THE EXCHANGE RATE AND AGRICULTURE: REAL ISSUE OR DEAD HORSE!

by

Leroy J. Hushak

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Department of Agricultural Economics and Rural Sociology
Ohio Agricultural Research and Development Center
The Ohio State University

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ABSTRACT

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Recent research and data are analyzed to examine the linkages between agricultural trade and prices, the exchange rate and monetary and financial variables. World currency reserves, bank liabilities, and money, and U.S. money and the Federal debt are found to have important roles in exchange rate, price and trade determination.

The Exchange Rate and Agriculture: Real Issue or Dead Horse!

Schuh argues that overvaluation of the U.S. exchange rate during 1950-70 resulted in reduced agricultural exports, with the result of reduced U.S. commodity prices and undervaluation of agricultural resources. He proposes the exchange rate as the "omitted variable" in the explanation of the paradox that the world's most technologically advanced agriculture simultaneously needed price supports to retain resources in agriculture and export subsidies to compete in international markets. After a decade of rising agricultural output, prices and exports during the 1970's, the exchange rate is again being blamed for falling prices and exports since 1980.

The paper serves two purposes. The first is to summarize research results (1) on the linkages between the U.S. exchange rate and agricultural commodity prices and trade and (2) on the effects of U.S. and world monetary and fiscal policies on the U.S. exchange rate and on world trade and commodity prices. The second purpose is to present a correlation analysis of the key variables and an examination of the consistency of research findings with the data.

Several shocks occurred which motivated much of this research. The food crisis of 1972 resulted from low world carryover stocks of grain and a world agricultural production decrease of about 6 percent (UN-FAO). The food crisis was followed by the first OPEC oil embargo in 1973, and another in 1978. World growth of the money supply (M1) rose above 11 percent in 1971 and has exceeded this rate in every year since (IMF). Since 1972, world currency reserves have grown by an average of 13 percent and world debt by over 22 percent per year (IMF).

As financial pressures grew in the early 1970's, the U.S. devalued the dollar in 1972 and then floated it in 1973. During the 1970's, the value of the dollar remained low, U.S. agricultural exports surged in 1973-74 and again in 1978-80 in response to high and rising world agricultural prices, and U.S. and world inflation rates were high by previous standards.

Since 1980, U.S. agricultural exports have declined while the exchange rate has risen. While many continue to blame the rising exchange rate for reduced agricultural exports, the international financial system of the early 1980s is far different from that of the early 1970s. First, the exchange rate is no longer a controllable or policy variable; it is an endogenous variable in the flexible/managed float exchange system. Second, the U.S. has adopted a tight money policy to control inflation while fiscal policy is incurring large deficits. The ratio of debt to GDP rose from 34 percent in 1981 to 42 percent in 1983 after a declining trend since 1960 (ERP). Total developing country debt has grown from $156 billion in 1973 to $700 billion in 1982, and major U.S. agriculture markets hold over 60 percent of this debt (Shane and Stallings).

Is the exchange rate to blame for falling agricultural exports? Even if it is, under the current financial system we must look beyond the exchange rate to find those factors which are responsible for the rising value of the dollar. Research and data on linkages between agricultural trade, the exchange rate, and several key variables are examined in the next two sections.

Literature Review

Research on agricultural trade and commodity prices is reviewed in four segments: (1) exchange rate linkages, (2) money supply linkages, (3) money neutrality, and (4) international dimensions of money.

Exchange Rate Linkages

Johnson, Grennes, and Thursby (JGT) analyze a deterministic differentiated goods model for U.S. wheat prices. Analysis of 1973-74 shows that a 10 percent devaluation of the dollar results in a 6.9 percent increase in wheat prices. The EEC tariff policy and the combined Canada-Australia-Japan trade policies each have larger effects. Chambers and Just (1979) criticize the JGT model which constrains the percent change in price to be less than or equal to the percent devaluation, which holds for aggregate trade but not for individual commodities. An econometric model consistent with these criticisms is estimated for wheat, corn, and soybeans (Chambers and Just, 1981). A 10 percent devaluation of the dollar results in a long run increase in wheat prices of 7.9 percent. However, the long-run elasticities for corn and soybeans prices and all short run elasticities are greater than one. Chambers and Just (1982) lag the exchange rate by one quarter in the export equations and add a reduced form exchange rate equation. The long run elasticities of price with respect to domestic credit (not defined) are elastic except for corn.

