A Weaker Dollar and U.S. Farm Exports: Coming Rebound Or Empty Promise?

By David Henneberry, Mark Drabenstott, and Shida Henneberry

Crumbling export markets have been at the center of U.S. agriculture's economic and financial woes in the 1980s. Booming farm sales abroad ushered in agriculture's prosperous 1970s, and sagging sales signaled the deep farm recession of the 1980s. One principal factor in the wide swing in farm exports has been the exchange value of the U.S. dollar. A generally weak dollar throughout the 1970s made U.S. farm products attractive abroad, while a strengthening dollar in the early 1980s raised prices to foreign buyers.

The decline in the U.S. dollar over the past two years has been heralded by many as signaling a turnaround in farm exports. Since early 1985, the value of the dollar has fallen sharply against many currencies. The critical question for agriculture is, Will the drop in the dollar lead to a rebound in exports or will exports remain weak? If the lower dollar can boost exports, the currently austere farm outlook clearly would brighten. But if the lower dollar cannot provide that stimulus, agriculture must look elsewhere for its recovery.

This article concludes that the depreciation in the dollar may lead to some recovery in farm exports but that agriculture would benefit more if the dollar's decline extended to more currencies important to world grain trade and if the world economy were growing more strongly. Two questions are crucial to a consideration of how the value of the dollar affects farm exports. First, from agriculture's perspective, what is the appropriate measure of the dollar's value? And second, how does this measure of an "agricultural" exchange value affect farm exports? In addressing these questions, the first section compares movements in different measures of the dollar's value and the second section develops reasons why common measures of the dollar's exchange value do not fully reflect farm trade patterns. The third section explores the linkage between an "agricultural" exchange value of the dollar and farm exports by presenting some empirical results of exchange value fluctuations on the exports of wheat, a major

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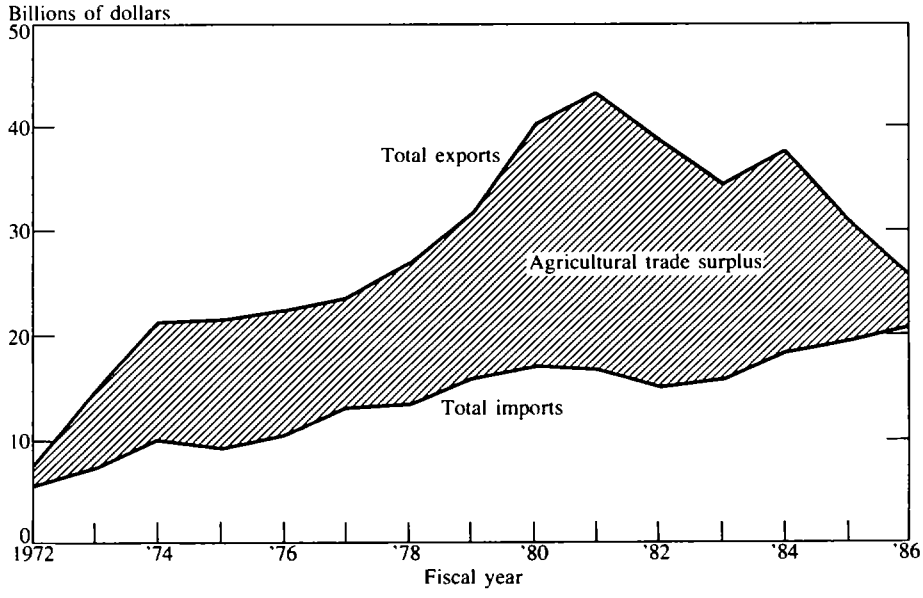
CHART 1
U.S. agricultural trade, 1972-1986



U.S. farm export commodity. The fourth section draws conclusions about the farm export outlook.

The rise and fall in the value of the dollar

U.S. farm exports have fallen sharply in the 1980s. Chart 1 shows that after topping in 1981, agricultural sales slumped to $26.3 billion in 1986, fully 40 percent less than the peak. A weak world economy, mounting competition from other exporting countries, and the strength of the dollar are the principal causes of the decline. Though analysts disagree on which factor has been more important, some observers have argued the dollar has had the most effect.

The most widely watched indexes of the dollar's value—those maintained by the Federal Reserve Board and by Morgan Guaranty—indicate the dollar has fallen in nominal value about 40 percent since it peaked in early 1985. The Federal Reserve index includes ten countries while the Morgan Guaranty index referred to here has 40 countries. The Federal Reserve index is a multilateral index with country weights based on the country's share of total world trade. The Morgan Guaranty index is a bilateral index with country weights based on the country's share of U.S. trade in manufactures.[1] Both indexes might be called "general" trade-weighted indexes because they pertain to trade in a broad mix of products. The decline in these indexes has led many observers

[1] A multilateral exchange rate index is based on total world trade, with each country's weight equal to its share of that trade. A bilateral exchange rate index is based on total trade for one country—in this case, the United States—with each country's weight equal to its share of the base country trade.

to expect a strong rebound in farm exports. But are indexes based on trade in a broad mix of products the right measure of the dollar's value for individual sectors of the economy, such as agriculture? Closer inspection indicates that the dollar has not declined as much against currencies important to agriculture.[2]

