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Exchange Rates and U.S. Agricultural Trade

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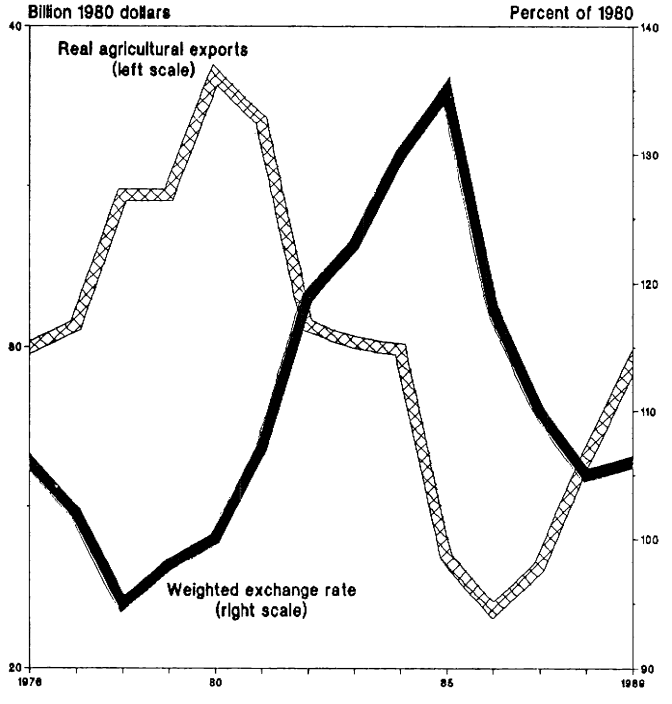
In this report...*Exchange rates are now the single most important variable in determining the economic environment for agricultural trade. Currency values have important effects on the competitive position of the United States relative to other major agricultural exporters. Cycles of exchange rate swings since 1969 have coincided with changes in U.S. agricultural exports. Economic analysis indicates that the exchange rate accounted for more than 25 percent of the rebound in U.S. agricultural exports since 1985. While exchange rates are key to competitiveness of all agricultural exports, specific commodity markets show different levels of exchange rate variation. Wheat markets had the least movement, so currency values affected competitiveness of wheat exports the least, while soybean exchange rates changed markedly.*

The cycles of exchange rate swings that have affected the United States since 1969 have coincided fairly closely with broad changes in U.S. agricultural exports (fig. 1). This is not surprising since changes in the real exchange rate change the prices of U.S. goods on international markets. An appreciating exchange rate raises the prices of U.S. goods on the international market, while a depreciating dollar lowers these prices. Changes in the exchange rate have accounted for more than 25 percent of the increase in U.S. agricultural exports since 1985.

One of the most pronounced features of the postwar economy is the development of an integrated global market. The consequence of growing economic integration is that nations are much more interdependent. Changes in the world economy now affect domestic economies much more than they did in the past. Integration of the world economy, particularly the expansion of financial markets, led to the system of flexible exchange rates, which fundamentally changed the environment for agricultural trade.

Since the advent of flexible exchange rates in 1973, the relative value of a nation's currency has played a much more important role in transmitting the effects of macroeconomic policies onto trade sectors. Exchange rates are particularly important for agriculture in countries like the United States where exports account for a major portion of agricultural production. U.S. agricultural policy should therefore be designed to maintain flexible prices for export commodities so our relative competitive position is not eroded by large changes in exchange rates.

Figure 1
Real exchange rate and U.S. agricultural exports. Changes in agricultural exports followed swings in the dollar's value.



Background: The Economics of Currency Exchange Rates

The exchange rate helps determine the international price for agricultural commodities and thus affects how much of the commodity other countries purchase. Policies that set domestic prices interfere with the link between exchange rates and trade.

Exchange rates affect trade by altering the relationship between international and domestic prices. The exchange rate converts prices on international markets to domestic currency. Appreciation of an importer's currency decreases the importer's cost of foreign exchange, which lowers the commodity's price in the import market and increases the quantity demanded. This tends to raise world prices in the exporter's currency, inducing exporters to increase the quantity supplied to the world market. Under depreciations of importers' currencies, world demand and prices decline because importers face higher domestic prices for imported goods.

Most government interventions in trade disrupt the link between domestic and international commodity prices normally provided by exchange rates, thus preventing commodity price equalization between the domestic and world markets. Examples of such interventions in the international trade sector are import or export taxes or subsidies as well as import quotas. An import tax can take the form of a tariff on imports or a tax on foreign exchange, as in the case of Argentina. An export subsidy can also take many forms. Regardless of the form, an import tax raises commodity costs much like a currency depreciation in the context of an individual commodity market.

