EFFECTS OF THE MACROECONOMIC ENVIRONMENT ON AGRICULTURAL PRICES IN THE EARLY 1980S

Charles B. Moss, Timothy G. Baker, and B. Wade Brorsen

Proceedings of
Regional Research Committee NC-161

FINANCING AGRICULTURE IN A CHANGING
ENVIRONMENT: MACRO, MARKET,
POLICY AND MANAGEMENT ISSUES

Denver, Colorado
October 6-7
1987

EFFECTS OF THE MACROECONOMIC ENVIRONMENT ON AGRICULTURAL PRICES IN THE EARLY 1980s

by

Charles B. Moss
Timothy G. Baker
and
B. Wade Brorsen

In the late 1970s and early 1980s several changes occurred in the United States' macroeconomic environment. An expansionist fiscal policy resulted in the federal deficit increasing from $40.2 billion in 1979 to $127.9 billion in 1982. At the same time, the operating policy of the Federal Reserve Board changed. In the 1970s the Federal Reserve Board used open market operations to peg the federal funds rate. In October 1979, the Federal Reserve Board changed to controlling growth in money aggregates. As a result of the changes in fiscal and monetary policy in the early 1980s the general economy experienced higher real interest rates, lower inflation rates, higher growth in the real gross national product, a capital inflow from other countries, and an increase in the real exchange rate.

At the same time the farm sector suffered through a severe period of financial stress. According to Melichar, real asset values in agriculture fell from 1,241.6 billion dollars in 1979 to 726.6 billion dollars in 1986. The rate of return on farm assets fell from 7.5 percent in 1979 to -11.1 percent in 1984, and the rate of return to farm equity went from 8.9 percent in 1979 to -16.0 percent in 1984.

Charles B. Moss is an Assistant Professor, the Department of Food and Resource Economics, University of Florida. Timothy G. Baker is an Associate Professor and B. Wade Brorsen is an Assistant Professor, Department of Agricultural Economics, Purdue University.

The change in monetary and fiscal policy in the United States in the early 1980s and the subsequent downturn in the farm sector in the mid 1980s could be related. Agriculture does not exist in a vacuum; it purchases inputs from the general economy and is sensitive to changes in the real interest rate. Further, agriculture is affected by inflation both from changes in asset values and input and output prices. And finally, Schuh's work (1974,1976) brought focus on the possible importance of exchange rates in determining output prices.

This study seeks to determine the effect of monetary and fiscal policy on real corn and soybean prices in the 1980s. Specifically, this study examines the response of real corn and soybean prices through time to changes in government surplus, money supply, growth in real gross national product, and the real exchange rate. Secondly, this study determines the changes in real agricultural prices from October 1979 to January 1987 attributable to each of these macroeconomic factors.

The importance of this study is the implications that macroeconomic factors have on real income and policy cost in the farm sector through real prices. If macroeconomic factors effect real agricultural prices, then they also influence the cost and distribution of agricultural policies in the United States. Macroeconomic factors which affect the probability distribution of real agricultural input and output prices also affect the investment and financing decisions of the firm. Any change in macroeconomic environment which changes the optimal leverage of the firm also has implications for the sector including collateral values, interest rates, farm income, and cash flow.

The next section of this paper uses macroeconomic and microeconomic theory to specify the variables for the time series model developed in the following section of the paper. In addition, the theory section also provides insight into the expected results for comparison with the empirical results. Once the variables of interest have been developed from theory, an autoregressive representation is estimated, the time series model is discussed in the procedure section.

Theory

The theory section develops the economic theory used to specify the endogenous variables for the time series representation to be estimated, and provides expected results for the interactions between the system of endogenous variables. First this section presents the microeconomic theory. Next, the section examines a static model of the economy for insights into the interactions between the macroeconomic variables. And finally, changes which are necessary for the dynamic representation of the time series process are presented.

134

In microeconomic theory a primary determinant of the demand for a good is the consumer's income. An increase in real income moves the budget constraint outward increasing the potential level of consumption. Increased nominal income completely offset by a nominal increase in commodity prices does not increase the potential level of consumption.

Another theoretical consideration from standard microeconomic theory is the effect that an outward shift in the budget constraint on consumption of a specific good. Corn and soybeans are typically considered normal goods. Therefore, real income increases, the consumer increases consumption of each of these goods, but at a lesser rate than the increase in income. The net effect is that the portion of the consumer's income spent on corn and soybean decreases as income increases. The result is a shrinking agricultural sector portion of the general economy is devoted to agriculture as pointed out by Tweeten. However, the expanding consumption should cause agricultural prices to increase as real income increases, if supply were fixed.

Another microeconomic effect of a macroeconomic factor involves the real interest rate. As the real interest rate increases, the cost of capital to agriculture increases. The farm sector uses large amounts of borrowed capital for everything from holding grain inventories to buying fixed assets. Even if the capital is not borrowed, however, the investors suffer an opportunity cost as the real interest rate in the economy increases. The increased interest rate will have two effects on agricultural asset values. First the increased interest rate should cause the supply curve to shift upward causing the return to assets to increase and the asset values to increase. However, the increased real interest rate also causes the asset values to fall by the capitalization theory. The empirical results in Featherstone and Baker indicate that the net effect of an increase in the real interest rate is a decline in real asset values.

Lastly, the stickiness of prices in agriculture could cause inflation to have an effect on real corn and soybean prices. If prices were administratively set, adjustments to changes in the general price level could lag behind. The stickiness of administered prices therefore cause some industries to lose ground in periods of rapid inflation. The speed of price adjustment would, probably not affect agriculture because of the competitive nature of agricultural markets. However, corn prices in the 1980s in the United States have been affected by government programs that set nominal support prices. If the nominal support price fails to adjust for inflation, then monetary or fiscal shocks which introduce a change in inflation would change the real corn price.

Macroeconomic Theory

The theoretical effect of fiscal policy on real gross national product is dependent on the model or school of economic thought. An increase in government spending in the Keynesian model causes an increase in aggregate income. In the Keynesian model the economy is demand constrained, and the increased demand caused by larger deficits increases aggregate income. In the monetarist model, the economy is constrained by a natural or full employment level. Therefore, an increase in government spending simply crowds out individual consumption leaving the level of aggregate income unchanged.

Both schools of thought agree on the effect of a fiscal policy stimulus on the real interest rate. In the monetarist model the primary effect of fiscal policy stimulus is an increased real interest rate. Part of the crowding out of private consumption comes by crowding out investment. In the Keynesian model the effect of the fiscal stimulus on the real interest rate is dampened by increasing aggregate income.

The effectiveness of monetary policy as a countercyclical economic tool has been at the center of the debate in macroeconomic theory for a long time. The monetarist argue that the total effect of an increase in money supply is to increase the price level. In the Keynesian model, an increase in the money supply increases the price level, but it also increase the gross national product by reducing the real interest rate.

The effect of macroeconomic variables on international trade and financial variables such as exchange rates and capital flows involves simple extensions of the static macroeconomic model. In macroeconomic models, imports are an increasing function of income and a decreasing function of the real exchange rate and capital flows are an increasing function of the interest rate. The balance of payments is simply the sum of net exports and the capital flow. A decrease in the balance of payments implies that there is an excess of dollars in the world trade accounts and that downward pressure will begin on the value of the dollar against foreign currencies.

Unfortunately, in most cases concrete theoretical conclusions about the effect of fiscal policy are not possible. For example, fiscal stimulus increases the demand for imports, causing downward pressure on the real exchange rate. However, a budget deficit also increases the real interest rate causing upward pressure on the real exchange rate through an increased capital inflow. The net effect of a fiscal stimulus thus depends on the relative strength of the two effects. In the monetarist model, the fiscal stimulus will result in higher real interest rates leading to higher real exchange rates. The Keynesian model, on the other hand, suggests that the increase in real gross national product may be sufficient to cause the import

demand to rise faster than the capital inflows causing the real exchange rate to fall.

Another sticky theoretical point is the reaction of the exchange rate to the balance of payments. In the current macroeconomic environment exchange rates are not clean floating; central banks around the world intervene to stabilize the foreign exchange rates according to some policy goals. Instead of allowing currencies to seek their own price in exchange rate markets, clean floating, central banks often buy or sell foreign and domestic currency to effect the relative value of currency, dirty floating. The real exchange rate is therefore subject to foreign and domestic policy decisions, as well as, market pressures.

The net expected effect of fiscal stimulus from a monetarist viewpoint is that an increased federal budget deficit will cause a little change in aggregate income, but an increase in the real interest rate. The balance of payments should become positive leading to higher real exchange rates and lower real corn and soybean prices.

In the monetarist model, increase in money supply will likewise cause no change in the real interest rate or aggregate income. Since the change in money supply causes no change in the imports or capital flows, the increase in money supply does not effect real exchange rate. The lack of effect of money supply on the real exchange rate will mean no change in the export demand for real corn and soybeans.

Dynamics

One final theoretical point, the preceding discussion has developed the relationship between monetary and fiscal policy and real corn and soybean prices in a model without time. In reality, all movements in the economy are not instantaneous. Agents in the economy require time to discover and adjust to changes. Given this lag it is possible for monetary and fiscal policy to have short term "real" effects even in a monetarist model. Most of these models include an expectations process which models the assimilation of information by agents in the economy.

Procedure

This section explains the empirical procedure used in this study to investigate the relationship between monetary and fiscal policy and real corn and soybean prices. The section first explains the theory behind the time series representation of the relationship between the endogenous variables in this study.

Then the section briefly explains the technical estimation procedure. Finally, the techniques used to interpret the estimated relationship are explained.

Introduction to Vector Autoregression

In the preceding section, the study did not explicitly discuss functional forms or mathematical specifications for the relationships developed. There are two reasons for this omission, but both involving specification error (Leamer). The theory section discussed two schools of thought, monetarist and keynesian. Strictly following either of these schools would lead to zero-one restrictions on the reduced form of the system estimated. Such restrictions would impose additional information on the estimated model. Generally, imposing theory on an estimation procedure is advantageous; especially, as is the case in most microeconomic applications, where the economic theory is well accepted. Unfortunately, the two opposing schools indicate basic disagreements exist in macroeconomic theory. Compounding the specification error in the contemporaneous, or static theory is the lack of dynamic theory. The expectations, or learning process, is generally assumed to be rational, but the use of past variables in projecting current variables and the current decisions leave the theoretical dynamic system incompletely defined (Sims).