An agricultural exchange value of the dollar

Movements in general trade-weighted indexes of exchange value do not fully represent agriculture's interest in foreign trade. As many analysts of world food trade have noted, an index of dollar exchange value maintained by the U.S. Department of Agriculture (USDA) is the only major index available that focuses on currencies important for trade in agricultural products.[3] The USDA index is a bilateral index because it focuses on U.S. farm trading partner countries, with country weights equal to each country's share of total U.S. farm trade. The index also might be called an "agricultural" trade-weighted index of the exchange value of the dollar because the index pertains to trade in agricultural products, not traded goods in general. The USDA index is only one of many possible indexes of the agricultural exchange value of the dollar. The USDA index differs from the Federal Reserve Board and Morgan Guaranty indexes by attaching less weight to industrial trading partners and more weight to developing countries. Table 1 compares the country weights of the three indexes. The Federal Reserve Board index centers exclusively on the G-10 countries—Belgium, Canada, France, West Germany, Italy, Japan, the Netherlands, Sweden, and the United Kingdom—and Switzerland. The Morgan Guaranty 40-country index attaches less weight to these countries and gives some weight to developing countries. The 38-country USDA index, on the other hand, gives nearly a third of its weight to developing countries and 6 percent to other industrial countries important to U.S. farm exports.

The Federal Reserve Board and USDA indexes suggest broadly similar movements in the value of the dollar, as shown in Chart 2. There are minor differences, as might be expected since the Federal Reserve index has different country weights and is a multilateral index; that is, it focuses on total world trade, not U.S. trade alone. The Federal Reserve Board index indicates more than a 70 percent rise in the value of the dollar from 1979 through early 1985, and about a 40 percent drop in the value of the dollar from early 1985 through the end of 1986. The USDA index suggests a rise and fall, but of different dimensions. This index shows the dollar increasing a little over 50 percent between 1979 and early 1985 and then falling about 25 percent through the end of 1986. At the end of 1986, the two indexes were nearly equal. Thus, comparing movements in the two indexes since early 1985 suggests the agricultural exchange value of the dollar—as measured by the USDA index—has declined roughly in step with the general exchange value of the dollar—as measured by the Federal Reserve Board index.

The U.S. dollar and U.S. farm commodities

Is the agricultural exchange value of the dollar still relatively strong? The USDA index suggests a considerable decline, as discussed above. But alternative measures of the agricultural exchange value of the dollar indicate that it remains quite strong. This section presents a series of alternative indexes that measure the agricultural exchange

[2] For a discussion of how specific U.S. industries are affected by movements in the dollar, see Deborah Olivier, "Few Industries Benefit from the Weaker Dollar," *Wall Street Journal*, January 30, 1987, p. 16.

[3] See, for example, Michael T. Belongia, "Estimating Exchange Rate Effects on Exports: A Cautionary Note," *Economic Review*, Federal Reserve Bank of St. Louis, Vol. 68, No. 1, January 1986.

TABLE 1
Country weights in alternative indexes of the exchange value of the dollar

	Exchange Value Index (Percent)		
	Federal Reserve Board	Morgan Guaranty (40-Country Index)	USDA
Belgium	6.4	2.2	2.6
Canada	9.1	20.7	8.3
France	13.1	5.1	2.7
West Germany	20.8	9.9	9.0
Italy	9.0	3.7	4.8
Japan	13.6	18.5	21.1
Netherlands	8.3	2.0	11.3
Sweden	4.2	1.5	—
United Kingdom	11.9	8.2	4.6
All G-10 countries	96.4	71.8	64.4
Switzerland	3.6	1.8	1.2
Australia	—	1.7	—
Denmark	—	0.4	1.0
Spain	—	1.3	3.7
Middle and low-income countries	—	23.0	29.7
Total	100.0	100.0	100.0

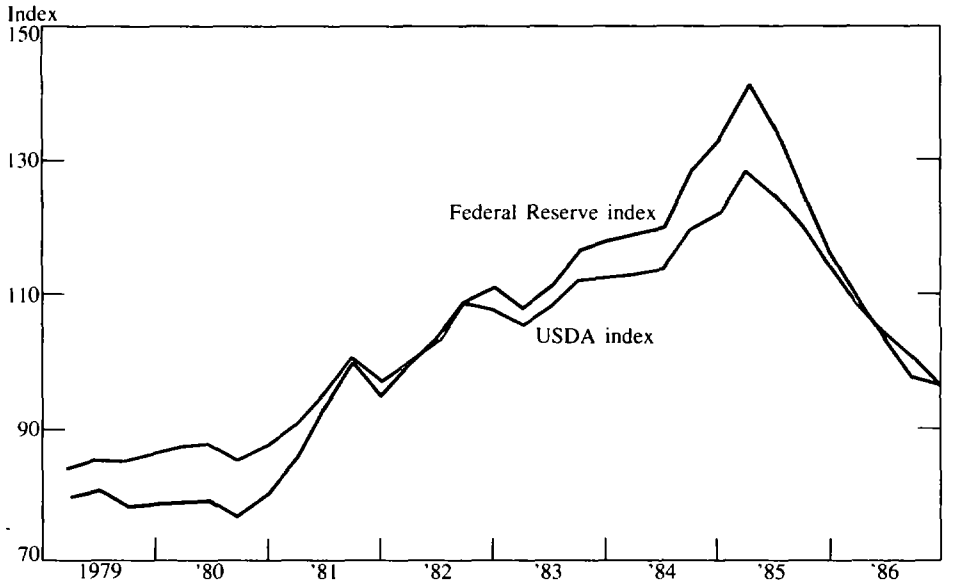
value of the dollar as it pertains to U.S. farm exports in general and specific farm commodities in particular. An examination of these indexes provides a more comprehensive view of the relative strength of the dollar from agriculture's perspective.