Van Duyne examines bad harvests, commodity speculation, and world economic boom during 1973-74 in a two-sector two-country fixprice (foreign) flexprice (domestic) stock equilibrium model. In the case of a bad harvest, the commodity spot price increases and remains high until stocks, not

flows, are restored. The price of foreign exchange declines as domestic stocks of foreign exchange are reduced. Shei and Thompson decompose the 1973 inflation across four shocks, the devaluation, expansion of the U.S. monetary base, the food crisis, and the Soviet grain purchase of 1973, in a 24 equation econometric model. The U.S. monetary base expansion and the Soviet grain purchase had much larger effects than the devaluation and the reduction in world food production. Batten and Belongia find that increases in the real value of the dollar significantly reduce agricultural exports, but this is dominated by the effects of changes in real economic activity in importing countries.

Money Supply Linkages

Several studies have examined the direct linkages between money growth and agricultural prices or exports. Barnett, Bessler and Thompson, Belongia and King, and Chambers all use Granger causality techniques and find evidence of statistically significant causal linkages from money growth to agricultural commodity or food prices. Bessler finds a similar causal relationship for prices in Brazil. However, the diversity of lag structures makes difficult the drawing of any policy or research implications. Further, the necessary condition that the time series be stationary, or at least homogeneous nonstationary (Granger), may not be met in these studies, or if it is met the series is so short that any conclusions are at best tenuous. Zellner argues that Granger causality is a nonoperational definition which involves predictability in a special confirmatory setting. The results of these mechanical tests of causality cannot be unambiguously interpreted.

Money Neutrality

The Dornbusch overshooting model and the Bordo contract theory model show how a change in the money supply can generate non-neutral or real effects in the economy. These models distinguish assets from goods. In contrast to Van Duyne, which deals only with real effects, the Dornbusch and Bordo models analyze the responses to a nominal change in money supply under the hypothesis that asset prices adjust faster than goods prices. Dornbusch concludes that asset prices (exchange rates, primary commodity prices) "overshoot" long run equilibrium levels to compensate for the lack of response in final goods prices. Bordo finds that the mean lag for raw goods prices is shorter than for manufactures prices, crude materials shorter than for intermediate goods prices, farm prices shorter than for industrial prices.

Lucas tests the "natural rate" of real output hypothesis for eighteen countries. In a stable price country such as the U.S., a policy to increase nominal income has a relatively large real output effect, while in a volatile country such as Argentina the effect is all on prices. Parks and Ashley find a significant effect of unanticipated inflation rates on relative price variance. In a test of the Macro rational expectations (MRE) hypothesis, i.e., that anticipated changes in aggregate demand policy are taken into account and evoke no further response, Mishkin jointly rejects the money neutrality and MRE hypotheses for both the unemployment rate and real output at a lag of twenty quarters. These results suggest that money is non-neutral for periods up to five years, and that asset prices, including agricultural prices, respond more rapidly than final goods prices to changes in money growth rates.

International Dimensions of Money

Frenkel argues that data on foreign exchange and interest rates provide information on market conditions, e.g., high interest rates and currency appreciation since 1979 indicate a rising demand for money. McKinnon (1981) holds the insular economy concept (limited financial and commodity arbitrage) responsible for "ill-chosen" monetary and exchange rate policies during the 1970's. He concludes that in an open economy a persistent balance of payments deficit does not indicate that its currency should be depreciated, but likely reflects a deficit in public finances.

McKinnon (1982) develops the hypothesis that there now exists a relatively stable demand for world money. The currencies of the industrial countries are highly substitutable, which destabilizes demand for the monies of individual countries. Tests of the McKinnon hypothesis by Willett, and Radcliffe, Warga and Willett, estimating the relationship between money growth and nominal U.S. GNP, show U.S. money growth is more closely related to GNP growth than world money. However, McKinnon, et al. all agree that there was a reduction in the ability of U.S. M1 to explain U.S. prices or income during 1972-82 as compared to 1958-69.

Stoeckel argues that "international economic activity and world monetary developments play a crucial role in the prices of our primary commodities." Bond, et al. (1984) show linkages among groups of commodity prices and discuss a link between less stable commodity prices and higher growth rates of money during the 1970s than the 1960s. Bond, Vlastuin and Crowley (1983) find that anticipated and unanticipated monetary

disturbances affect real and nominal commodity prices. They combine an MRE model with a commodity price model and find that commodity prices respond more quickly than global inflation rates to anticipated and unanticipated changes in the money (M1) supply of major industrial countries.