The chief difference between an import tax or export subsidy and a depreciation is that a tax or subsidy is applied to a single commodity market while a depreciation applies to all markets. A tax or subsidy applied to a single commodity changes the price of that commodity relative to others and therefore changes the incentive to trade it. When a tax or subsidy is uniformly applied to all markets, or currency values differ by market, this distinction disappears.

Government interventions that affect commodity prices also prevent price changes in the international market from affecting the domestic price. The U.S. loan rate during 1981-85, for instance, maintained the domestic price above market-clearing levels. The effect was to make the United States the supplier of last resort and to allow our competitors to undercut us in the international marketplace. Whether the intervention is in the domestic market or a border measure, the overall effect is to reduce the degree to which domestic producers respond to signals of changes in the international market, undercutting our longrun competitive position.

Definitions

Exchange rate is the rate at which one currency trades for another.

A **trade-weighted exchange rate** is an index-weighted average of bilateral exchange rates using trade volumes as weights. It measures the extent of appreciation or depreciation against the trade-weighted average of bilateral exchange rates which dominate trade in a particular commodity.

The **real exchange rate** is the trade-weighted exchange rate adjusted by relative rates of inflation as measured by consumer price indexes.

Appreciation (depreciation) is when one currency increases (declines) relative to another. An appreciation implies that one currency becomes more valuable relative to another and hence requires less in exchange for the other.

Devaluation occurs when a government decides to reduce the value of its currency relative to others and thus increases the number of its currency to be exchanged for others.

A **flexible exchange rate system** is one in which exchange rates are determined by supply and demand on currency markets. **Floating exchange rate** is another way of referring to a flexible exchange rate system.

A **fixed exchange rate system** is one in which government central banks agree to intervene in foreign exchange markets to maintain the relative value of currencies at fixed, agreed-upon rates. Such a system was set up at Bretton Woods in 1944 and was maintained until the United States was forced to go to a flexible exchange rate system in 1973.

Exchange Rates Link Domestic and International Prices

Case	Export price	Exchange rate	Import price	
1. Initial relationship.	$2.50	$1=DM 1.9[1]	DM 4.75	
2. Domestic price changes, due to change in agricultural policy, weather, or production, but exchange rate is unchanged.	$3.00	$1=DM 1.9	DM 5.70	*Higher export price results in a higher import price to trade partners.*
3. Exchange rate changes, due to change in relative monetary policies, relative investment opportunities, relative trade flows, or political instability.	$2.50	$1=DM 2.28	DM 5.70	*Higher exchange rate raises the import price, just like an increase in the export price.*

[1] DM=Deutschmark

The Dollar's Value Fluctuated in the 1980's

The U.S. dollar exchange rate rose, fell, and then rose again during the 1980's, measured in real terms on a total-trade-weighted basis. Measuring the exchange rate as it applies only to agriculture showed slightly smaller swings in the dollar's value. When the dollar was high, U.S. agricultural exports were less competitive in the world market.

The real U.S. exchange rate, measured on a total-trade-weighted basis, increased 82 percent between the low in October 1978 and the high in March 1985. From its peak in 1969, the real exchange rate fell by more than one-third to a low in 1979, rose again more than 50 percent to a high in 1985, fell again by more than one-third to a low in early 1988, and increased again by approximately 10 percent by mid-1989 (fig. 2). Agricultural exports have followed these exchange rate cycles because the exchange rate affects the price of U.S. commodities to other countries.

Exchange rates are becoming more variable, measured by the length of the appreciation or depreciation cycle. The period of depreciation between 1970 and 1978/79 was approximately 9 years. The period of appreciation that followed, between 1978/79 and 1985, was 6 years. The most recent period of depreciation, from 1985 to 1988, was only slightly more than 3 years.

To examine the effect of exchange rate changes on trade, indexes of total-trade- and agricultural-trade-weighted real exchange rates are needed. These indexes attempt to show the effect of exchange values on the global competitiveness of the country in question. Bilateral exchange values are weighted by total or agricultural trade in computing these indexes to get a summary measure, or index, of the effect of these values on the type of trade being examined. Between March 1985 and December 1987, the total-trade-weighted index declined 43 percent (table 1). The index has subsequently increased 13 percent through May 1989.

Measuring exchange rate changes based on total trade, which is the usual practice, probably overstates the effect of currency values on agricultural trade. The real U.S. exchange rate, measured on an agricultural-trade-weighted basis, went up 55 percent, subsequently fell 27 percent through December 1987, and increased only 3 percent through May 1989.