As a result of this specification problem the current method of choice in empirical macroeconomic research has become vector autoregression. Vector autoregression models a vector of macroeconomic variables as a function of lagged values of those variables. The modeling technique imposes only the most general theoretical restriction on the economic process that the macroeconomic variables are related.

Bayesian Vector Autoregression

Bayesian vector autoregression is a technique used to estimate a autoregressive process using a general prior. The Bayesian vector autoregression allows the researcher to impose restrictions that are less stringent than the restrictions imposed by structural models. Bayesian vector autoregression is achieving acceptance in macroeconomic literature especially in forecasting (Litterman (1984, 1986), and Todd). These studies find improvement in predictive power of the time series representation by using priors. Litterman and Wiess recently used a Bayesian vector autoregression to study the relationship between money and income in post war data. In agricultural economics literature, Bessler and Kling used Bayesian vector autoregression to improve the forecast of hog prices.

138

This study uses Bayesian vector autoregression to study the relationship between fiscal and monetary policy and real corn and soybean prices in much the same way Litterman and Wiess used the technique to study the relationship between money and income. First the study posits a system of theoretically related variables and the interactions between them. The time series representation is then estimated using a Litterman prior. After estimating the model the time series representation is compared with the theoretical responses to determine if the estimates are consistent with the theory.

Bayesian vector autoregression is based on the mixed estimation technique proposed by Thiel. Theil's mixed estimation technique use a prior distribution for the coefficients of the vector autoregression consisting of a vector of means and a matrix of tightness parameters. Each equation in the vector autoregression is assigned a vector of prior means for the estimated coefficients. The most commonly prior is a random walk. The random walk prior assigns a prior mean of one on the first lag of the dependent variable. All other variables in each equation are given a prior mean of zero. The matrix of tightness coefficients along with an overall tightness coefficient for the model and the decay or the pattern of the tightness coefficients for coefficients on lagged variables are used to specify the variance of the prior. With these priors, Thiel's mixed estimation technique can be used to estimate an autoregressive model of the relationships between the endogenous variables (Ford).

This study uses Bessler and Kling's approach of a nonsysmmetric or general prior. A general prior does not mean that a random walk prior is not used, but that the tightness parameters of the prior distribution around various coefficients are different. For example, the study specifies an extremely loose prior for the effects of macroeconomic variables on macroeconomic and microeconomic variables, and the effect of microeconomic on microeconomic variables. However, an extremely tight distribution is assumed for the effect of microeconomic variables on macroeconomic variables. Thus, less information is required to change the estimated coefficient from the prior for all but the effects of farm sector variables on macroeconomic variables. The tight prior for the effect of farm sector variables on macroeconomic variables reduces the probability that farm sector variables will significantly effect macroeconomic variables.

The equations estimated in this study are

$$\begin{bmatrix} SUR \\ MON \\ GNP \\ EXCH \\ CORN \\ BEAN \end{bmatrix}_t = \hat{\alpha} I_t + \sum_{i=1}^{n} \hat{\beta}_i \begin{bmatrix} SUR \\ MON \\ GNP \\ EXCH \\ CORN \\ BEAN \end{bmatrix}_{t-i}$$

where SUR is government surplus as a percentage of gross national product,[1] MON is the growth in money aggregates, GNP is the growth in real gross national product, EXCH is the real exchange rate, CORN is the real corn price, and BEAN is the real soybean price. The vectors of estimated coefficients in the n lag autoregressive model are $\hat{\alpha}$ and $\hat{\beta}$. $\hat{\alpha}$ is a vector of coefficients on the constant and three seasonality variables for each equation I_t. The matrix $\hat{\beta}_i$ gives the estimated effect of the ith lay on the current vector of endogeneous variables.

Interpreting the Results of the Vector Autoregression

Interpreting the results of a vector autoregression typically focuses on three aspects: statistical significance, economic significance, and historical significance. The statistical significance measures the statistical likelihood that the lagged coefficients on a given variable in a given equation equals zero. The standard test for the significance of the lagged observations in one variable in explaining the current value of an endogenous variable is called Granger causality. Granger causality is a purely statistical concept and does not imply causality in the economic sense.

Unfortunately the reduced form estimation of the autoregressive model can lead to some difficulties with the Granger causality approach. For example in the current study, the real exchange rate in the Keynesian model could be affected by expansionist fiscal policy through an increased import demand, and an increased capital flow. These two results push the real exchange rate in opposite directions. It is, therefore, possible that government deficits would be statistically as well as economically insignificant in causing the real exchange rate in the reduced form, but economically significant in explaining real exchange rates in a structural sense.

---

[1]The government surplus variable is the negative of government deficits. An increase in the level of government surplus is equivalent to a decrease in the deficit.

To answer the question of economic significance, this study uses the impulse response function. The impulse response function gives the effect over time on one endogenous variable to a shock or innovation to another endogenous variable. Thus, it shows the direction and amount of response. The impulse response functions are similar to dynamic multipliers (Brorsen, Chavas, and Grant). They describe the magnitude of response of a variable of interest to a change in another variable (or itself).

The impulse response functions raise the question of contemporaneous structure in the time series representation. In estimating the time series representation, vector autoregression makes no adjustments for contemporaneous relationships between variables. When examining the impulse response functions, the contemporaneous correlations are included by using the Cholesky decomposition of the variance-covariance matrix of the residuals as the initial shock for the moving average representation (Bessler). The use of the Cholesky decomposition to model contemporaneous relationships imposes very specific assumptions on the contemporaneous relationships between endogenous variables. Thus, the variables should be ordered with the most exogenous variable first and the most endogenous variable last to avoid misrepresentations in the impulse response functions.

Lastly, the study examines the historical significance of macroeconomic factors in explaining real corn and soybean prices in the 1980s. To examine the historical significance of macroeconomic factors in determining real corn and soybean prices, this study uses historical decomposition of forecast error (Burbridge and Harrison, and Featherstone and Baker). Historical decomposition of forecast error is basically a counter factual simulation technique that determines the change in forecast error attributable to information on each endogenous variable (Doan and Litterman). First, the value for real corn prices are simulated for some historical period given only the initial conditions. For example, the price of corn is forecast for 1980 to 1987 given only information for 1970 to 1980. Next, real corn prices are simulated from 1980 to 1987 with the information on real government surplus for the period 1980 to 1987. The change in forecast error is then the effect of real government surplus on real corn prices.

In addition to the standard historical decomposition of forecast error, this study also considers the effect of the change in economic environment in October 1979, identified by Huzinga and Mishkin. Huzinga and Mishkin found that the economic process generating the real interest rate changed in October 1979. This study will, therefore, test for a significant shift in the process relating monetary and fiscal policies with real corn and soybean prices on October 1979. If a significant change in the process has occurred, the study will examine the economic effect of this change on real corn and soybean prices by looking at the change in forecast error between the two sets of coefficients.

Data

The government surplus and growth in real gross national product used in this study are based on seasonally adjusted annual data from the U.S. Department of Commerce. The government surplus variable is derived by dividing the federal government's revenues less expenditures by the gross national product. The growth in real gross national product is computed by differencing the logarithm of the gross national product minus inflation calculated using the personnel consumption expenditures component of the Implicit GNP deflator (PCE).

The growth in money supply is the differences in the logarithms of money aggregates (Federal Reserve Bank of St. Louis). Money aggregates are money in circulation adjusted for reserve requirements.

Agricultural data is from the USDA. The real corn and soybean prices are from the USDA's Crop Reporting Board corn and soybean prices from Indiana adjusted by the PCE. The real exchange rate is the real agricultural trade weighted exchange rate from the Agriculture and Trade Analysis Division of the USDA Economic Research Service.

Results

This section presents the results beginning with general tests on the model. Next, the impulse response functions are examined. And finally, the study presents the historical decomposition of forecast error depictiny the actual effects of various factors on agricultural variables for the October 1979 to January 1987 period.

The first question is whether macroeconomic variables effect real agricultural prices. A log-likelihood test indicates that government surplus, money supply and real gross national product taken as a group are statistically significant in explaining real corn and soybean prices at the 1 percent level of significance over the April 1970 to January 1987 period. The results also indicate that the same group of macroeconomic variables are statistically significant in explaining real corn and soybean prices for October 1979 to January 1987 subperiod.

The sample contains two separate policy environments. The hypothesis that the economic structure is the same in the post October 1979 environment as in the average April 1971 to January 1987 period is rejected at the 1 percent confidence level. Therefore, there are two statistically different relationships between the system of variables in the April 1970 to January 1987 period.

Table 1 gives the Granger causality results for the post October 1979 environment. These results show that individual macroeconomic factors are statistically significant in explaining a specific agricultural variable in two instances. Government surplus is significant in explaining the real agricultural exchange rate at the 1 percent confidence level, and the growth in money supply is significant in explaining the real corn prices at the 5 percent level of significance.

Impulse Response Functions

Exchange Rates

Figure 1 panel A shows that the real exchange rate decreases significantly due to a reduction in the deficit. The real agricultural trade weighted exchange rate index decreases 7.19 percent in 22 quarters after the .7 billion dollar reduction in the federal budget deficit. This would decrease the price of U.S. agricultural products 7.19 percent in foreign markets. For example, the real soybean price in the second quarter 1987 was $4.96/bu. The 7.19 percent reduction in real exchange rate means that the real soybean price has declined by 36 /bu. abroad. The decline in the real exchange rate with a tighting of fiscal policy is consistent with the monetarist model.

An innovation, the exogeneous shock at time zero, in the growth rate for money supply has little effect on the real agricultural trade weighted exchange rate (Figure 1 Panel B). The lack of response in the real exchange rate to money supply is consistent with the monetarist proposition that money has no real effects. This result is also consistent with the findings of Branson, who found that monetary policy was ineffective in addressing real exchange rate imbalances. Branson argues that money does not alter the arbitrage opportunities in the financial markets.

Figure 1 panel C depicts the response of the real agricultural trade weighted exchange rate to an innovation in growth in real gross national product. Before October 1979, an increase in the growth rate of real gross national product had little effect on the real agricultural trade weighted exchange rate. After October 1979, however, an increase in the growth rate for real gross national product causes little change in the real exchange rate in the short run, but a declining real exchange rate in the longer run.

An increase in real corn prices in the current macroeconomic environment causes the real agricultural trade weighted exchange rate to be higher through time. One possible explanation is that an increased real corn price increases the balance of payments because the import demand is relatively inelastic. An inelastic demand curve implies that as price increases, total revenue to the suppliers increase. An increased total revenue from exports

would reduce the current account and the balance of payments.

