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Macroeconomic Policies and Their Impact Upon the Farm Sector

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The macroeconomic policies — fiscal and monetary — which the Federal government has pursued during the post-WWII period have been principally of the activist demand-management type. The government has attempted to affect, if not control, the rate of growth of aggregate demand or total spending for the output of the economy. For example, we have had numerous tax cuts. All but the one enacted in 1981 were for the expressed purpose of stimulating the growth of aggregate demand. We have also experienced several tax increases for the purpose of slowing the growth of spending. Similarly, monetary policy has been eased at times to increase demand and tightened at other times to rein in demand.

Of course, affecting the growth rate of aggregate demand has not been the ultimate goal of macroeconomic policies. It has been only a means. The ultimate goal has been to get (and keep) the economy moving along a growth path upon which resource utilization rates (e.g., employment rates) are high and yet the rate of inflation is held in check.

Clearly, the ultimate goal of macroeconomic policy activism was not achieved. On the other hand, the performance of the U.S. economy in the post-war period has not been bad. In fact, it looks very good, in most respects, when compared to the performance of the economy during periods of similar length during the years before WWII. One of the most notable achievements of the post-war economy — due to or in spite of policy activism, depending upon whose arguments you accept — has been the moderation of business cycle contractions. We experienced seven such contractions between 1947 and 1980, and all, save the contraction of 1973-75, have to be

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classified as mild if not very mild. Whether the contraction of 1973-75 should be classified as severe or mild is debatable.

The business cycle contractions of the post-war economy have been so mild that many economists are inclined to argue that short-run macroeconomic developments — including short-run macroeconomic policy actions — have had little impact upon the farm sector in the post-war period.

However, this argument or impression is not borne out by empirical analysis. That is the subject of this paper.

A Comparison of the Performances of the Farm and Nonfarm Sectors

I begin with a comparison of certain aspects of the performances of the farm and nonfarm sectors of the U.S. economy since the late 1940s.

As my basic measure of the performance of the farm sector, I have elected to employ the farm sector's contribution to U.S. GNP — henceforth referred to as farm output. This is the gross value added (i.e., gross of capital consumption) of the sector. From the output point of view, it is equal to the value of farm products less the value of currently used, non-capital goods purchased from abroad and from the nonfarm business sector.^{1/} From the point of view of the flow of income receipts, farm output is equal to the sum of the farm sector's:

compensation of employees

proprietors' income (with inventory valuation adjustment)

corporate profits (with inventory valuation adjustment)

net interest payments

indirect business taxes

business transfer payments

capital consumption allowances

less government subsidies to the farm sector.

For my basic measure of the performance of the nonfarm sector, I use the nonfarm business sector's contribution to U.S. GNP. Similar to that of the farm sector, it measures the gross value added of the nonfarm business sector. It is also equal to total factor payments of the nonfarm business sector plus the sum of its:

- indirect business taxes
- business transfer payments
- capital consumption allowances
- surplus of government enterprises

less government subsidies.

More than 80 percent of U.S. GNP is produced in the nonfarm business sector. In contrast, the farm sector's contribution has been only about 3 percent in recent years (although it was in the neighborhood of 7 percent of GNP as recently as the late 1940s). Other sectors in which GNP originates are the government, households-and-institutions, and rest-of-the-world sectors.

There are enormous difficulties connected with efforts to break down changes in the nominal outputs of the government, households-and-institutions, and rest-of-the-world sectors into changes in real outputs and mere changes in price levels. Consequently, the Bureau of Economic Analysis (U.S. Department of Commerce) employs only the most elementary techniques in making such breakdowns for these three sectors. This is the primary reason that I chose to use the nonfarm business sector to represent the nonfarm economy in my analysis, for I make extensive use of breakdowns of nominal output changes into changes in real outputs and changes in price levels.