Measuring Changes in the Exchange Rate

An exchange rate is the rate at which one currency trades for another. For example, approximately 150 Japanese yen equal one U.S. dollar. Since there now is no single international medium of exchange, say as there was under the gold standard, the total exchange rate is a trade-weighted average of bilateral rates expressed as an index with a common year base. There is no one overall exchange rate, but rather different rates depending on the trade mix of different commodities. In general, agricultural-trade-weighted exchange rates vary less than overall trade-weighted exchange rates.

Figure 2

Swings in the real value of the dollar. Both indexes varied, but the total trade index had larger swings than agriculture.

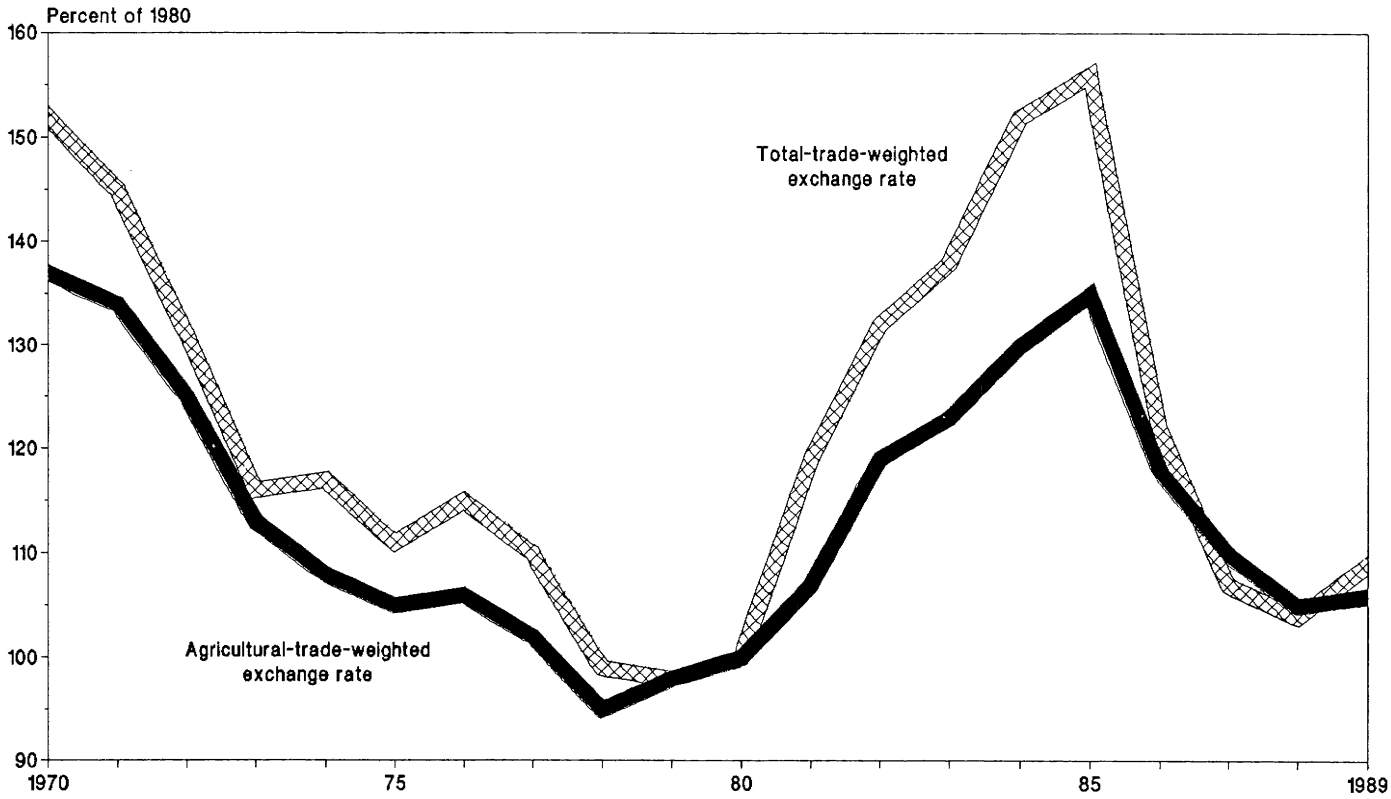


Table 1—Fluctuations in the dollar's value.

The total-trade-weighted exchange rate index varied more than the agricultural-trade-weighted index.

Year	Total exports	Agricultural exports	Year	Total exports	Agricultural exports
			1980 = 100[1]		
1970	152	137	1980	100	100
1971	145	134	1981	119	107
1972	131	125	1982	132	119
1973	116	113	1983	138	123
1974	117	108	1984	152	130
1975	111	105	1985	156	135
1976	115	106	1986	122	118
1977	110	102	1987	107	110
1978	99	95	1988	104	105
1979	98	98	1989[2]	109	106

[1] An increase in this index implies an appreciation of the U.S. dollar.
[2] Preliminary based on first 5 months of 1989.