Corn Price

     In the second macroeconomic environment a .6 million dollar
reduction in the federal budget deficit causes a maximum decline
of $.27/bu. in the real corn price in seventeen quarters.   Corn
prices in the first macroeconomic environment, on the other hand,
showed little response to a reduction in the deficit.

     In the post October 1979 environment, innovations in the
growth rate of money supply lead to an initial decrease in the
real corn price.   The contemporaneous relationship between the
growth in money supply and real corn prices is negative. After
that initial negative effect, however, an innovation in the
growth rate for money supply causes real corn prices to be
consistently higher through time. The initial negative effect of
money supply on the real corn price is probably a result of the
inflation induced by an innovation in the growth rate of money
supply. Because, in the short term nominal prices may be sticky,
an innovation in inflation could cause a decline in the real corn
price.   The longer run result is consistent with the results of
Rausser et al. who found that a looser money scenario would
result in higher real corn and soybean prices.   However, the
result is inconsistent with literature because the higher real
corn price are not the result of significant decline in the real
exchange rate.

     A 1 percent increase in the real agricultural trade weighted
exchange rate causes a 2.6 /bu. decline in real corn prices in
the same period, and a 7.6 /bu. decline in real corn prices after
twenty quarters (figure 2 panel D).   This decline in real corn
prices attributed to the increase in the real agricultural trade
weighted exchange rate is consistent with theory. An increase in
the real exchange rate increases the cost of corn to importing
countries.   The increased price in the country reduces the demand
for United States causing the real prices of corn in the United
States to decline.   The magnitude and statistical insignificance
of the response is not surprising.   Bessler and Babulu notes that
exchange rates are statistically insignificant in predicting
wheat prices.

     Once an innovation or shock to real corn price occurs,
change in real corn prices persists for a number of periods
(figure 2 panel E). The response function of the real corn price
to real corn price shows a high, almost constant response of real
corn prices to past innovations.   This response of real corn
prices in the current macroeconomic environment contradicts the
impulse response function in the before October 1979 where a
positive innovation in real corn prices decays rapidly toward
zero. The difference in the two response functions may be linked
to the significance of government programs in determining real
corn prices in the 1980s.

The impulse response function in figure 2 panel F show that real corn prices are not significantly effected by real soybean prices in the 1980s. The shape of the response function is similar to the response of real corn prices to real soybean prices in before October 1979, however, the amplitude of the response function is dampened in the second environment. Again, the decreased responsiveness of real corn prices may be due to the increased importance of government farm programs in determining corn prices in the second macroeconomic environment. Because of the base acreage for corn price supports, the farmer may suffer a loss in transfer payments by switching between corn and soybeans as the market price dictates. Therefore, the farmer may maximize total profit including transfer payments by not reacting to changes in the corn/soybean price ratio in the market place.

Soybean Price

Figure 3 panel A indicates that a decrease in the federal budget deficit would result in lower real soybean prices through time. The response of real soybean prices resemble the response of real corn prices to a decline in the deficit. Both response functions are inconsistent with response of the real exchange rate to a decline in the federal budget deficit. If the real exchange rate declines as a result of a decreased federal budget deficit, then real corn and soybean prices should increase.

Figure 3 panel B indicates that a 1.26 percent increase in the growth of money supply causes the real soybean price to increase 9.5 /bu. after one year and 16.4 /bu. after six quarters. The reaction of soybeans to an increase in the money supply is consistent with the response of real soybean prices to an innovation in the real exchange rate in figure 3 panel D. Real soybean prices decrease 4.9 /bu. with a 1 percent increase in the real exchange rate. An increased money supply would increase the inflation rate in the United States which results in a decreased real exchange rate. Figure 3 panel E shows the same response in real soybean price to an innovation in real corn price as the response of real corn price to an innovation in real corn price. The explanation is again the interference of government programs with the market for agricultural products. An innovation in corn prices, especially a negative innovation, leads to a long term price change because of validation by government programs. As a result, farmers change their planting decisions which effects the supply of a close opportunity (soybeans).

Exchange Rate

Figure 4 panel A shows that the actual real exchange rate has been substantially lower in the 1980s than what would have been forecast based on information up to 1980. Panel B of figure 4 shows that much of the increase in real exchange rates can be explained by the change in macroeconomic and other correlated changes in environment. In July 1984, the real exchange rate was 32.79 percent higher than projected under the pre 1979 environment. The most significant macroeconomic change in this instance probably involves the increased budget deficit. In 1981 a large reduction in income tax passed congress reducing government tax revenues. Since the structural change in income taxes, the federal deficit has remained high. The monetarist model demonstrates how an increased budget deficit can increase the real interest rate without increasing real gross national product. As a result the balance of payments becomes positive as capital flows in to take advantage of the increase in the real interest rate. Thus the positive balance of payments causes the real exchange rate to increase.

The next most significant factor appears to be unexplained variations in the federal budget deficit. In the early 1980s the federal budget deficit was larger than would have been projected using the post October 1979 economic environment. This increased federal budget deficit caused an increase in the real exchange rate as seen from July 1980 to July 1981. From the fourth quarter 1981 until the third quarter of 1984, the federal budget deficit caused the real exchange rate to be smaller than projected using the current macroeconomic environment (figure 4 panel C). From the fourth quarter of 1984 to the first quarter of 1987, the unexplained deviations in the federal budget deficit have caused the real exchange rate to be slightly higher.

After accounting for innovations in the federal deficit, the additional information added by the errors in the growth in money supply, growth in real gross national product, and real corn and soybean prices, or own innovations have little effect on the real exchange rate (figure 4 panels D through G).

Corn Prices

Figure 5 panel A shows that real corn prices in the 1980s have been lower than real corn prices projected using pre October 1979 coefficients and July 1979 initial values. The forecast error is especially pronounced for the January 1982 to January 1987 period where real corn prices were as much as $2/bu. lower. Figure 5 panel B indicates that most of this deviation is due to the change in environment. The change in environment is especially significant in explaining the decrease in real corn prices from January 1982 to January 1987.

Figure 5 panel C indicates that information on the deficit also causes dramatic changes in real corn price in the past October 1979 period. From July 1981 until January 1983 the deficit caused real corn prices to be as much as $.50/bu. lower. This downturn coincides with the substantial increase in government deficits the United States experienced in the early 1980s. The conclusion of the deficit on real corn prices from July 1981 to January 1983 involves an increase in the real exchange rate through an increase in the real interest rate. This logic, however, is contradicted by the historical effect of the deficit on the real exchange rate shown in figure 4 panel C. The historical decomposition of forecast errors shows that the deficit caused only marginally lower real exchange rates for the period of low real corn prices.

An alternative explanation for the effect of the federal budget deficit on real corn prices in the July 1981 to January 1983 period involves the crisis in Lesser Developed Country (LDC) debt in the early 1980s. The ballooning federal budget deficit, by increasing the real interest rate, may have caused a reduction in the buying power of LDCs. This reduction in purchasing power would have then caused lower real corn prices in the United States.

Figure 5 panels D and E suggest that money supply and growth in real gross national product have had little net effect on real corn prices in the 1980s. Neither of these phenomenon are surprising given a monetarist view of the economy and microeconomic theory. Under the monetarist framework, an increase in money supply causes no real changes in the economy and hence no changes in real prices. The only possible role or effect of money would be to introduce slippage or risk through unanticipated inflation. Since inflation during the 1980s has been relatively low and stable, we would expect that inflation would have little effect on real corn prices.

The change in forecast produced by the addition of information on the real exchange rate depicted in figure 5 panel F shows little effect of real exchange rates on real corn prices. Several reasons could explain this result. The response of real corn prices to the real exchange rate is fairly low. Another possibility is that the government deficits, money supply, and growth in real gross national product explain a majority of the deviations in real exchange rates. As a result, little new information is added by the real exchange rate. Figure 4 panel H supports this position. After all factors have been accounted for, there is little variation left unexplained in the real exchange rate. Further figure 4 panels F and G indicate that little error in exchange rates can be attributed to information on real corn and soybean prices. Therefore, the macroeconomic variables do a good job explaining real exchange rates.

Farm sector variables explain relatively little effect on real corn prices in the 1980s. Figure 5 panel G shows that

information on real soybean prices causes little change in the forecast of real corn prices. In addition, own factors shown in figure 5 panel H have had a slight positive effect on real corn prices.

Soybean Prices

The results of the historical decomposition in forecast error of real soybean prices are very similar to the historical decomposition of real corn prices. Figure 6 panel A shows that real soybean prices in the 1980s have been much lower than predicted using the pre October 1979 coefficients and information available in July 1979. Figure 6 panel B indicates that most of this decline is due to a change in coefficients. In addition figure 6 panel C shows that information on the government deficit as a percent on gross national product caused lower real soybean prices from July 1981 until January 1983. This decline coincides with the substantial increase in the government budget deficit in the early 1980s and the emergence of the LDC debt crisis.

Conclusions

This study investigates monetary and fiscal policy in the 1980s through a time series representation. The time series representation is used to determine the statistical significance of macroeconomic factors in determining current real corn and soybean prices, look at the expected effect of monetary and fiscal policy on real corn and soybean prices, and decompose the changes in real corn and soybean prices and allocate this decomposition to the various macroeconomic and farm sector variables.

The study found that macroeconomic factors as a group were statistically significant in explaining current real corn and soybean prices in the 1980s. However, the only individually significant effect is the effect of growth in money supply on real corn prices.

The impulse response functions indicate that the real corn and soybean prices are most responsive to changes in the federal budget deficit. A reduction in the federal budget deficit causes lower real corn and soybean prices in the 1980s. In addition, a decline in the federal budget deficit over the same period caused a significant decline in the real agricultural trade weighted exchange rate. This result points to an inelastic export demand with respect to the real exchange rate.

The historical decomposition of forecast error indicates that most of the decline in real corn and soybean prices in the 1980s can be explained by the change in economic structure in the

late 1970s.   In addition, the historical decomposition of forecast error supports the significance of the federal deficit indicated by the impulse response functions.   The largest change in the forecast error for real corn and soybean prices after the change in environment is due to information on the federal deficit.

References

Bessler, David A.   "An Analysis of Dynamic Relationships: An Application to the U.S. Hog Market." <u>Canadian Journal of Agricultural Economics</u> 32(March 1984): 109-24.