The indexes examined here measure changes in the real exchange rate, rather than the nominal rate discussed earlier. The nominal exchange rate represents changes caused by fundamental economic forces plus the effects of inflation across countries. In contrast, the real exchange rate represents only the changes caused by fundamental economic forces after adjusting for the different rates of inflation. Thus, the real exchange rate is what is most important to actual trade decisions.

The indexes focus on exchange rates with both food importing and food exporting countries.[4] The

[4] The indexes are all constructed as Fisher Ideal indexes. Put simply, the Fisher Ideal index is a way of combining the more

CHART 2
Trade weighted exchange value of the dollar, 1979-1986



importing country indexes are bilateral indexes with country weights determined by the country's share of U.S. farm exports. The importing country indexes each contain a large number of countries and account for virtually all U.S. farm exports destined for non-centrally planned countries. The exporting country indexes are multilateral indexes, with country weights equal to each country's share of the total world market for that commodity. The exporting country indexes concentrate on the small set of countries that are principal competitors to the United States in wheat, corn, and soybeans. The indexes were constructed for agricultural marketing years, from October 1 to September 30, and nominal exchange rates were deflated by changes in producer price indexes in the country involved to get real exchange rate movements.

Table 2 presents the indexes that provide a broader perspective on the agricultural exchange value of the dollar than the USDA index. Column 1 is a bilateral index based on total U.S. export trade with country weights based on trade flows with all U.S. trading partners. The index

commonly used Paasche and Laspeyres indexes. The Paasche index, which uses shifting quantity weights, tends to understate currencies that have weakened against the dollar. The Laspeyres index, which uses fixed, base-year weights, tends to overstate currencies that have weakened against the dollar. The Fisher Ideal index "averages" the two indexes. The two indexes are multiplied together, and the geometric mean is computed by taking the square root. The resulting Fisher index is a better measure than either of the other two indexes because it always falls between the boundaries of underestimation and overestimation set by the Paasche and Laspeyres indexes.

For a further discussion of these indexes, see David Henneberry, Shida Henneberry, and Luther Tweeten, "The Strength of the Dollar: An Analysis of Trade-Weighted Foreign Exchange Rate Indices with Implications for Agricultural Trade," *Agribusiness: An International Journal*, forthcoming.

TABLE 2

Trade-weighted real exchange rate indexes for the U.S. dollar based on trade in agricultural and related products, 1979-80 = 100*

	Indexes for Importing Countries						Indexes for Exporting Countries		
Year†	Total Exports	Nonagricultural Exports	Agricultural Exports	Wheat Exports	Corn Exports	Soybean Exports	Wheat Exports	Corn Exports	Soybean Exports
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1973-74	85	86	79	80	69	76	95	122	104
1974-75	83	85	78	81	67	74	102	192	154
1975-76	85	86	80	84	70	76	100	166	134
1976-77	84	86	78	80	68	74	105	178	142
1977-78	81	83	73	78	63	67	102	149	121
1978-79	81	83	73	81	62	64	101	119	104
1979-80	100	100	100	100	100	100	100	100	100
1980-81	109	108	110	108	110	118	109	122	116
1981-82	121	120	124	119	127	133	128	239	212
1982-83	125	124	129	126	133	143	131	230	236
1983-84	135	134	140	146	136	149	137	222	237
1984-85	139	138	148	156	143	158	146	239	254
1985-86	130	129	140	158	130	143	134	198	192
Number of countries represented	77	77	77	69	47	42	4	2	2

Source: David Henneberry, Shida Henneberry, and Luther Tweeten, "The Strength of the Dollar: An Analysis of Trade-Weighted Foreign Exchange Rate Indices with Implications for Agricultural Trade," *Agribusiness: An International Journal*, forthcoming

*Indexes were constructed using weights based on trade patterns in 1982, 1983, and 1984. These indexes were calculated as Fisher indexes—the geometric mean (the square root of the product) of the more common Paasche and Laspeyres indexes.