Exchange Rates Affect Competitiveness of Exporting Countries

The exchange rate fluctuations of the 1980's affected the competitive position of the United States relative to other major agricultural exporters. Competitor countries can maintain their competitive advantage by lowering the value of their currencies against the U.S. dollar.

In the two most recent swings in exchange rates, 1978/79-85 and 1985-88, changes in the exchange rate explain approximately 25 percent of the observed changes in U.S. agricultural trade.

U.S. agriculture has had to bear the brunt of changes in the world market. U.S. agricultural exports fell from a high of $43 billion in fiscal year 1981 to $26 billion in fiscal year 1987. As a portion of total U.S. exports, agricultural exports dropped from 19 percent to 13 percent. However, since early 1988 U.S. agricultural exports have been helped by the depreciating dollar and are now approaching the $40 billion level once again.

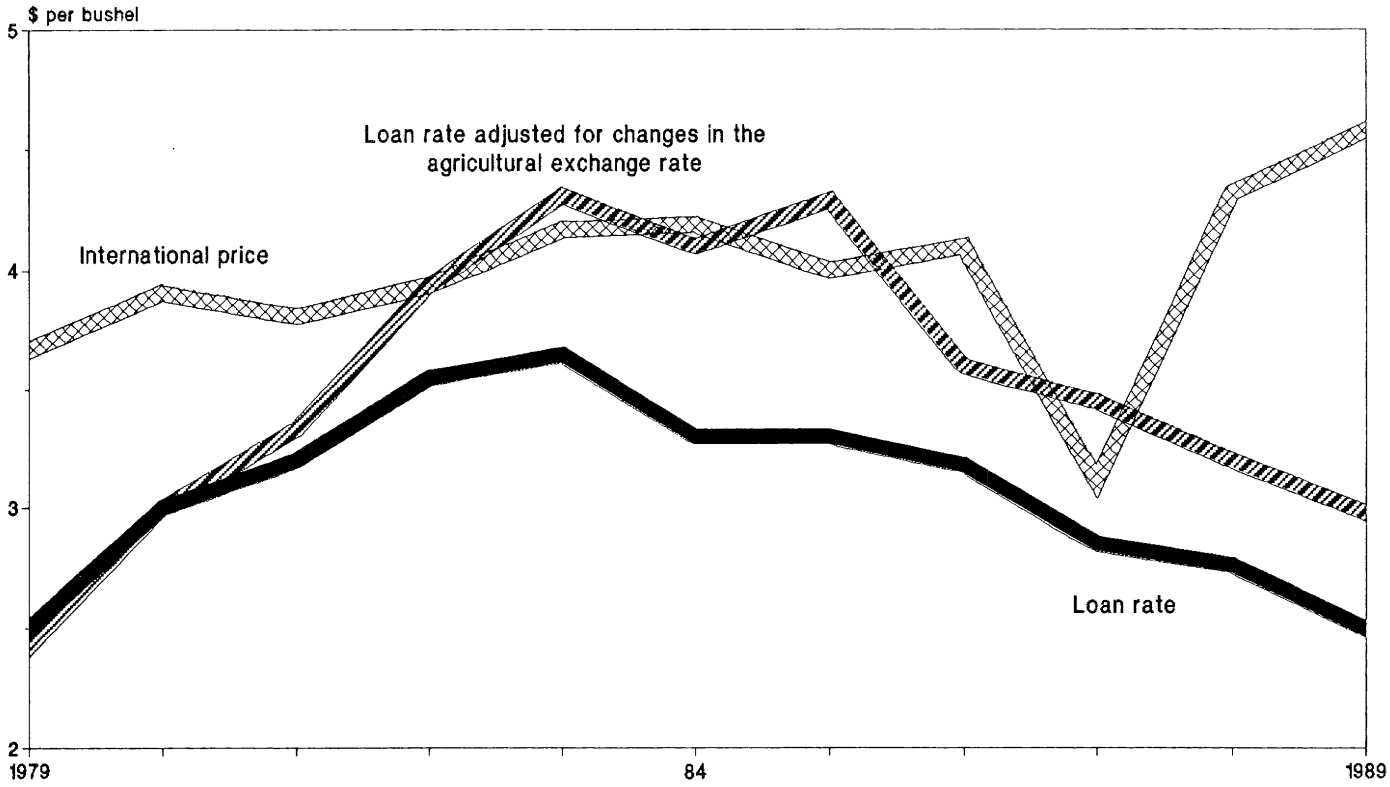
The appreciation of the dollar between 1979 and 1985 raised the exchange value of the U.S. loan rate significantly above world market-clearing levels (fig. 3). Our competitors allowed the appreciation to take place. U.S. export demand declined, the domestic price of grain dropped to the loan rate, and a substantial portion of domestic production that might otherwise have been exported was purchased by the Commodity Credit Corporation (CCC) to support the loan rate. Farm loan rates for wheat, for example, increased from $2.50 a bushel in crop year 1979/80 to $3.65 in 1983/84, before declining to $2.40 in 1986/87. Government expenditures and stocks accordingly rose to record levels during this period.