Bessler, David A. and John L. Kling.   "Forecasting Vector Autoregressions with Bayesian Priors". <u>American Journal of Agricultural Economics</u> 68(1) (February 1986): 144-51.

Bessler, David A. and Ronald A. Babulu.   "Forecasting Wheat Exports: Do Exchange Rates Matter?" <u>Journal of Business and Economic Statistics</u> 5(July 1987): 397-406.

Branson, William H.   "The Limits of Monetary Coordination As Exchange Rate Policy."   <u>Brookings Papers on Economic Activity</u>, 1986:1, 175-94.

Brorsen, B. Wade, Jean-Paul Chavas and Warren R. Grant.   "A Dynamic Analysis of Prices in the U.S. Rice Marketing Channel." <u>Journal of Business and Economic Statistics</u> 3(4) (October 1985): 362-69.

Burbridge, John and Alan Harrison.   "Testing for the Effects Oil Price Rising Using Vector Autoregression."   <u>International Economic Review</u> 25(2) (June 1984): 459-84.

Doan, Thomas A. and Robert B. Litterman.   <u>RATS User's Manual</u> (Minneapolis, MN: VAR Econometrics, 1984).

Featherstone, Allen M. and Timothy G. Baker.   "An Examination of Farm Sector Real Asset Dynamics." <u>American Journal of Agricultural Economics</u> 69(3) (August 1987): 532-46.

Federal Reserve Bank of St. Louis, Unpublished Data on Adjusted Monetary Base.

Ford, Steve.   "A Beginner's Guide to Vector Autoregression," Staff Paper P86-28, Department of Agricultural and Applied Economics, University of Minnesota, September 1986.

Hunzinga, John and Frederick S. Mishkin.   "Monetary Policy Shifts and Unusual Behavior of the Real Interest Rates." <u>Carnegie-Rochester Conference Series on Public Policy</u> 24(1986): 231-47.

Leamer, Edward E.   <u>Specification Searches: Ad Hoc Inference with Nonexperimental Data</u> (New York: John Wiley & Sons, 1978).

Litterman, Robert.   "Forecasting and Policy Analysis with Bayesian Vector Autoregression Models." <u>Quarterly Review</u> Federal Reserve Bank of Minneapolis, Fall 1984.

Litterman, Robert. "Forecasting with Bayesian Vector Autoregression - Five Years of Experience," _Journal of Business and Economic Statistics_, January 1986.

Litterman, Robert B. and Laurence Weiss. "Money, Real Interest Rates, and Output: A Reinterpretation of Postwar U.S. Data." _Econometrica_ 53(1) (January 1985): 129-56.

Melichar, E. _Agricultural Finance Databook_ Board of Governors of the Federal Reserve System, Washington, DC, June 1987.

Rausser, Gordon C., James A. Chalfant, H. Alan Love, and Kostus G. Stamoulis. "Macroeconomic Linkages, Taxes, and Subsidies in the U.S. Agricultural Sector." _American Journal of Agricultural Economics_ 68(2) (May 1986): 399-412.

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

Schuh, Edward G. "The New Macroeconomics of Agriculture." _American Journal of Agricultural Economics_ 58(5) (Dec. 1976): 802-11.

Sims, Christopher A. "Macroeconomics and Reality." _Econometrica_ 48(1) (Jan. 1980): 1-48.

Todd, Richard M. "Improving Economic Forecast with Bayesian Vector Autoregression," _Quarterly Review_ Federal Reserve Bank of Minneapolis, Fall 1984.

Tweeten, Luther G. _Foundations of Farm Policy_ Second edition (Lincoln, Nebraska: University of Nebraska Press, 1979).

United States Department of Agriculture, Economic Research Service, Demand and Trade Section, Agricultural Indicators Branch, Agriculture and Trade Division.

United States Department of Commerce, Bureau of Economic Analysis _Business Statistics_ 1984 24th ed.

United States Department of Agriculture, Crop Reporting Board, Statistical Reporting Service _Agricultural Prices_ Various Issues 1953-1987.

United States Department of Commerce, Bureau of Economic Analysis _Survey of Current Business_ Various Issues 1986-1987.

Table 1: Significance of Lagged Coefficients in Regression Equations

Dependent Variables	Independent Variables					
	Government Surplus	Growth in Money Supply	Growth in Real Gross National Product	Real Trade Weighted Exchange Rate	Real Corn Price	Real Soybean Price
Government Surplus	1					
Growth in Money Supply						
Growth in Real Gross National Product						
Real Trade Weighted Exchange Rate	1			1		
Real Corn Price		5			1	
Real Soybean Price						1

1 denotes statistical significance at the 1% level of confidence.
5 denotes statistical significance at the 5% level of confidence.

Table 2: Variance Matrix of Residuals from Vector Autoregression and Its Cholesky Decomposition

Variance Matrix

Dependent Variables	Government Surplus	Growth in Money Supply	Growth in Real Gross National Product	Real Trade Weighted Exchange Rate	Real Corn Price	Real Soybean Price
Government Surplus	.000028					
Growth in Money Supply	-.000002	.000058				
Growth in Real Gross National Product	-.000029	.000065	.000717			
Real Trade Weighted Exchange Rate	.001105	-.001167	-.006814	.728300		
Real Corn Price	.000287	-.000047	-.000067	.096801	.081042	
Real Soybean Price	.000554	.000805	-.001130	.216460	.185650	.807630

Cholesky Decomposition

Dependent Variables	Government Surplus	Growth in Money Supply	Growth in Real Gross National Product	Real Trade Weighted Exchange Rate	Real Corn Price	Real Soybean Price
Government Surplus	.005287					
Growth in Money Supply	-.000335	.007576				
Growth in Real Gross National Product	-.005426	.008295	.024881			
Real Trade Weighted Exchange Rate	.208903	-.144841	-.179998	.794532		
Real Corn Price	.054322	-.003763	.010395	.109220	.256901	
Real Soybean Price	.104824	.110956	-.059507	.251627	.597350	.600534
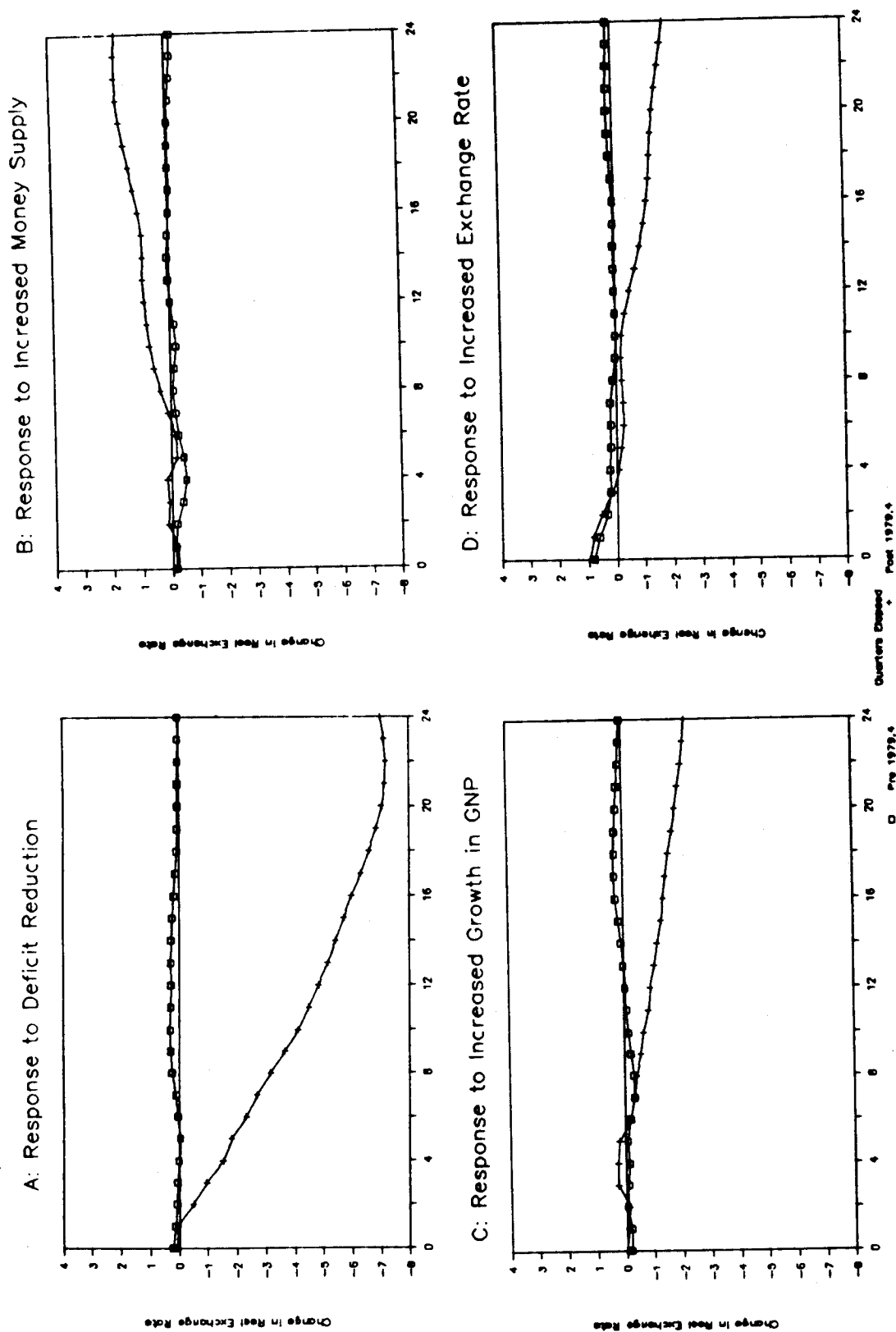
Figure 1. Response of Real Exchange Rates to an Impulse Shock in Endogeneous Variables.