†Agricultural marketing years, October 1 to September 30

pertains to trade in all products and thus is a general trade-weighted index. Column 2 is a bilateral index focused strictly on U.S. nonagricultural trade. The country weights are based on the trade flows of all nonagricultural U.S. exports, and thus it can be considered a general trade-weighted exchange value index that excludes agriculture. Column 3 is a bilateral index based on exchange rates with all the countries that import U.S. farm products and might be thought of as broadly comparable to the USDA index. The index differs from the USDA index by focusing on real exchange rates and by having more countries—in fact, twice as many. In particular, it has more developing countries. The indexes in columns 3 to 6 measure real movements in the dollar against the currencies of the countries that buy U.S. farm products in general, and wheat, corn, and soybeans in particular. Columns 7 to 9 list indexes that measure the dollar against the currencies of other countries that export wheat, corn, and soybeans. Thus, the last six columns examine how

the value of the dollar might affect exports of U.S. wheat, corn, and soybeans from the perspective of both importer and competitor.

The indexes in Table 2 generally show that the dollar appreciated sharply in real terms against the major food importing and exporting countries' currencies from the 1979-80 marketing year to the 1984-85 marketing year before beginning a modest decline. The indexes also show that, in real terms, the dollar appreciated more in agricultural markets than in nonagricultural markets throughout the 1980s. Specifically, the dollar increased 38 percent for nonagricultural products (column 2) and 48 percent for agricultural products (column 3). Similarly, the decline has been a little less for agricultural products than for nonagricultural products.

Fluctuations in the dollar have not been equal against the currencies of countries that import different types of U.S. farm products. From the 1979-80 marketing year to the peak in 1985-86, the dollar appreciated 58 percent against the currencies of countries that import U.S. wheat (column 4). For countries that import U.S. corn (column 5), the dollar appreciated 43 percent between 1979-80 and 1984-85 before declining about 10 percent in the 1985-86 marketing year. The dollar rose even more against the currencies of countries that import soybeans (column 6)—58 percent between 1979-80 and 1984-85—before declining about 10 percent in the 1985-86 marketing year.

The dollar has been particularly strong against the currencies of agricultural competitors. From the 1979-80 marketing year to the 1984-85 marketing year, the dollar rose 46 percent in real terms against the currencies of major wheat exporters (column 7)—Australia, Canada, and France. The dollar appreciated in real terms even more against corn and soybean exporters—139 percent against corn exporters (column 8) and 154 percent against exporters of soybeans (column 9). The major competitors in corn are Argentina and Thailand. The major soybean competitors are Brazil and Argentina. The dollar did decline some against competitor currencies in the 1985-86 marketing year but is still much higher than in the early 1980s.

In short, the alternative measures of the agricultural exchange value of the dollar presented here indicate the dollar remains quite strong for agriculture. Agricultural trading partner countries have had about a 40 percent erosion in the real purchasing power of their currencies since 1979. At the same time, the real value of the dollar has increased more than 40 percent against the currencies of major competitors—even more for some commodities. The U.S. dollar has begun to decline against the currencies of countries that purchase and compete against U.S. farm exports, but the declines in real terms have been modest so far.

Farm exports and exchange rate regimes

Why is the behavior of the "agricultural" trade-weighted exchange value of the dollar different from that of the "general" trade-weighted exchange value? One obvious reason, as explained in the previous section, is the different mix of countries in the indexes. But the difference in behavior goes beyond the mix of countries in farm trade. Another distinction between agricultural trading partners and general trading partners is the greater tendency for farm trading partner countries to have fixed exchange rate regimes.

Exchange rate regimes are important in considering the linkage between the value of the dollar and farm exports. The exchange regime a country uses can affect how quickly developments in the exchange market translate into changes in the exchange rate and, thus, in product prices to the foreign buyer. An exchange rate regime refers to the institutional mechanism that governs currency fluctuations. These regimes vary significantly across countries, but most can be grouped into one of three broad categories: floating regimes, which allow exchange rates to respond quickly to

market forces; limited flexibility regimes, which allow only limited fluctuations and may involve frequent government intervention; and pegged or fixed regimes, which allow no fluctuations and, therefore, are not responsive to short-run market forces.

There is an important difference between flexibility in the exchange rate regime and fluctuations in the exchange rate. A fixed exchange regime does not imply that the exchange rate does not vary. Rather, the flexibility of the exchange regime determines the extent to which short-run market forces translate into changes in the exchange rate. Many South American currencies, for example, are pegged to the U.S. dollar, and these same currencies have been devalued repeatedly in recent years. Such devaluations are usually unanticipated and add an element of instability to international trade. Agricultural trade is particularly subject to this type of instability induced by the exchange rate regime.

While it is possible for a currency pegged to the U.S. dollar to vary more than currencies that are freely floating, in general, fixed exchange regime currencies tend to be less volatile. For example, the West German mark is an important currency to U.S. farm trade and is a benchmark floating currency. Since 1979, the mark has fluctuated an average of 4.8 percent each quarter, with a standard deviation of 2.9 percent. The standard deviation is one statistical measure of variability; the higher it is, the more variable the exchange rate is. Malaysia, a country of growing importance to U.S. farm exports, has a fixed exchange rate regime. The Malaysian currency, the ringgit, has fluctuated only 1.8 percent a quarter since 1979 with a standard deviation of 1.4 percent. Thus, in at least some cases, the evidence is that fixed exchange currencies tend to be more stable, responding less to exchange market developments, while floating exchange currencies tend to be more volatile, responding more quickly to exchange market developments.