Implications for Empirical Examination

Four key implications emerge which merit empirical examination in the next section. First, the exchange rate is linked to trade, and in particular, to U.S. agricultural prices and exports. Second, the domestic money supply has a significant effect on commodity prices and trade. Results from tests of money neutrality suggest that asset prices (exchange rate, primary commodity prices) respond faster than final goods prices. Third, international money aggregates respond to a stable international demand for money; domestic currencies are not separable from international money. Fourth, the balance of payments position under flexible exchange rates reflects the fiscal deficit-surplus status of the budget more than the relative values of currencies.

Correlation Analysis

Selected values of the key variables and average annual rates of change are presented in Table 1; the correlation matrix for 1972-83 is in Table 2 (for 1960-83 in the Appendix). The period 1972-83 is chosen because it covers the flexible/managed-float period. The correlation analysis is focused on determining the largest correlations between variables. In Table 2, coefficients are presented only for those leads or lags which contain the maximum corrrelation coefficients.

By source of variables, from ERP XR is the trade-weighted value of the dollar, AEXP is U.S. agricultural exports, PREC is prices received by U.S. farmers, PPD is prices paid by farmers, FOPR is the U.S. CPI for food, and DEBT is U.S. gross Federal debt; from IMF USM1 is U.S. money defined as M1, WM1 is world M1, IMMI is industrial countries' aggregate M1, USP is the U.S. GDP deflator, USGDP is U.S. gross domestic product (GDP), IMFO is the world food commodity price index, WP is the world GDP deflator, WGDP is world GDP, WLIAB is deposit bank foreign liabilities, and ICR is world foreign exchange; from USDC NFI is net foreign investment; from USDA STOCKS is U.S. grain stocks, and from UN-FAO WAGEX is world agricultural exports. The letter D before a variable indicates the percent change and L or L2 indicates a lag of one or two years (Table 2).

After devaluation in 1973, XR remains relatively low and stable, reaches a low of 87 in 1980, then begins an increase which continues through 1984. Changes in the exchange rate (XR) lead changes in prices received (PREC) by less than one year, agricultural exports (AEXP), food prices (FOPR) and net foreign investment (NFI) by one year, and the GDP deflator (USP) by two years (Table 2).

The U.S. money supply grows more rapidly during 1972-83 than during 1960-71 (Table 1). Growth in U.S. M1 (USM1) appears to lead agricultural exports, prices received and the exchange rate by one year and DSTOCKS, DPPD and DUSP by two years (Table 2). These results support a significant role for XR and USM1 in U.S. agricultural trade, and that commodity prices respond faster than goods prices.

Both world M1 and industrial aggregate M1 grow more rapidly during 1972-83 than 1960-71. With respect to the McKinnon hypothesis, all three

money variables have significant correlation coefficients with world nominal GDP, with LDWM1 the largest, followed by L2IMMI. The most significant correlation between M1 and DUSGDP is LDWM1, which is significant at 12 percent. The strongest linkage with world prices (DWP) is L2DUSM1 while all three money variables lagged two years have similar correlation coefficients with DUSP. With respect to the world and U.S. trade variables, industrial country M1 lagged one or two years has the strongest linkages followed by USM1 similarly lagged.

What appears to emerge from this analysis is that world money has the strongest influence on world nominal output and leads it by about two years. Inflation rates are about equally affected by all three M1 variables lagged two years. With respect to the trade variables, the money supply of the industrial countries, which control the bulk of the traded commodities, has the strongest effect followed by the U.S. money supply. As with the U.S. money-trade linkage, money (world, industrial or U.S.) leads all variables; the exchange rate and U.S. prices received by farmers by one year or less, exports and world commodity prices by one year or more, and goods prices by two years.

The percentage change in DEBT is negatively and significantly correlated with net foreign investment (-.74) and positively and significantly correlated with LDXR (.80). This supports McKinnon's hypothesis that the fiscal deficit position affects the balance of payments position. In addition, LIMMI and LDUSM1 are both highly correlated with world deposit bank foreign liabilities, a measure of international credit (Table 2). Finally, international reserves (L2D1CR) appear to lead changes in USM1 and IMMI by one year. ICR also appears to lead the

exchange rate by one year while WLIAB lags it by one year. Both L2D1CR and DWLIAB are positively and significantly correlated with DWAGEX, only DWLIAB with DAEXP. These results suggest that while U.S. trading partners are reducing debt to supportable levels, the value of the dollar will increase and agricultural prices and exports will decline.