Figure 1 (continued)

E: Response to Increased Corn Price

F: Response to Increased Soybean Price

155
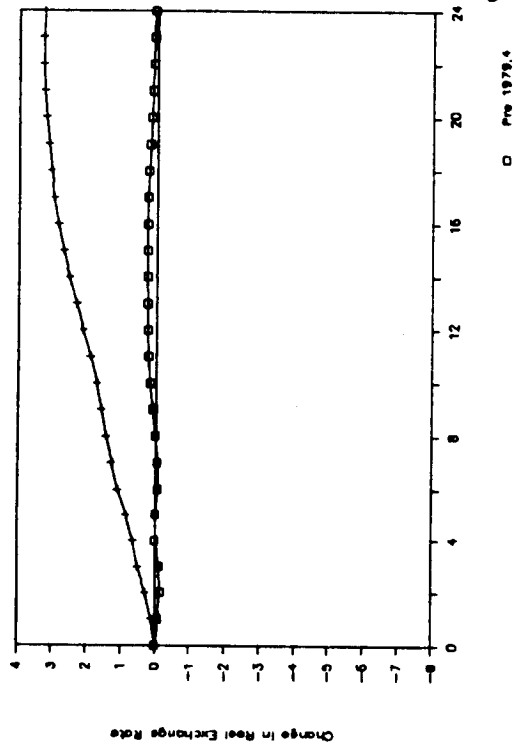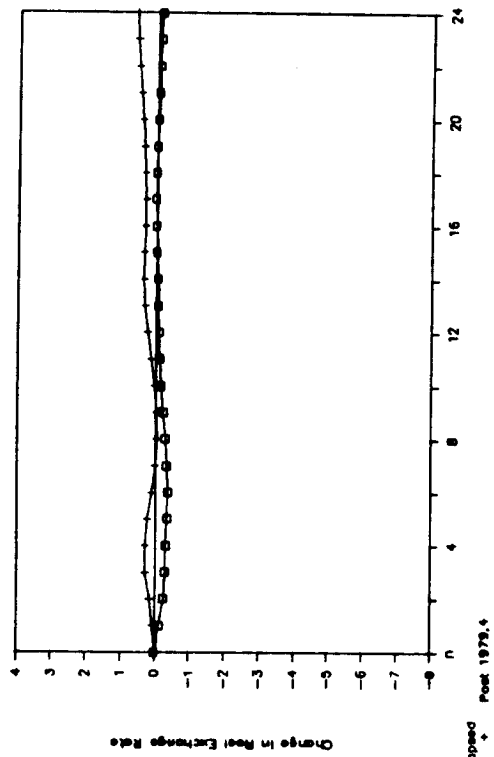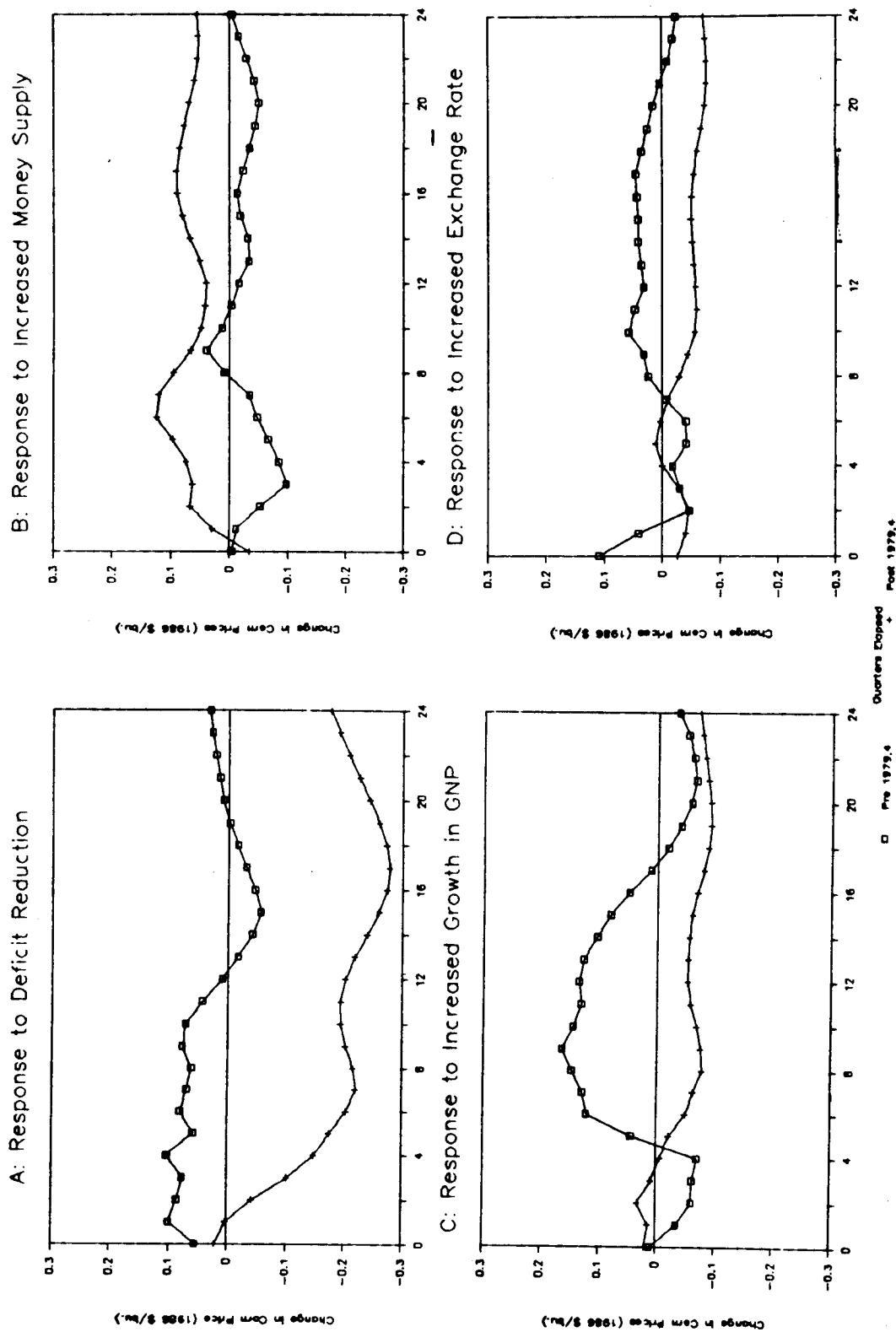
Figure 2. Response of Real Corn Price to an Impulse Shock in Endogeneous Variables.

156

Figure 2 (continued)

E: Response to Increased Corn Price

F: Response to Increased Soybean Price

157
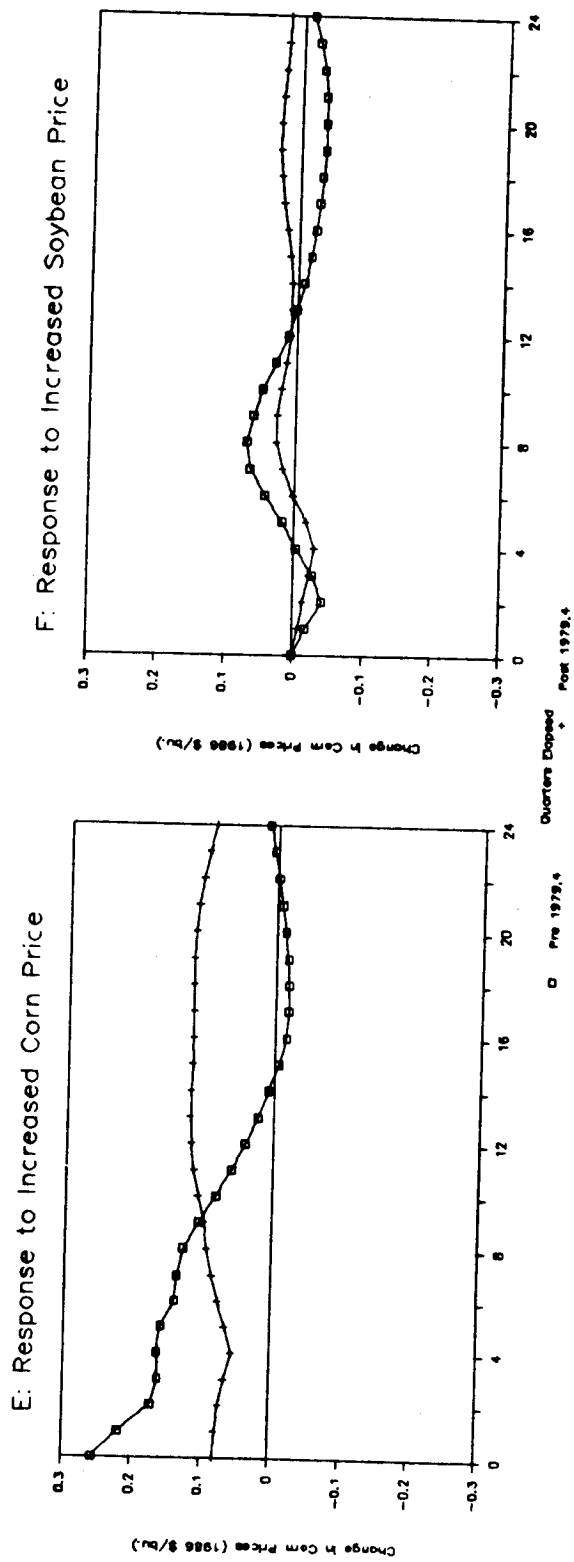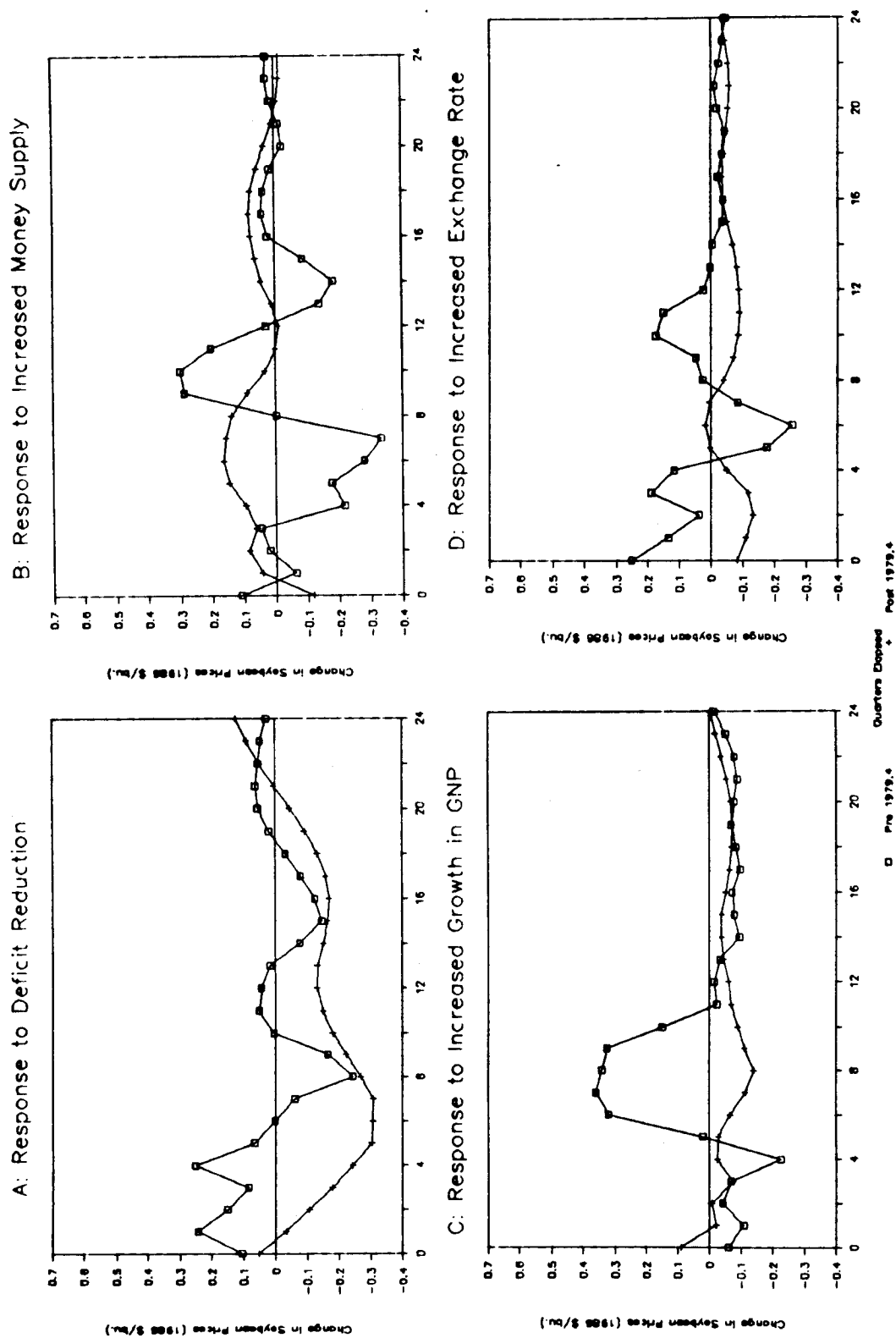
Figure 3. Response of Real Soybean Price to an Impulse Shock in Endogeneous Variables