A bigger share of U.S. farm exports goes to countries with fixed exchange rate regimes than is true for nonagricultural exports. An analysis of U.S. farm trade in 1984 showed that destination countries with fixed or pegged exchange rates accounted for almost 20 percent of the farm exports and only 15 percent of the nonagricultural exports.[5] On the other hand, destination countries with floating exchange rates accounted for 43 percent of U.S. nonagricultural exports but only 28 percent of U.S. agricultural exports. The higher proportion of fixed regimes in agricultural trade reflects the market importance of less developed countries, where fixed exchange regimes are more common. Thus, U.S. farm exports may respond more slowly than nonagricultural exports to an overall weakening of the dollar in the exchange market because farm trading partners tend to have less flexible exchange rates.

Trade in some U.S. farm products appears particularly unlikely to respond quickly to general exchange market fluctuations. Such commodities as wheat and live cattle are exported primarily to developing countries, where exchange regimes are less flexible. Conversely, such commodities as soybeans and frozen meats are sold primarily to industrial countries, and most of the industrial countries have managed floating or freely floating exchange regimes. Table 3 shows the proportion of U.S. wheat, corn, and soybean exports going to countries with various exchange regimes. The conclusion from these data is that U.S. wheat sales may be slower to respond to exchange market developments than corn and soybeans.[6]

[5] See David M. Henneberry, "Institutional Constraints on Foreign Exchange Markets: A Comparison of Agricultural and Nonagricultural Trade Flows," *Current Farm Economics*, Oklahoma State University, Vol. 58, No. 3, September 1985.

[6] Currencies pegged to currencies other than the U.S. dollar may fluctuate markedly against the dollar depending on the behavior of the base currency.

TABLE 3

Proportion of U.S. wheat, corn, and soybean exports classified by foreign exchange regime of the designation country, 1984

(Percent)

Foreign Exchange Regime (June 30, 1984)	Number of Countries	Proportion of Wheat Exports	Proportion of Corn Exports	Proportion of Soybean Exports
Pegged Regimes				
Pegged to U.S. dollar	28	7.69	8.25	0.12
Pegged to French franc	13	0.00	0.00	0.00
Pegged to other currencies	4	0.00	0.00	0.00
Pegged to SDR's	9	1.19	0.00	0.00
Pegged to other composites	24	19.91	0.53	3.46
Subtotal	78	28.79	8.78	3.58
Limited Flexibility				
Limited flexibility: single	8	0.92	0.00	0.00
Limited flexibility: group	7	4.68	8.54	35.14
Adjusted by set indicators	6	16.68	6.12	3.50
Subtotal	21	22.28	14.66	38.64
Floating				
Managed floating	23	34.11	22.16	30.27
Independently floating	7	14.83	54.40	27.50
Subtotal	30	48.94	76.56	57.77
All regimes	129	100.00	100.00	100.00

Source: U.S. Department of Agriculture, *Foreign Agricultural Trade of the United States*, various calendar year issues, and International Monetary Fund, Annual Report of the Executive Board

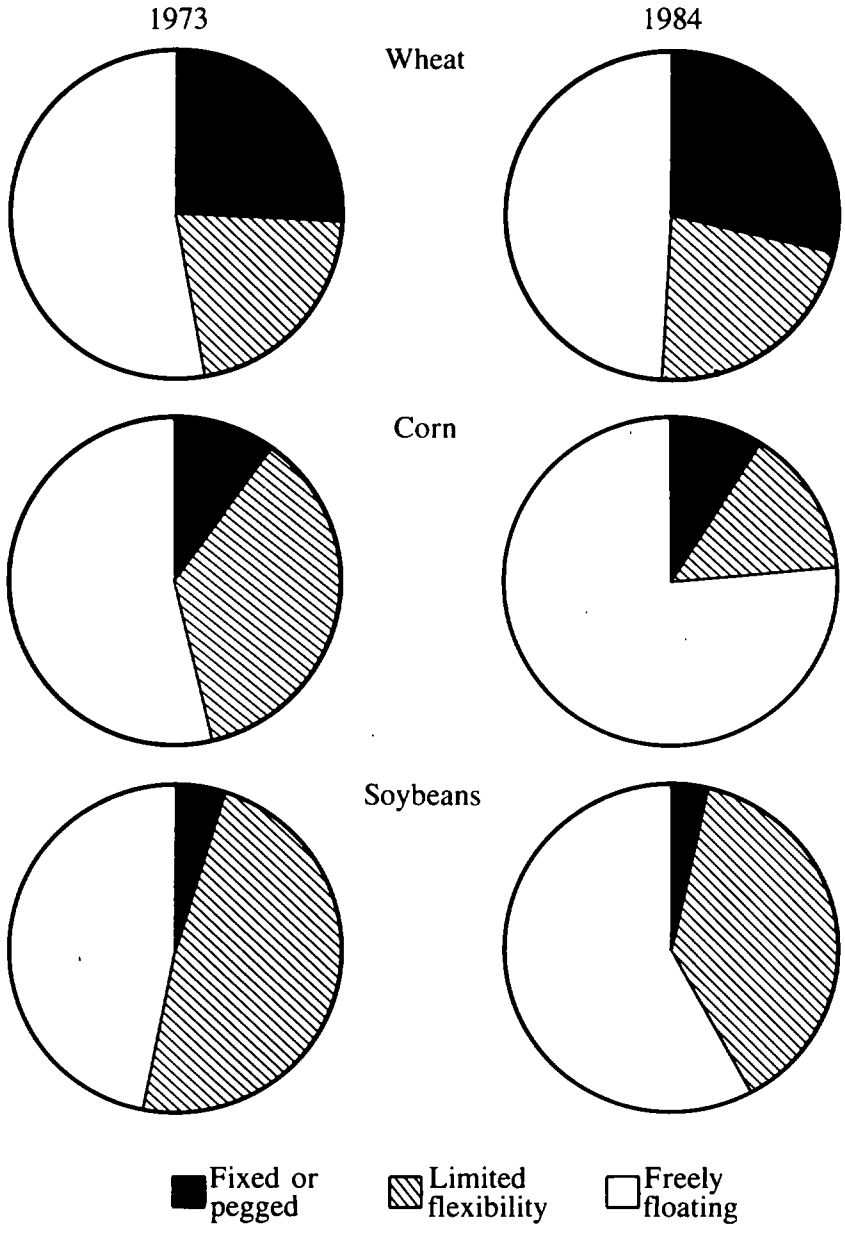
Moreover, as Chart 3 shows, wheat sales are becoming more concentrated in countries with fixed regimes while corn and soybean foreign sales are becoming more concentrated in floating regime countries.