Conclusions and Implications

In conclusion, we can identify several important variables which influence agricultural prices and trade. While the exchange rate is one of the variables (a real issue), it is no longer a policy or control variable (a dead horse). We must search for variables which affect the exchange rate as well as trade. The variable which appears to lead all other variables is the growth of international reserves. The strongest correlations consistently show ICR leads money and the exchange rate by one year and all other variables by two or more years. Money growth leads the exchange rate, world liabilities, farm level prices, and trade by one year, food and other goods prices by one to two years. Tighter reserve and monetary growth policies both imply slower trade growth. World bank credit (WLIAB) is highly correlated with trade. The slower growth of WLIAB, 5 percent per year, during 1981-83, implies slower trade growth. Finally, the rapidly growing U.S. debt since 1981 is drawing world resources into the U.S. economy at growing rates ($120 billion net investment inflow in 1984), resources which could otherwise be invested in other countries. If the U.S. had been forced to monetize this portion of the fiscal deficit at the end of 1984, M1 would have increased by at least 20 percent, the monetary base by 60 percent.

Table 1. Key Variables and Annual Average Percent Change, 1960-83

	1960	1972	1983	Average Annual Percent Change[a] 1960-71	1972-83
XR (1973=100)	120.0	109.1	125.3	-0.2	0.6
USM1 ($bil)	146.6	261.7	506.0	4.3	6.4
WM1 (1980=100)	13.3	36.2	144.1	8.0	13.4
IMMI[b]				8.4	14.3
AEXP ($bil)	4.8	9.4	36.6[c]	0.3[d]	2.6[d]
NFI ($bil)	2.8	-5.1	-33.9	0.04[d]	-2.8[d]
STOCKS (mil.mt.)	119.7	73.9	156.3	-4.5	14.6
PREC (1977=100)	52.0	69.0	135.0	1.4	7.3
PPD (1977=100)	44.0	62.0	160.0	2.5	8.9
FOPR (1967=100)	88.0	123.5	219.7	2.3	7.9
USP (1980=100)	38.5	56.0	120.7	3.0	7.0
USGDP ($bil)	502.9	1,175.0	3,256.5	6.8	9.8
DEBT ($bil)	290.9	437.3	1,381.9	3.0	10.7
WAGEX ($bil)	33.1	65.8	210.7[c]	2.6	6.8
IMFO (1980=100)	27.0	37.4	74.5	1.7	10.1
WP (1980=100)	22.7	39.8	140.3	4.5	11.7
WGDP (1980=100)	9.8	30.4	145.6	9.6	15.1
WLIAB ($bil)	34.9[e]	272.4	2,325.3	26.2	22.4
ICR (mil. SDR)	18.5	96.7	309.5	15.0	12.9

[a] Average of the annual percent changes.
[b] Data is in percent change only.
[c] 1982.
[d] Absolute change, not percent change, from prior year.
[e] 1963.

Table 2. Correlation Matrix of Monetary Variables by Trade, Price, and Output Variables, 1972-83[a]

