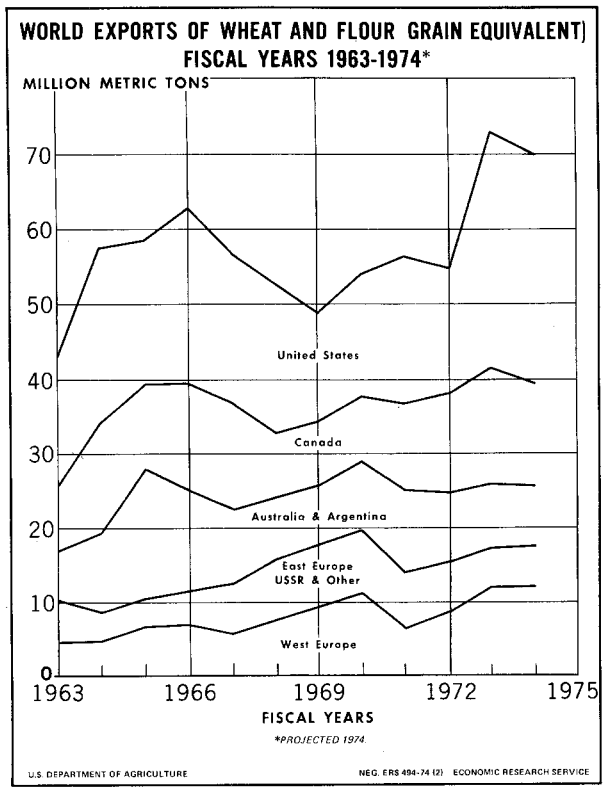

FIGURE 6

States produced two-thirds of the world's soybeans and exports 94 percent of the volume traded internationally.

2. Price uncertainty is magnified by shortfalls in world output when world stocks are low. The impact on world markets of fluctuations in agricultural production in some of the main grain-producing areas such as the USSR and China is magnified by the small size of world import requirements and export availabilities in contrast to total world production and consumption of most agricultural products (except for the purely export crops such as coffee and cocoa) [3]. The relatively small amount of world trade also helps to explain the striking instability of world agricultural markets, i.e., the fast transitions, in a period of two to three years, from a situation of embarrassing surpluses to acute shortages of supplies or vice versa.
3. International inflation is transmitted rapidly among countries with differential impacts [5]. In industrialized countries the adverse effects of inflation generated by rising food prices can be mitigated by higher negotiated wages, higher costs of industrial materials and generally higher cost of production.[3] The less developed countries which are normally short of basic foodstuffs and/or other essential primary products, and are unable to participate in the current export boom, are hit hard by inflated prices of their imports. Among these hardship cases are most of the so-called least-developed and populous countries of the Indian subcontinent, and the drought-stricken countries of Africa as well as some of the more advanced countries of Latin America; oil producing nations are notable exceptions. All the exchange-short LDC's will be receiving a diminished quantity of food imports on concessional terms, or they may lack the export earnings to pay for their imports. In 1972 world agricultural exports increased about 15 percent – nearly three-fourths of the expansion was due to exports from developed countries (primarily from reserve stocks).
4. Price uncertainty affects both producers and consumers. Producers usually respond to price uncertainty by reducing input costs and often output, while consumers pay with higher prices and reduced food consumption. Food prices have been an important factor in the acceleration of inflation everywhere [4]. The weight of food in the consumer price index is 22 percent in the United States, 41 percent for Europe as a whole, and 43 percent for Japan. In the United States during 1973 the Consumer Price Index is estimated to have risen 11.2 points, 5.7 points of which was due to food.
5. Insulation of domestic markets from events in other countries becomes increasingly more difficult in the industrialized countries as they become more interdependent with respect to food supplies and prices. A large number of countries have decided to rely on world markets for their food supplies beyond what can be explained merely by growth in income and population, i.e., greater reliance upon international trade. Stabilization of food supplies and prices puts increased emphasis on the role of food

[3] No attempt was made to analyze the influence of inflation on commodity prices, terms of trade or speculation in commodity markets because the focus of this paper was on the factors triggering price increases (supply) rather than an analysis of factors affecting the extent of price increases.

reserves or reserve production capacity which can readily be brought into production.

TOWARD A RESEARCH AGENDA

A return to the free market will be associated with an increase in uncertainty – about foreign supplies, demand, and world prices – thereby making United States agriculture more heavily dependent upon exports in order to survive. If price uncertainty cannot be reduced, the American farmer logically can be expected to reduce output if he is currently at or near his production capacity. Even if a modified free market with limited grain reserves policy were to be chosen, more knowledge about foreign supply and demand conditions will be needed. The following is a partial listing of these areas needing additional research:

1. **Weather.** More information is needed about weather patterns rainfall, temperatures, and their effects on crops, etc., in major producing and consuming countries so changes in weather in these countries can be quickly translated into changes in supply-demand estimates and import requirements.
2. **Nature and structure of demand.** More information is needed about the nature of price and income elasticities for most food products in both developed and less developed countries in order to better assess the effects of foreign economic growth on long-term markets for United States agricultural products as well as to predict short-term changes in demand resulting from price changes.
3. **Supply responses.** Historical production data are available for most crops, but yield estimates are almost impossible to obtain because of insufficient information on cropland harvested. Consequently, estimates of supply responses to increased fertilization and mechanization or other production inputs are difficult to assess.
4. **Trade and development patterns.** Little is known about the effect of economic growth on trade and how resource limitations affect both economic growth and patterns of trade. It is possible that more knowledge about the effects of resource endowments on trade might lead to a better understanding of international comparative advantage and efficient resource use.
5. **Monetary adjustments and demand.** Most of what has been said so far about the positive effects of exchange rate adjustments or dollar devaluations on United States agricultural exports has been based upon logic rather than facts. Little or no evidence has been put forth so far to show that countries actually increased their demand for United States agricultural products as a result of currency realignments in 1971 and 1973. In fact, as stated earlier, some evidence has been given that indicates that the United States devaluations had little impact on export demand. However, it will be some time before sufficient data will become available with which the effects of exchange rate adjustments can be fully evaluated.
6. **The nature and form of food reserve programs needed to reduce price uncertainty.** If major grain exporters are to assimilate the volatile demand requirements of the Central Plan countries, some method of contingency planning for supply and price uncertainties must be found. One method for dealing with demand and price uncertainty is with a food reserve program. The optimum methods, techniques, and cost-sharing arrangements between nations need to be evaluated along with the critical stock level that triggers price rises.

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