In summary, a significant portion of U.S. farm exports are destined for countries with currencies that tend not to respond quickly to general exchange market forces. This insensitivity and the tendency of these countries to peg to the U.S. dollar help explain why various measures of the agricultural exchange value of the dollar have not declined as rapidly or as much as such broad measures of exchange value as the Federal Reserve Board general trade-weighted index.

An empirical analysis of farm exports and the dollar

How much will U.S. farm exports respond to movements in the "agricultural" value of the dollar? Only empirical analysis can offer insight

CHART 3
U.S. exports to countries by foreign exchange regimes



to that question. Previous studies attach different emphasis to exchange rate fluctuations on U.S. farm exports.

Two recent studies modeled the effect of exchange rates on U.S. farm exports. Chambers and Just examined the dynamic effects of exchange rate fluctuations on U.S. exports of corn, wheat, and soybeans.[7] They used quarterly data from 1969 to 1977 in an econometric model to explain the volume of exports in terms of the inflation-adjusted U.S. price, the exchange rate expressed in terms of Special Drawing Rights (SDR's), the European Economic Community threshold price for wheat imports, the stocks of wheat in other major wheat exporting countries, Public Law 480 (Food for Peace) shipments of wheat, and seasonal factors. They found that although the exchange rate variable has the expected negative sign, it was less significant for exports of wheat than for exports of corn and soybeans.

Bessler and Babula used a vector autoregression model in studying wheat exports.[8] Analyzing data from January 1974 to March 1985, they found that movements in the exchange rate do not help to explain U.S. wheat export shipments. But they did find that the exchange rate movements are a significant factor in explaining fluctuations in wheat prices.

This section presents a model that measures the effect of exchange rate movements and other key factors on U.S. wheat exports. Other farm commodities will react somewhat differently to the economic variables considered here. Nevertheless, the wheat model offers some insight into how farm exports in general may respond to the decline in the agricultural trade-weighted value of the dollar.

A quarterly model of wheat exports

Wheat exports presumably respond to a handful of key economic variables, including the price of U.S. wheat, the price of wheat produced in competing countries, the price of substitute commodities, the income of importing countries, and the exchange value of the dollar measured in terms of the currencies of countries that import U.S. wheat. These factors can be combined mathematically as an export demand equation for U.S. wheat as in Equation 1.

Economic theory provides insight into how each variable should affect exports. Increased world income can have both positive and negative effects on U.S. wheat exports, although an overall positive effect is expected. As incomes increase, there may be a substitution away from direct consumption of wheat for protein toward more animal protein. Wheat is a feed grain, however, and wheat consumption does increase with income in most countries. The model has two price variables. The first, PX_t, is the inflation-adjusted price of U.S. wheat. An increase in the real price of U.S. wheat should reduce export demand. Conversely, an increase in the real price of Australian wheat—PC_t, the other price variable—should help U.S. sales since U.S. and Australian wheat are direct substitutes in the world market. The exchange rate also should have a negative effect, since foreign demand should decline as the dollar increases in value. Similarly, the real price of wheat substitutes—rice in this case—should be positively related to U.S. wheat exports. And all things equal, as world wheat production increases and competing supplies rise, U.S. wheat exports may be expected to decline somewhat.

The critical exchange rate variable used in this model was a wheat trade-weighted dollar exchange rate index for 1973 to 1986 and is the same index

[7] Robert G. Chambers and Richard E. Just, "Effects of Exchange Rate Changes on U.S. Agriculture: A Dynamic Analysis," *American Journal of Agricultural Economics*, Vol. 63, 1981, pp. 32-46.