Figure 3 (continued)

E: Response to Increased Corn Price

F: Response to Increased Soybean Price

159
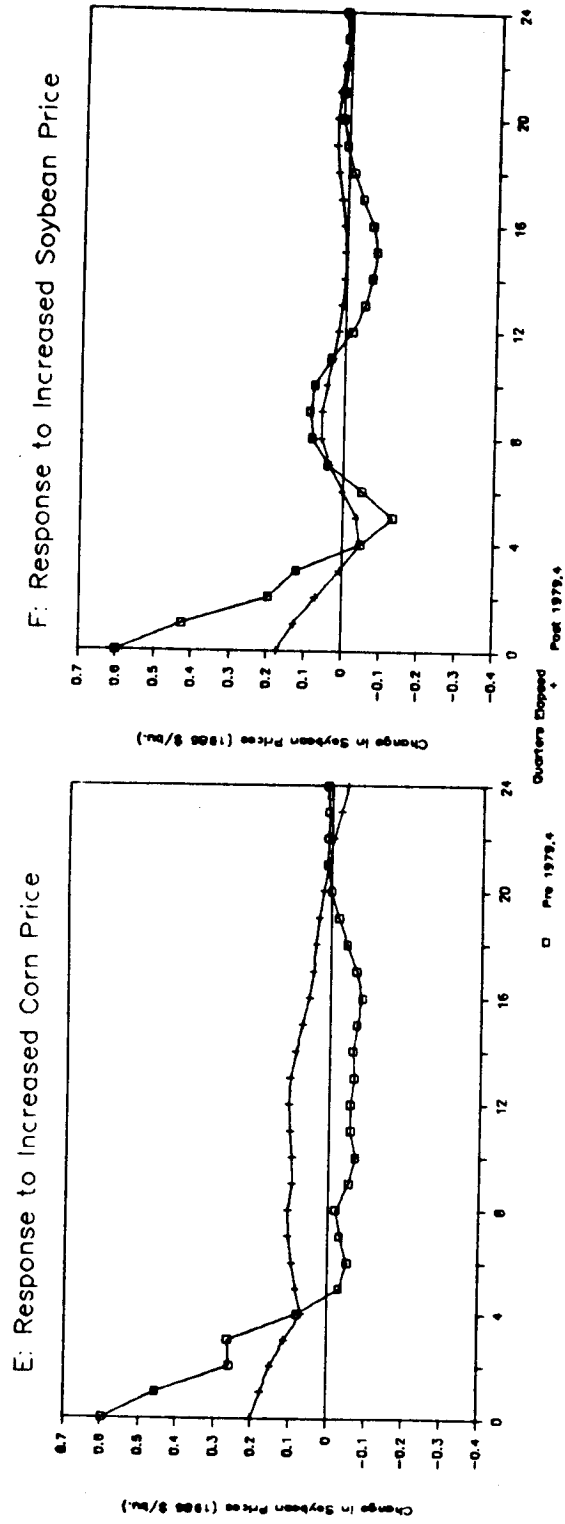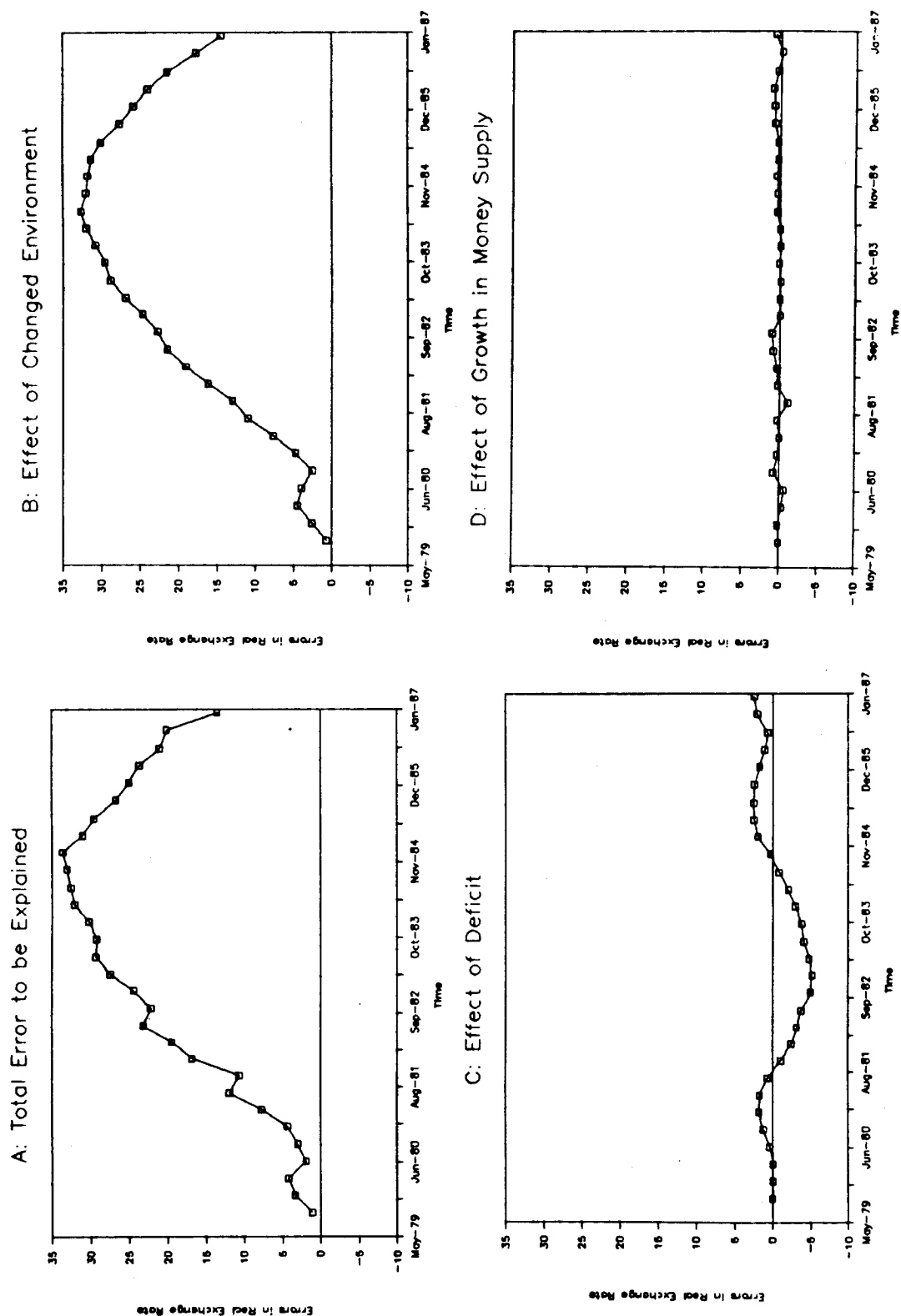
Figure 4. Historical Decomposition of Forecast Error for the Real Exchange Rate

Figure 4 (continued)

E: Effect of Growth in GNP
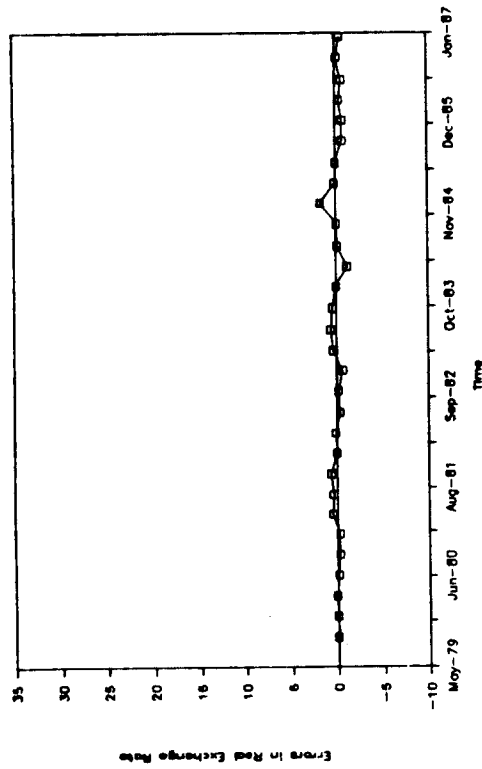
F: Effect of Real Corn Prices