	LDXR	L2DXR	LDUSM1	L2DUSM1	LDWM1	L2DWM1	LIMM1	L2IMM1
DXR	0.50127 0.0969 12	0.09403 0.7713 12	-0.50871 0.0912 12	0.02232 0.9451 12	-0.26937 0.3972 12	0.19611 0.5413 12	-0.74926 0.0050 12	-0.28057 0.3771 12
DAEXP	-0.86489 0.0006 11	-0.06522 0.8489 11	0.70612 0.0152 11	0.43686 0.1791 11	0.60581 0.0482 11	0.12370 0.7171 11	0.70893 0.0146 11	0.62817 0.0385 11
DNFI	-0.68686 0.0136 12	-0.65084 0.0219 12	0.27937 0.3792 12	0.45560 0.1366 12	0.12175 0.7062 12	0.28586 0.3677 12	0.38286 0.2193 12	0.63729 0.0258 12
DSTOCKS	0.77196 0.0033 12	0.49710 0.1001 12	-0.18131 0.5728 12	-0.62819 0.0287 12	-0.17988 0.5759 12	-0.28663 0.3664 12	-0.34029 0.2791 12	-0.77137 0.0033 12
DPREC	-0.59775 0.0401 12	0.05203 0.8724 12	0.74793 0.0052 12	0.16430 0.6099 12	0.18384 0.5674 12	-0.20320 0.5265 12	0.62275 0.0305 12	0.31239 0.3229 12
DPPD	-0.88053 0.0002 12	-0.64080 0.0248 12	0.44844 0.1437 12	0.67142 0.0168 12	0.46722 0.1257 12	0.26244 0.4099 12	0.64313 0.0241 12	0.77410 0.0031 12
DFDPR	-0.73659 0.0063 12	-0.50375 0.0950 12	0.44666 0.1455 12	0.70575 0.0103 12	0.44445 0.1477 12	0.39666 0.2017 12	0.54522 0.0667 12	0.86172 0.0003 12
DUSP	-0.43782 0.1546 12	-0.67507 0.0160 12	-0.05057 0.8760 12	0.74848 0.0051 12	0.29785 0.3471 12	0.78550 0.0025 12	-0.04430 0.8913 12	0.76399 0.0038 12
DUSGDP	-0.55075 0.0635 12	0.06381 0.8438 12	0.42774 0.1654 12	0.03258 0.9199 12	0.47457 0.1190 12	0.12835 0.6910 12	0.43363 0.1590 12	0.32870 0.2969 12
DWAGEX	-0.70924 0.0145 11	-0.07293 0.8313 11	0.62517 0.0397 11	0.20048 0.5545 11	0.44847 0.1665 11	-0.30515 0.3615 11	0.89725 0.0002 11	0.41350 0.2062 11
DIMFU	-0.60184 0.0384 12	-0.14841 0.6453 12	0.63724 0.0258 12	0.51701 0.0852 12	0.46764 0.1253 12	-0.08221 0.7995 12	0.70852 0.0099 12	0.47961 0.1146 12
DWP	-0.20089 0.5313 12	-0.46514 0.1276 12	-0.19733 0.5387 12	0.74533 0.0054 12	0.37045 0.2359 12	0.69206 0.0126 12	-0.16195 0.6151 12	0.59894 0.0396 12
DWGDP	-0.74068 0.0059 12	-0.35999 0.2504 12	0.36769 0.2396 12	0.53622 0.0723 12	0.79513 0.0020 12	0.33097 0.2933 12	0.56928 0.0534 12	0.66527 0.0182 12
DWLIAB	-0.85751 0.0004 12	-0.31078 0.3255 12	0.65471 0.0209 12	0.20178 0.5294 12	0.43713 0.1553 12	-0.06142 0.8496 12	0.83476 0.0007 12	0.53729 0.0716 12
L2DTCR	-0.57263 0.0517 12	-0.14657 0.6494 12	0.55645 0.0602 12	-0.01088 0.9732 12	0.02462 0.9395 12	-0.44370 0.1485 12	0.67268 0.0165 12	0.16951 0.5984 12

[a] Correlation coefficient, significant level, and number of observations.

References

Ashley, Richard. "Inflation and the Distribution of Price Changes Across Markets: A Causal Analysis." Economic Inquiry 19(1981): 650-660.

Barnett, Richard C., David A. Bessler, and Robert L. Thompson. "The Money Supply and Nominal Agricultural Prices." American Journal of Agricultural Economics 65(1983): 303-307.

Batten, Dallas S. and Michael T. Belongia. "The Recent Declines in Agricultural Exports: Is the Exchange Rate the Culprit?" Review, Federal Reserve Bank of St. Louis 66(1984): 5-14.

Belongia, Michael T. "Why do Food Prices Increase?" Review, Federal Reserve Bank of St. Louis 65(1983): 5-12.

Belongia, Mike and Richard A. King. "A Monetary Analysis of Food Price Determination." American Journal of Agricultural Economics, 65(1983): 131-135.

Bessler, David A. "Relative Prices and Money: A Vector Autoregression on Brazilian Data." American Journal of Agricultural Economics 66(1984): 25-30.

Bond, Gary, Chris Vlastuin, and Peter Crowley. "Money and Primary Commodity Prices: A Global Perspective." Mimeo, Bureau of Agricultural Economics, Canberra, September 1983, 21 pp.