During the period of the high dollar, U.S. farmers earned the lowest real incomes they had seen since the 1930's, but farmers abroad earned record-high incomes. World grain prices rose to within 5 percent of the European Community's (EC) domestic support price in 1985, an unprecedented event which substantially reduced the normally high cost of the EC agricultural policy. The high dollar set off a major effort by some within the EC to implement reforms. Others, by contrast, saw the high dollar as an opportunity to continue existing levels of income support longer than would otherwise have been financially possible. The reduced budgetary cost did not lead to reductions in EC internal support prices.

The sharp decline in the dollar after 1985 reversed this process, and world prices for agricultural commodities fell. U.S. exports began to expand rapidly. Simultaneously, lower U.S. loan rates under the Food Security Act of 1985 went into effect and magnified the effects of the exchange rate. Lower prices caused great hardship in countries like Australia, Canada, Argentina, and the European Community, which had invested heavily in expanding agricultural production during the upswing in prices, and then found the market flooded with surpluses when the downswing came.

Figure 3

The U.S. loan rate and the international price of wheat. The high loan rate between 1982-85 helped cause U.S. exports to crash.



Economic Analysis Suggests that the Dollar's Value Significantly Affects U.S. Exports

U.S. agricultural exports fell because of the high dollar and rebounded as the dollar declined after 1985. Results from an economic model suggest that a 1-percent decline in the real exchange rate leads to an increase in U.S. agricultural exports of greater than 1 percent.

It is hard to isolate the effect of the exchange rate alone on U.S. agricultural trade. Many other factors contributed to the rebound in our exports since 1985. For example, the Export Enhancement Program and legislation that reduced the U.S. loan rate contributed to the gains in U.S. wheat exports. However, by using some of the frameworks developed at the Economic Research Service, estimates of the exchange rate effect can be obtained.

Results from a depreciation experiment conducted with a computable general equilibrium (CGE) model of the United States show that the long-term responsiveness of agricultural trade to an exchange rate change can be quite high. The model represents the entire economy disaggregated into 30 sectors.

Estimates from the experiment imply that a 1-percent depreciation in the real exchange rate will lead to a greater than 1-percent increase in U.S. agricultural exports worldwide (table 2).

The real U.S. agricultural exchange rate declined 23 percent between the end of 1985 and 1988. A sustained change of that magnitude would lead to a greater than 23-percent increase in U.S. agricultural exports, according to the CGE model. Recent research using the CGE model yields an exchange rate responsiveness coefficient of 1.35 for agricultural-trade-weighted exchange rates (table 2).

There is a significant delay between the change in the exchange rate and the export response. The full response might take 3 years or more, although much of the response should be felt within 1 to 2 years. Thus, the exchange rate depreciation between the end of 1985 and 1988 accounted for 25 to 35 percent of the increase observed in U.S. farm exports. The longrun effects of a sustained increase would be even greater.

Computable General Equilibrium Model

The underlying model is described in Robinson, Kilkenny, and Hanson (1989). Starting from a 1988 base solution, the exchange rate in the model was fixed exogenously at its 1986 level and the model was resolved. No other exogenous variables or parameters were changed. In this version, both labor and capital are assumed mobile across sectors, and the balance of trade is assumed to adjust to the change in the real exchange rate. The CGE model embodies a functional relationship between the real exchange rate and the balance of trade, but contains no assets, asset markets, or time-dependent expectations. The results reflect only the longrun responses of suppliers and demanders to changes in relative prices.

For more information, see: Sherman Robinson, Maureen Kilkenny, and Kenneth Hanson, *The Structure and Properties of the USDA/ERS Computable General Equilibrium (CGE) Model of the United States,* unpublished paper, U.S. Dept. Agr., Econ. Res. Serv., 1989.

Table 2—Effects of exchange rate devaluation on U.S. exports.
Simulated results of the U.S. computable general equilibrium model show that a 1-percent depreciation leads to a greater than 1-percent rise in U.S. agricultural exports.