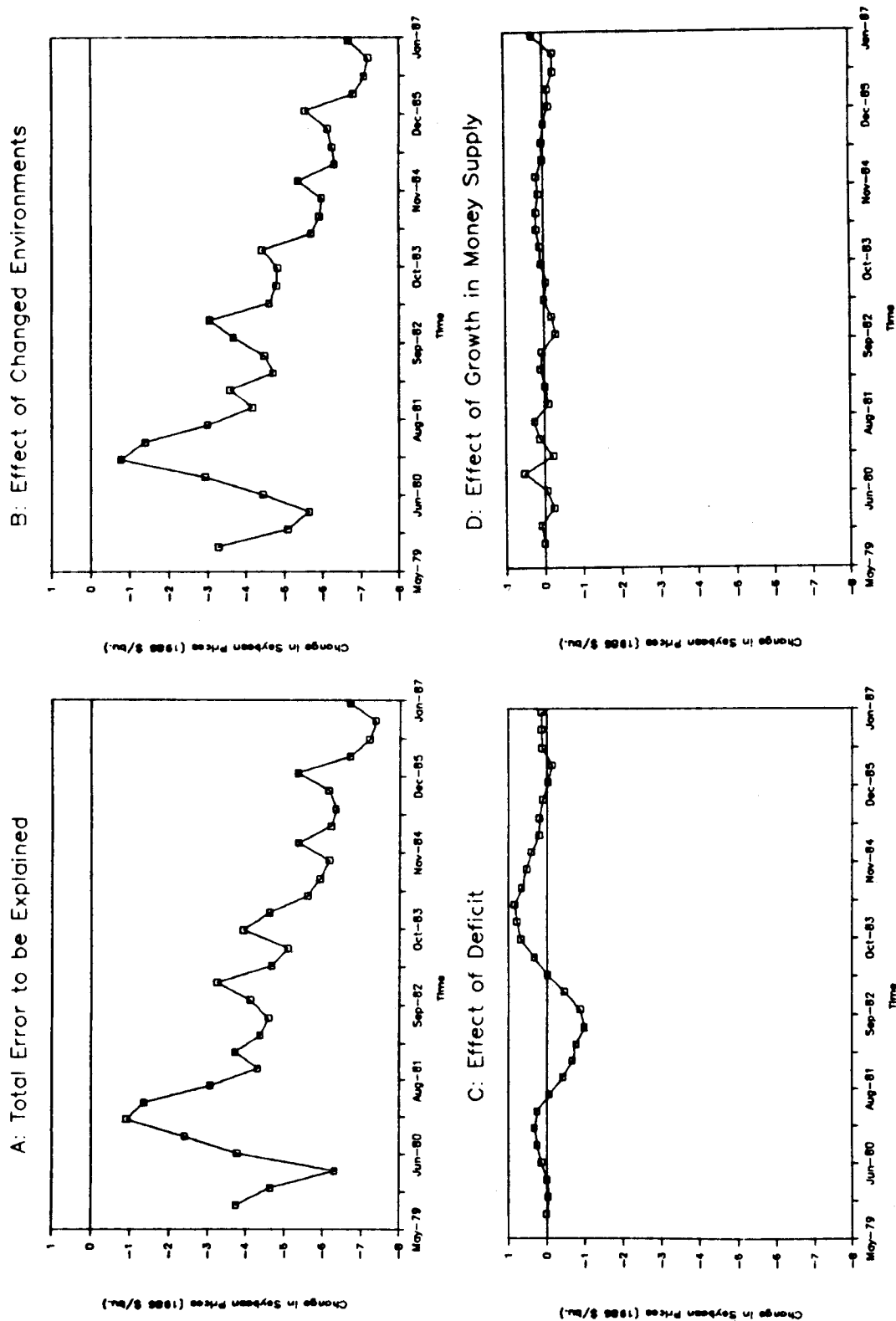G: Effect of Real Soybean Prices

H: Effect of Other Factors

161
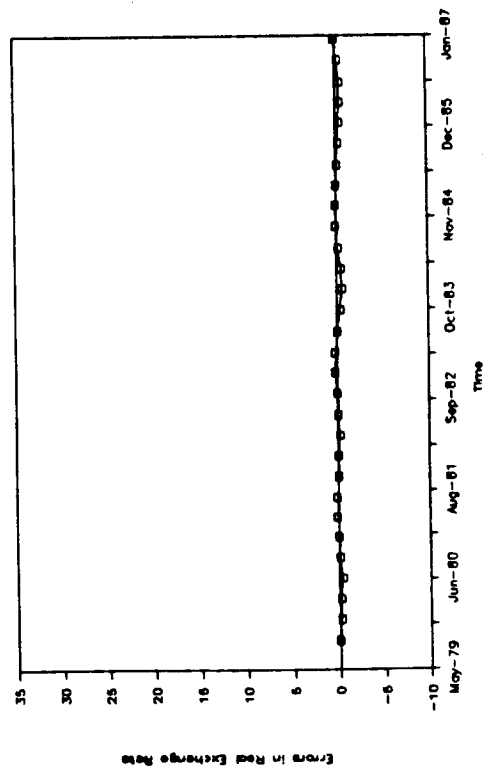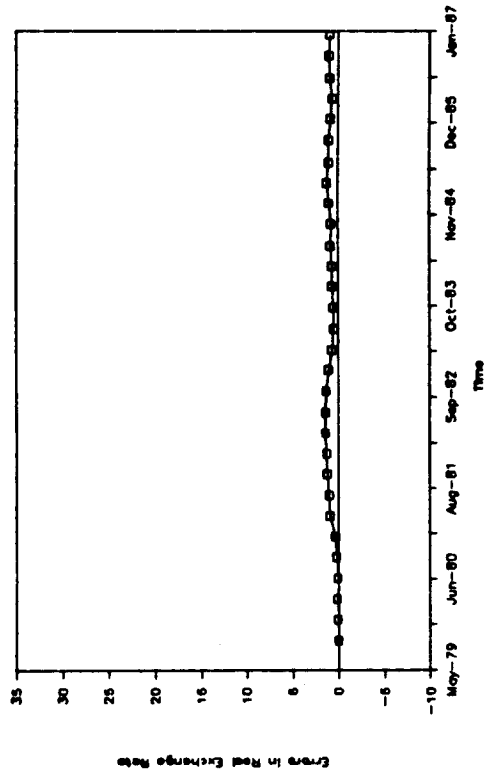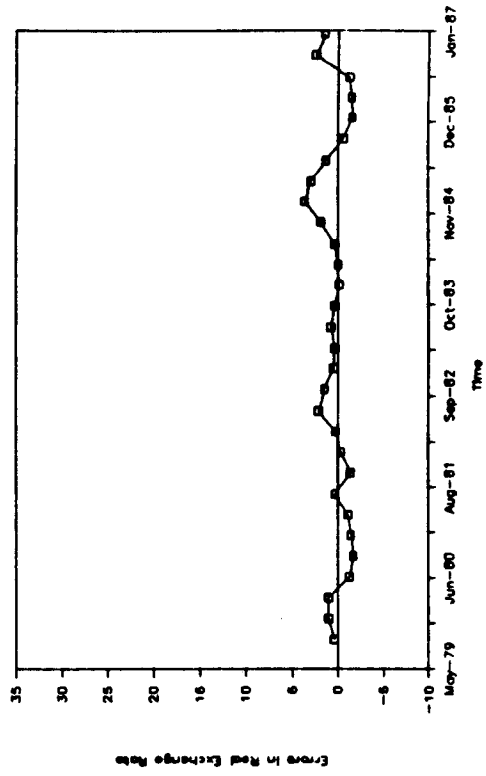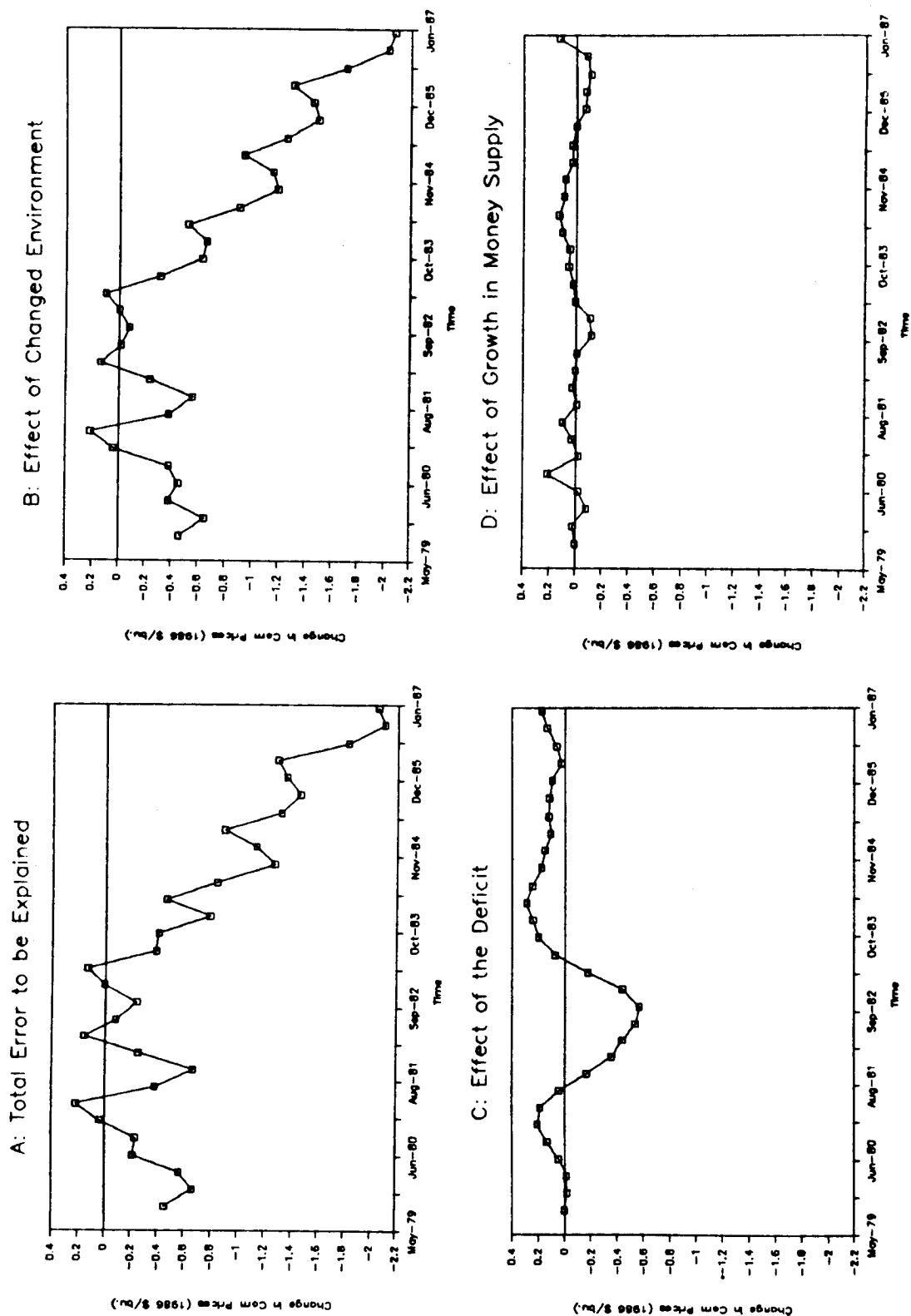
Figure 5. Historical Decomposition of Forecast Error for Real Corn Price