[8] David Bessler and Ronald A. Babula, "Forecasting Wheat Exports: Do Exchange Rates Matter?" *Journal of Business and Economic Statistics*, forthcoming.

EQUATION 1

Export demand function for U.S. wheat

$$X_t = f(YW_t, PX_t, ER_t, PC_t, PR_t, QW_t, e_t)$$

where:

X_t is the volume of U.S. commercial wheat exports as measured in metric tons.

YW_t is the real Gross Domestic Product of developed and developing wheat importing countries expressed as a weighted index. The weights are based on each group's wheat imports from the United States (1980 Q1: = 100).

PX_t is the real U.S. wheat export price expressed in U.S. dollars per metric ton. It is measured by the unit value of U.S. wheat exports deflated by the U.S. CPI (1980 Q1: = 100).

ER_t is the wheat trade-weighted real exchange rate index of the U.S. dollar versus the currencies of wheat importing nations (1980 Q1 = 100). The exchange rate is defined as foreign currency per U.S. dollar.

PC_t is the real price of Australian wheat expressed in U.S. dollars per metric ton. This variable is used as a proxy for all U.S. export competitor prices. Since world wheat prices move together quite closely, it is assumed that this variable adequately captures the variation in competitor prices. The Australian CPI (1980: Q1 = 100) is used as a deflator.

PR_t is the deflated world price of rice expressed in U.S. dollars per metric ton. The variable is represented by the price of Thailand rice.

QW_t is the production of wheat in the rest of the world expressed in thousands of metric tons.

e_t is the random error.

listed in column 4 of Table 2. The index was constructed as a weighted market basket of currencies for major U.S. wheat importers, with weights equal to each country's share of total U.S. wheat exports.[9] The most important countries in the index are Brazil, Mexico, South Korea, India, Egypt, and Morocco. The exchange variable is defined as the real, or inflation-adjusted, exchange rate because that is the exchange rate most critical to trade decisions.[10]

[9] The index was constructed as a Fisher Ideal index.

[10] For a more complete discussion of nominal and real exchange rates and their effect on farm trade flows, see David Henneberry, Shida Henneberry, and Luther Tweeten, "The Strength of the Dollar: An Analysis of Trade-Weighted Foreign Exchange Rate Indices with Implications for Agricultural Trade," *Agribusiness: An International Journal*, forthcoming.

The model was estimated for the period from the first quarter of 1973 to the second quarter of 1986. Different functional forms were estimated—linear, logarithmic, and semi-logarithmic—but results for the logarithmic form provided the best fit to actual data.[11] The model was estimated by using ordinary least squares. No serial autocorrelation was evident, so no other estimation techniques were used.

Model results

Regression results from the model are consistent with the effects economic theory would suggest. Table 4 presents ordinary and standardized regression coefficients for the model variables. The estimated equation explains only 43 percent of the variation in U.S. wheat exports, but that level of success is as good or better than other quarterly models that try to model U.S. farm trade. The model exhibits the direction of effects expected for all the key variables, and all but one variable is significant at the 5 percent level. The exception is world income, which is significant at the 10 percent level. As expected, the real exchange value of the dollar has a negative effect on exports. Based on the standardized regression coefficients, the exchange rate appears to have less effect on exports than U.S. prices, foreign prices, world wheat production, or world income. The price of U.S. and foreign wheat are clearly the most important variables.

The model suggests, therefore, that U.S. wheat exports will respond somewhat to a weaker dollar. To spark a significant turnaround in farm exports, however, a combination of factors probably will be necessary. The standardized coefficients indicate that the U.S. price, the competing country price, world production, and world income are all more important than the exchange rate. The muted effect of the exchange rate on wheat exports in the model may reflect the fact that more than half of U.S. wheat sales abroad are to countries that do not have floating exchange rates. To these foreign buyers, the U.S. market price and their own income are much more important determinants of their buying power. Also, the exchange rate variable in the model may not capture all the exchange rate effects. The two price variables may reflect part of the effect. In a competitive world market, the U.S. and Australian price of wheat would be expected to move together. Thus, it is especially difficult to interpret coefficient estimates on the price and exchange rate variables.

Implications for the export outlook

An empirical analysis of exports and exchange rates suggests that the exchange value of the U.S. dollar is important but may not be the most important factor in determining U.S. farm exports. The decline in the dollar that has already occurred should lead to improved farm exports in the near future. Still, that improvement will be less than the decline in the "general" trade-weighted exchange value of the dollar would suggest.

The response of farm exports to general movements in the value of the dollar will not be uniform across commodities. Wheat exports are likely to be slow in turning up. That outlook rests on the overriding importance of developing countries as importers of U.S. wheat. Many of the developing countries have fixed exchange rate regimes that are likely to be slow in responding to exchange market forces. Corn and soybean exports, on the other hand, should respond to the fall in the dollar more quickly because U.S.