Sector	Exports base 1988	1988 exports without 1986-88 devaluation[1]	Ratio (1)/(2)	Elasticity
	----------*$ billion*----------		----------*Unit*----------	
Agriculture	20.89	16.12	1.30	1.35
Dairy	.36	.27	1.33	1.52
Livestock and meats	2.99	2.13	1.40	1.84
Grains	8.24	6.42	1.28	1.29
Oilseeds	5.84	4.64	1.26	1.18
Sugar	0	0	--	--
Other agriculture	3.26	2.51	1.30	1.36
Nondurables	64.76	42.63	1.52	2.36
Resources	10.09	6.39	1.58	2.63
Petroleum	9.97	6.66	1.50	2.26
Chemicals	27.57	18.12	1.50	2.37
Other nondurables	17.05	11.39	1.50	2.26
Durables	179.13	123.10	1.46	2.07
Metals and equipment	104.65	71.79	1.46	2.08
Electronics	63.19	43.24	1.46	2.10
Other durables	11.29	8.07	1.40	1.81
Services	104.32	71.38	1.46	2.10
Construction, trade, and transport	46.51	31.76	1.46	2.11
Finance and services	57.89	39.69	1.46	2.08
Total	369.10	253.23	1.46	2.08

-- = Not applicable.
[1] We compared the 1988 base run which has been designed to mirror the 1988 outcome against an alternative solution to the model which holds the exchange rate at the 1986 level. The real exchange rate depreciated 23 percent between these two outcomes.
Source: Economic Research Service, 30-Sector U.S. Computable General Equilibrium Model simulations.

Volatility of Exchange Rates Varies by Commodity

Some agricultural commodity markets, such as corn and soybeans, experience large swings in exchange rates. Exchange rates for wheat markets show the least movement, so changes in currency values tend to affect competitiveness of wheat the least.

Under flexible exchange rates, the United States no longer faces a single exchange rate. Appreciations and depreciations of the U.S. dollar occur through the aggregated result of bilateral changes (changes in one currency's value compared with another). Therefore, exchange rate movements differ markedly depending upon the trade composition of different commodities—that is, which countries' exchange rates are involved in setting the market price of the commodity.

Under the current system, the dollar depreciates when our partners appreciate their currencies against the dollar. Thus to assess the observed exchange rate effect, one must calculate the weighted exchange rate based on the trading partners of a specific commodity.

In general, the U.S. agricultural-trade-weighted exchange rate tends to depreciate less rapidly than the overall trade-weighted exchange rate. Part of the relative stability in agricultural exchange rates occurs because U.S. agricultural trade is more heavily weighted toward developing countries than developed countries. Because many of the developing countries now face financial constraints from debt payment problems, they must maintain a highly competitive position for their exports. Some countries have devalued their currencies even more rapidly than the depreciation of the U.S. dollar.

Figure 4 shows the substantial differences in the observed exchange rate between different commodities. The exchange rate index based on total trade weights for the major industrial countries tends to have the largest swings. The U.S. wheat trade-weighted index tends to move the least.

A comparison of our agricultural competitors' exchange rate movements is also instructive in understanding our relative competitive position in international markets (fig. 5). The agricultural competitors' exchange rate index is a weighted average of the other major agricultural exporters based on their relative export shares. Major agricultural exporters' exchange rates tend to depreciate less and appreciate more than do the indexes based on our export shares.

The soybean and corn competitor indexes show particularly pronounced changes because of the importance of Brazil and Argentina in the indexes. Both countries have faced serious debt repayment problems and have had to devalue substantially against the dollar. Between 1970 and 1979, the soybean index went down by the same amount as the all-agriculture index and only 5 percentage points less than the total-trade-weighted index (table 3). But after 1979, soybean markets underwent marked changes in exchange rates. Between 1979 and 1985, the soybean index increased five times as much as the all-agriculture index and almost four times as much as the total-trade index. Since 1985, the soybean index came down less than half of the fall in the total-trade-weighted index.

Table 3—Changes in real exchange rate indexes weighted by different commodity trade weights. *Wheat varied the least, while soybeans varied the most.*

Index	1970-78/79	1978/79-85	1985-88
	Percent change		
Total-trade-weighted index	36	60	33
U.S. agriculture	31	42	22
U.S. wheat	25	41	30
U.S. soybeans	37	51	30
Major agricultural competitors	21	54	17
Soybean competitors	31	210	16

Figure 4

Wheat and total-trade-weighted exchange rates, 1970-89. The wheat exchange rate varied less than the total exchange rate.