Bond, Gary, Chris Vlastuin, Peter Crowley and Peter Demura. "Why World Commodity Markets will Remain Unstable." Quarterly Review of the Rural Economy 6(1984): 172-177.

Bordo, Michael David. "The Effects of Monetary Change on Relative Commodity Prices and the Role of Long Term Contracts." Journal of Political Economy 88(1980): 1088-1109.

Chambers, Robert G. "Agricultural and Financial Market Interdependence in the Short Run." American Journal of Agricultural Economics 66(1984): 12-24.

Chambers, Robert G. and Richard E. Just. "A Critique of Exchange Rate Treatment in Agricultural Trade Models." American Journal of Agricultural Economics 61(1979): 249-257.

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

Chambers, Robert G. and Richard E. Just. "An Investigation of the Effect of Monetary Factors on Agriculture." Journal of Monetary Economics 9(1982): 235-247.

Dornbusch, Rudiger. "Expectations and Exchange Rate Dynamics." Journal of Political Economy 84(1976): 1161-1176.

Economic Report of the President (ERP). U.S. Government Printing Office, 1984.

Frenkel, Jacob A. "Monetary Policy: Domestic Targets and International Constraints." American Economic Review 73(1983): 48-53.

Granger, C.W.J. "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods." Econometrica 37(1969): 424-438.

International Monetary Fund (IMF). International Financial Statistics: Yearbook. Washington, D.C., 1984.

Johnson, Paul R., Thomas Grennes and Marie Thursby. "Devaluation, Foreign Trade Controls, and Domestic Wheat Prices." American Journal of Agricultural Economics 59(1977): 619-627.

Lucas, Robert E., Jr. "Some International Evidence on Output-Inflation Tradeoffs." American Economic Review 63(1973): 326-334.

McKinnon, Ronald I. "Currency Substitution and Instability in the World Dollar Standard." American Economic Review 72(1982): 320-333.

McKinnon, Ronald I. "The Exchange Rate and Macroeconomic Policy: Changing Postwar Perceptions." Journal of Economic Literature 19(1981): 531-557.

McKinnon, Ronald, Christopher Radcliffe, Kong-Yam Tan, Arthur D. Warga, and Thomas D. Willett. "International Influences on the U.S. Economy: Summary of an Exchange." American Economic Review 74(1984): 1132-1134.

Mishkin, Frederic S. "Does Anticipated Monetary Policy Matter? An Econometric Investigation." Journal of Political Economy 90(1982): 22-51.

Parks, Richard W. "Inflation and Relative Price Variability." Journal of Political Economy 86(1978): 79-95.

Radcliffe, Christopher, Arthur D. Warga, and Thomas D. Willett. "Currency Substitution and Instability in the World Dollar Standard." American Economic Review 74(1985): 1129-1131.

Schuh, G. Edward. "The Exchange Rate and U.S. Agriculture." American Journal of Agricultural Economics 56(1974): 1-13.

Shane, Mathew D. and David Stallings. "Trade and Growth of Developing Countries Under Financial Constraint." ERS Staff Report No. AGES840519, U.S. Department of Agriculture, 1984.

Shei, Shun-Yi and Robert L. Thompson. "Inflation and Agriculture: A Monetarist-Structuralist Synthesis." Mimeo, Department of Agricultural Economics, Purdue University, September 1981, 55 pp.

Stoeckel, Andy. "Issues in World Agricultural Trade." Outlook '84, Proceedings, 60th Annual Agricultural Outlook Conference, U. S. Dept. of Agriculture, Washington, D.C., November 1983.

United Nations (UN). FAO Production Yearbook. Rome, Various years.

United Nations (UN). FAO Trade Yearbook. Rome, Various years.

United States Department of Agriculture (USDA). Agricultural Statistics. U.S. Government Printing Office, Various years.

United States Department of Commerce (USDC). Survey of Current Business. National Income and Product Accounts, Table 4.1, Bureau of Economic Analysis, Various Years.

Van Duyne, Carl. "The Macroeconomic Effects of Commodity Market Disruptions in Open Economies." Journal of International Economics 9(1979): 559-582.

Willett, Thomas D. "U.S. Monetary Policy and World Liquidity." American Economic Review 73(1983): 43-47.

Zellner, Arnold. "Causality and Econometrics." in Karl Brunner and Allan H. Meltzer, editors, Three Aspects of Policy and Policymaking: Knowledge, Data and Institutions, Carnegie-Rochester Conference Series on Public Policy, Vol. 10, New York: North-Holland, 1979, pp.9-54.