[11] The estimated form of the model, then, can be expressed as the following equation.

$$LnX_t = B_0 + B_1LnYW_t + B_2LnPX_t + B_3LnER_t + B_4LnPC_t + B_5LnPR_t + B_6LnQW_t + U_t$$

TABLE 4
Determinants of U.S. wheat export demand, 1973 to 1986

Dependent Variable	Independent Variables					
U.S. Wheat Exports	Intercept	World Income	U.S. Price of Wheat	Real Wheat Trade-Weighted Exchange Value of U.S. Dollar	Foreign Price of Wheat	World Wheat Output
Ordinary coefficient	19.13	1.84	−1.56	−0.63	1.55	−2.01
t-value	6.93	1.63	−3.00	−2.07	2.87	−1.94
Standard error of estimate	2.761	1.127	0.520	0.305	0.542	1.035
Standardized coefficient	0.00	0.45	−0.62	−0.40	0.55	−0.54
Summary statistics:	R^2 = 0.43 with 48 degrees of freedom Durbin Watson = 2.06					

markets for these commodities tend to have floating exchange rate regimes.

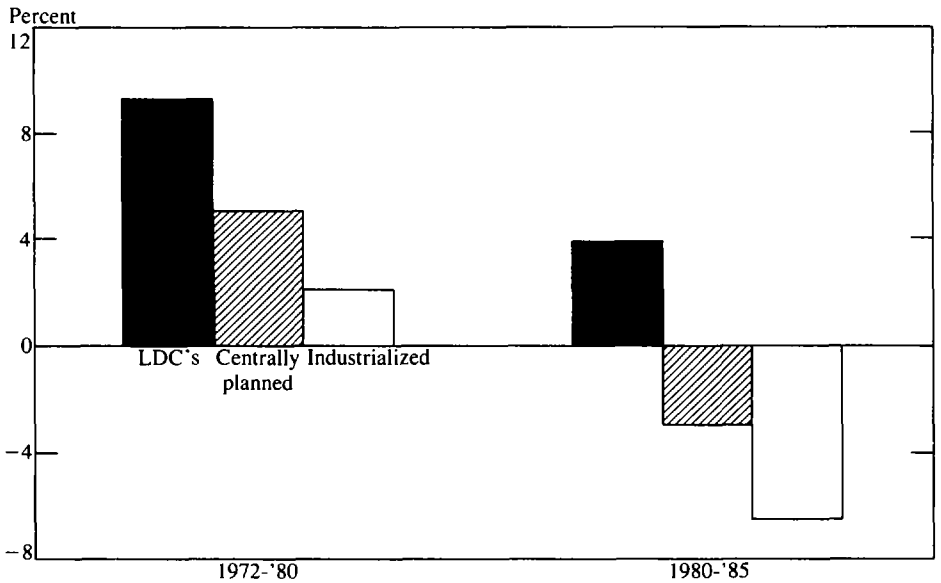
The model results may not reveal the full importance of stronger income growth abroad as a principal factor in restoring export growth for U.S. agriculture. There is no clear explanation for why the model results do not attach more weight to income. Improving per capita incomes was a principal reason for developing countries to increase purchases of U.S. farm products throughout the 1970s. The developing countries have become the primary export market for many U.S. farm products. For example, the share of U.S. wheat exports purchased by developing countries increased from 44 percent in the 1972-73 marketing year to 67 percent in 1985-86. Over that period, the proportion of U.S. corn exported to developing countries rose from 17 percent to 34 percent.

The pivotal role of developing countries in expanding U.S. farm export markets is reinforced by recognizing that centrally planned countries and the industrialized countries have not contributed any growth to U.S. farm exports in the 1980s. Chart 4 shows that sales to developing countries have continued to grow in the 1980s while exports to the other groups have fallen markedly. Thus, even though the United States still exports more farm products to the developed countries, U.S. agriculture can hope to find significant growth in exports only through improving economies in the developing world.

Market prices are a critical determinant of U.S. farm exports. Thus, the effect of farm and trade policies on export prices remains a key international issue. The model results indicate that, overall, the lower U.S. support prices brought

CHART 4

Average annual growth in wheat and feed grain imports, U.S. trading partner countries



about by the 1985 Food and Security Act should stimulate U.S. grain exports. Nevertheless, different price elasticities among trading partner countries suggest that the response may not be uniform.[12]

Summary

The agricultural exchange value of the dollar, as measured by a number of indexes, has begun to decline. The decline is less, however, than for general trade-weighted measures of the dollar's value. One reason that the agricultural value of the dollar has remained relatively strong is that farm trading partner countries are more likely to have fixed exchange rate regimes, and these regimes are less repsonsive to exchange market forces. In addition, many developing countries that peg their currencies have chosen to resist allowing their currencies to rise against the dollar. Empirical analysis suggests that a weakening agricultural trade-weighted dollar will stimulate U.S. farm exports somewhat, but market prices and income may be more important factors. On balance, a weaker dollar will lead to stronger farm exports, but a weaker dollar alone will not ensure the vigorous rebound in trade that U.S. agriculture is awaiting. The direction of U.S. farm commodity programs and the health of the world economy will probably have an even greater effect on how strong the turnaround in farm exports becomes.

[12] For a discussion of the varying price elasticities for food importing countries, see Shida Henneberry, "A Review of Agricultural Supply Responses for International Policy Models," Staff Paper, Department of Agricultural Economics, Oklahoma State University, May 1986.