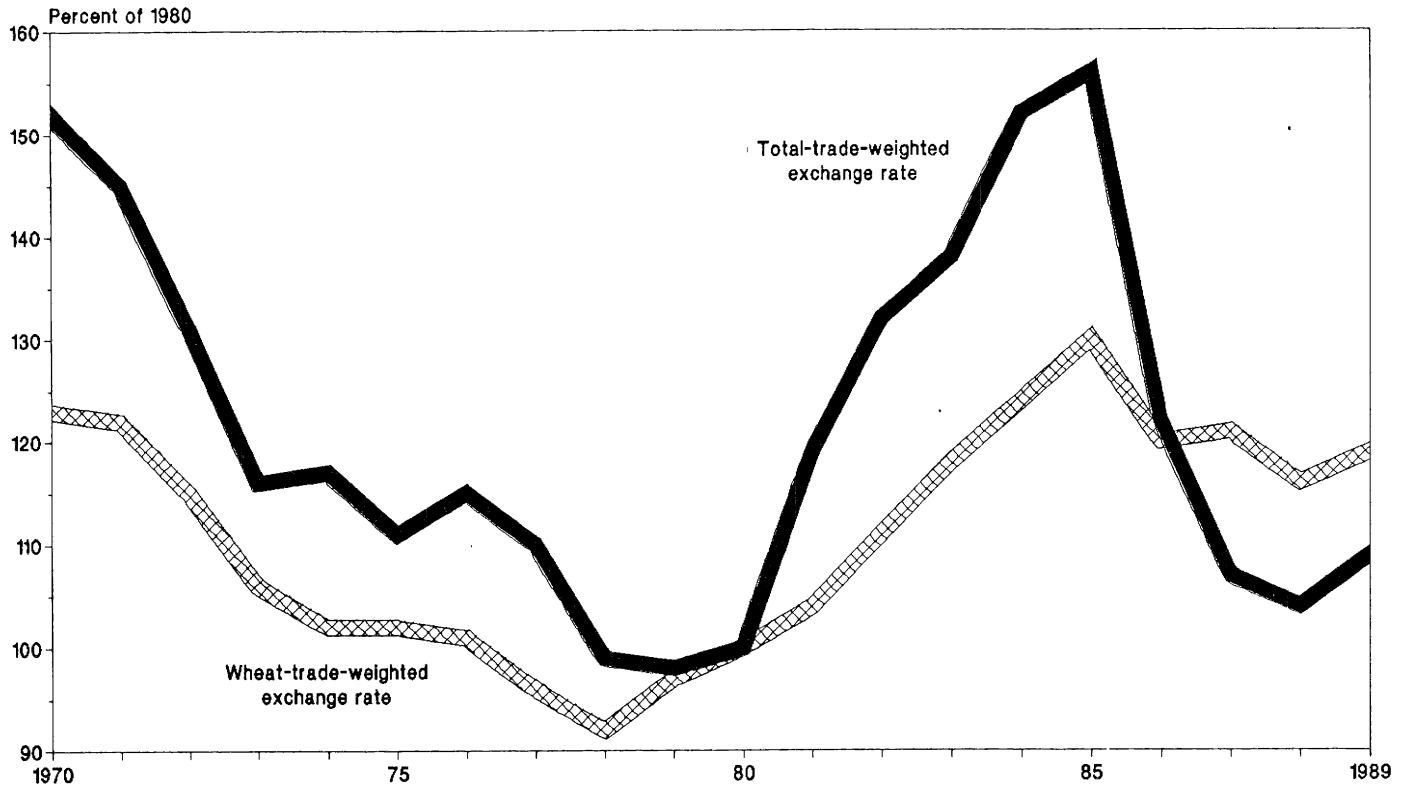
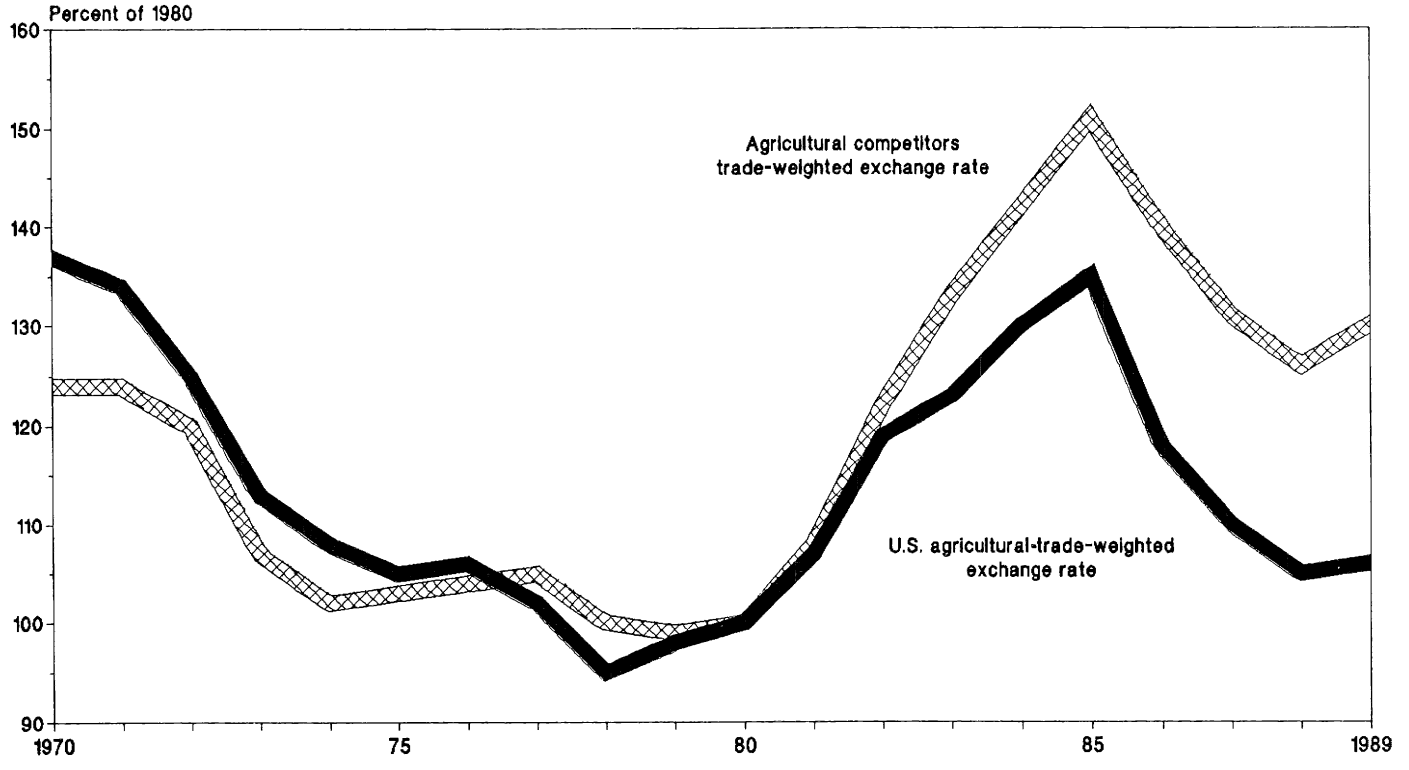