Appendix. Correlation Matrix of Monetary Variables by Trade, Price, and Output Variables, 1960-83[a]

	LDXR	L2DXR	LDUSM1	L2DUSM1	LDWM1	L2DWM1	LIMM1	L2IMM1
DXR	0.49645 0.0160 23	0.07996 0.7235 22	-0.21610 0.3220 23	0.02635 0.9073 22	-0.02868 0.8966 23	0.12922 0.5666 22	-0.42698 0.0374 24	-0.15324 0.4851 23
DAEXP	-0.84182 0.0001 22	-0.20078 0.3828 21	0.52672 0.0118 22	0.43416 0.0492 21	0.51588 0.0140 22	0.37272 0.0961 21	0.65461 0.0007 23	0.62767 0.0018 22
DNFT	-0.66421 0.0006 23	-0.60439 0.0029 22	0.03685 0.8674 23	0.22066 0.3237 22	-0.08297 0.7066 23	0.02098 0.9262 22	0.12653 0.5558 24	0.31744 0.1399 23
DSTOCKS	0.67115 0.0005 23	0.37738 0.0834 22	0.23072 0.2895 23	-0.11655 0.6055 22	0.25794 0.2347 23	0.09227 0.6830 22	0.04833 0.8226 24	-0.25115 0.2477 23
DPREC	-0.55711 0.0058 23	0.00061 0.9979 22	0.60658 0.0022 23	0.27290 0.2192 22	0.33918 0.1134 23	0.17148 0.4454 22	0.59022 0.0024 24	0.40500 0.0552 23
DPPD	-0.57746 0.0039 23	-0.52187 0.0127 22	0.66964 0.0005 23	0.63525 0.0015 22	0.76947 0.0001 23	0.68375 0.0005 22	0.78235 0.0001 24	0.82814 0.0001 23
DPOPR	-0.53594 0.0084 23	-0.45076 0.0353 22	0.62877 0.0013 23	0.73943 0.0001 22	0.70945 0.0001 23	0.68226 0.0005 22	0.73311 0.0001 24	0.87474 0.0001 23
DUSP	-0.25779 0.2350 23	-0.48495 0.0222 22	0.54204 0.0076 23	0.77208 0.0001 22	0.74824 0.0001 23	0.84422 0.0001 22	0.55685 0.0047 24	0.82264 0.0001 23
DUSGDP	-0.39597 0.0614 23	-0.04780 0.8327 22	0.69198 0.0002 23	0.17418 0.4382 22	0.65290 0.0007 23	0.45810 0.0320 22	0.65509 0.0005 24	0.50245 0.0146 23
DWAGEX	-0.67951 0.0005 22	-0.21450 0.3505 21	0.49417 0.0194 22	0.34427 0.1265 21	0.49582 0.0189 22	0.19011 0.4091 21	0.75467 0.0001 23	0.50431 0.0167 22
DIMFD	-0.57324 0.0043 23	-0.16758 0.4560 22	0.42675 0.0423 23	0.41522 0.0546 22	0.29636 0.1697 23	0.09518 0.6735 22	0.56913 0.0037 24	0.41548 0.0486 23
DWP	-0.11648 0.5966 23	-0.34171 0.1196 22	0.48387 0.0193 23	0.69040 0.0004 22	0.87830 0.0001 23	0.88822 0.0001 22	0.61050 0.0016 24	0.78304 0.0001 23
DWGDP	-0.36013 0.0914 23	-0.30862 0.1623 22	0.66552 0.0005 23	0.59095 0.0038 22	0.93234 0.0001 23	0.76751 0.0001 22	0.81508 0.0001 24	0.77289 0.0001 23
DWLIAB	-0.52511 0.0174 20	-0.18541 0.4339 20	0.48898 0.0287 20	0.12169 0.6093 20	-0.05057 0.8323 20	-0.26460 0.2596 20	0.36206 0.1167 20	0.05518 0.8173 20
L2DICP	-0.49075 0.0204 22	-0.19399 0.3870 22	0.58015 0.0046 22	0.24418 0.2735 22	0.45400 0.0338 22	0.17719 0.4302 22	0.73104 0.0001 22	0.36704 0.0929 22

[a] Correlation coefficient, significant level, and number of observations.