Figure 5 (continued)

E: Effect of Growth in GNP
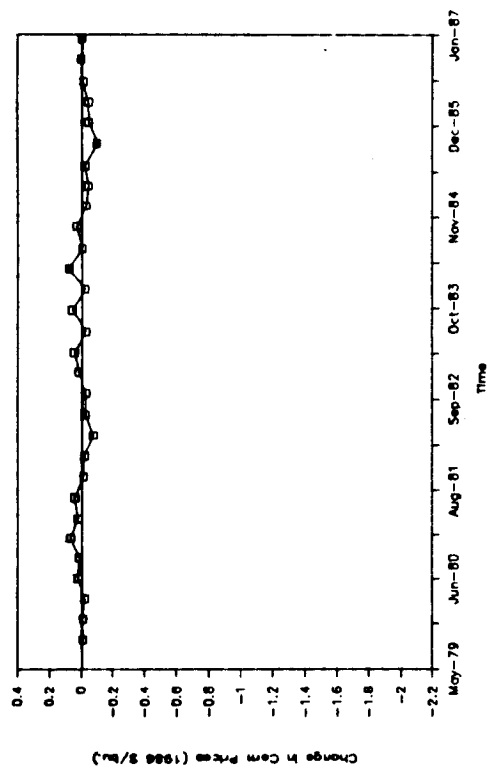
F: Effect of Real Exchange Rate

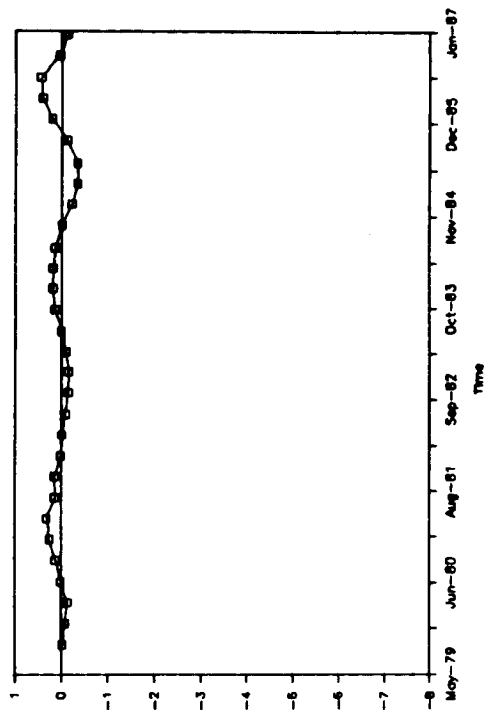G: Effect of Real Soybean Prices

H: Effect of Other Factors

163
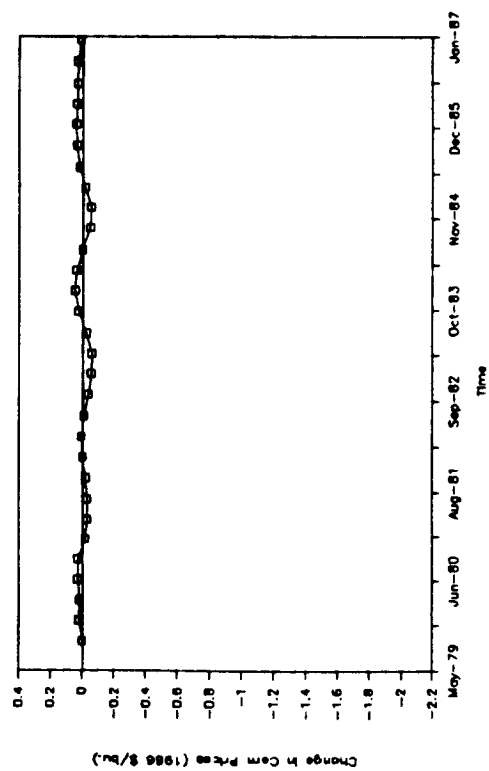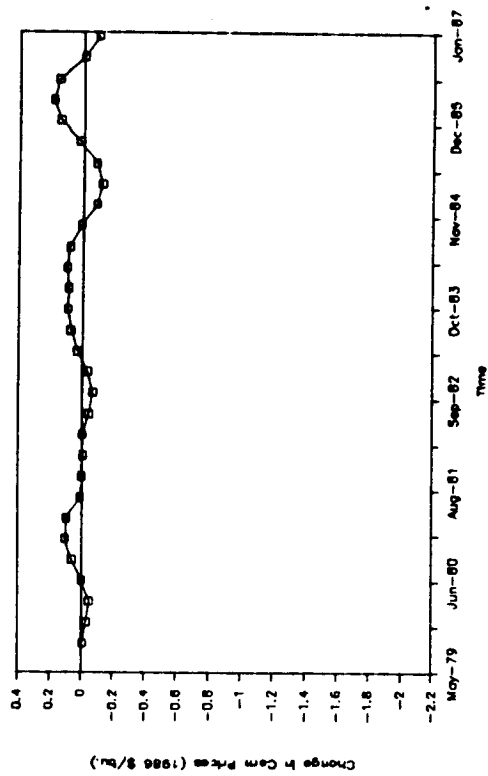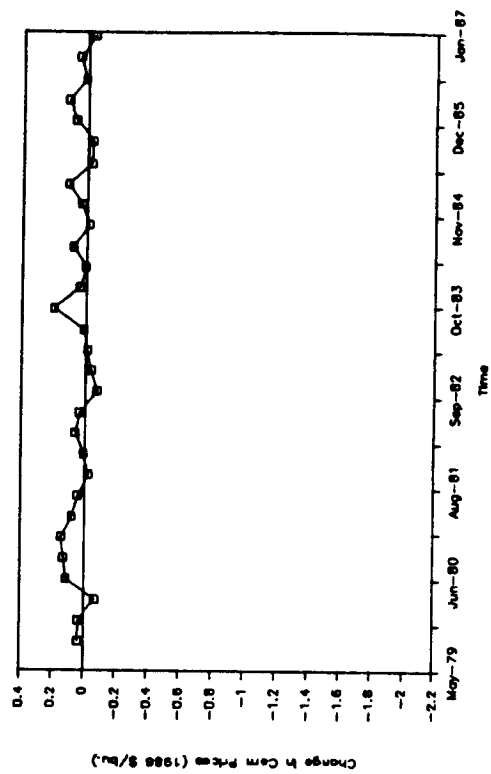
Figure 6. Historical Decomposition of Forecast Error for Real Soybean Price
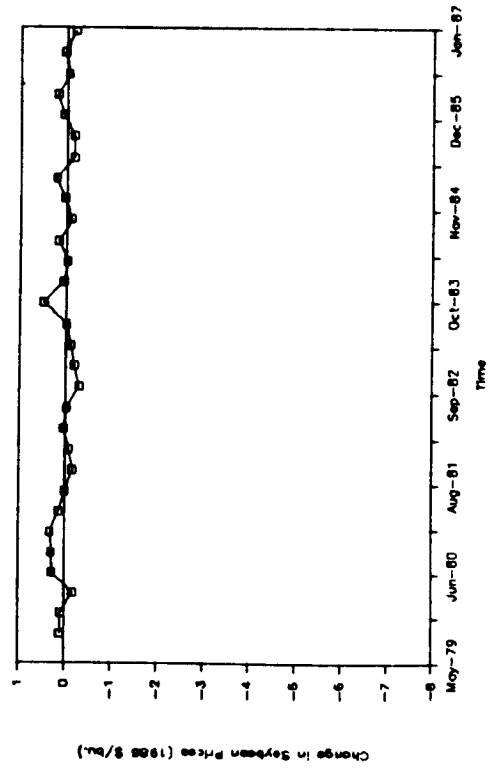
Figure 6 (continued)

E: Effect of Growth in GNP
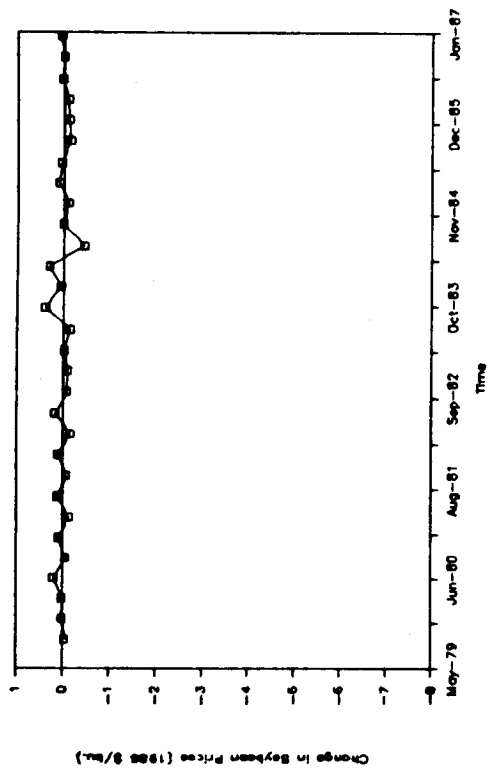
F: Effect of Real Exchange Rate

G: Effect of Real Corn Price

H: Effect of Other Factors