Figure 5

Exchange rate swings of U.S. agricultural trade and competitors. Competitors have tended to maintain their currency value at more competitive rates than have U.S. agricultural trading partners.



General Merchandise Trade's Responsiveness to the Dollar's Value

Evidence suggests that nonagricultural trade is more responsive than agriculture to changes in the real exchange rate.

Although the impact of the devaluation on U.S. agricultural exports has been high, empirical analysis suggests that nonagricultural trade is more responsive than agriculture to changes in the real exchange rate. The balance of trade deficit might have been more than twice the current deficit if the dollar's value had not declined after 1985. Our trade deficit might have been over $300 billion instead of the current $120 billion (table 4).

U.S. trade is dominated by durable and nondurable goods. The largest single item is petroleum imports which contribute more than $100 billion to our trade deficit. Only agriculture, services, and resources were net exporting sectors in 1988. Metals and equipment and electronics were swing sectors with large import and export components.

Table 4—Effect of exchange rate changes on net exports and the balance of trade.
The trade deficit would have been much higher without the dollar's depreciation after 1985.

Sector	Net exports base 1988	Net exports without 1986-88 devaluation[1]	Change in net exports from devaluation
		$ billion	
Agriculture	10.62	3.29	-7.33
Dairy	-.12	-.21	-.09
Livestock and meats	-.21	-1.75	-1.54
Grains	8.07	6.19	-1.88
Oilseeds	5.17	3.49	-1.68
Sugar	-.68	-.68	0
Other agriculture	-1.81	-3.90	-2.09
Nondurables	-145.25	-198.57	-53.32
Resources	6.09	.40	-5.69
Petroleum	-109.13	-136.04	-26.91
Chemicals	6.02	-9.03	-15.05
Other nondurables	-48.31	-53.97	-5.66
Durables	-84.28	-179.86	-95.58
Metals and equipment	-40.00	-86.09	-46.09
Electronics	-26.84	-73.11	-46.27
Other durables	-17.44	-20.66	-3.22
Services	66.83	26.61	-40.22
Construction, trade, and transport	10.92	-10.73	-21.65
Finance and services	22.30	-2.80	-25.10
Total	-152.08	-348.53	-196.45

[1] We compared the 1988 base run which has been designed to mirror the 1988 outcome against an alternative solution to the model which holds the exchange rate at the 1986 level. The real exchange rate depreciated 23 percent between these two outcomes.
Source: Economic Research Service, 30-Sector U.S. Computable General Equilibrium Model simulations.

For more information...
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