Figure 1 presents plots of annual percentage changes in the nominal or current-dollar outputs of the farm and nonfarm business sectors.^{2/} It is

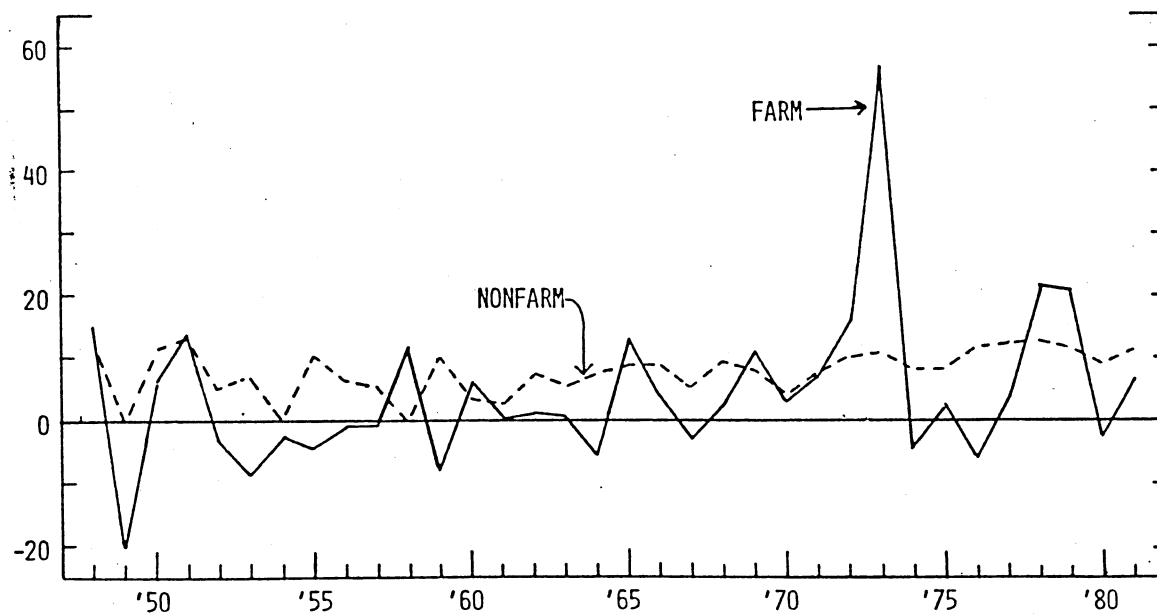


FIGURE 1. ANNUAL PERCENTAGE CHANGES IN NOMINAL OUTPUT

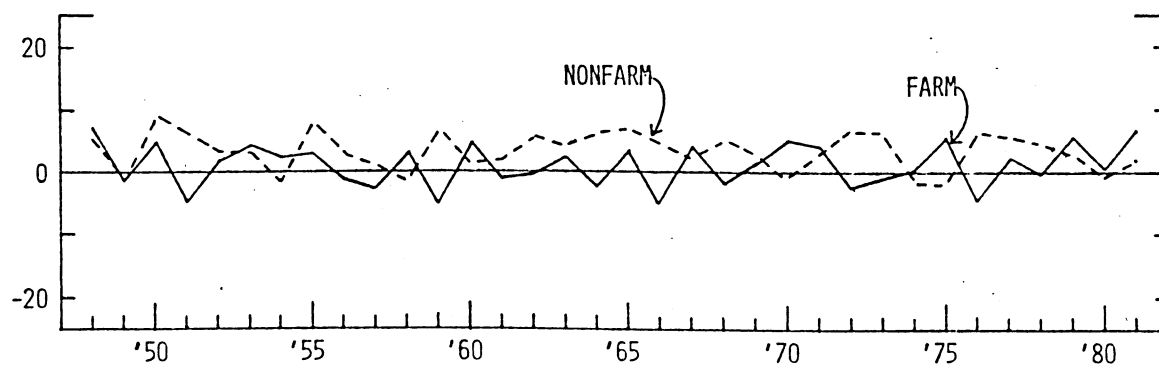


FIGURE 2. ANNUAL PERCENTAGE CHANGES IN REAL OUTPUT

readily apparent that there is much greater year-to-year variability in the nominal output of the farm sector than of the nonfarm sector. For a quantification of this impression, the standard deviation (about the mean) of nominal farm output changes is 12.8 percent (9.1 percent with 1973 removed) for the 1948-81 period, 8.9 percent for 1948-64, and 14.8 percent (8.6 percent with 1973 removed) for 1965-81. On the other hand, the standard deviations of annual percentage changes in nonfarm output for these same three periods are 3.8 percent, 4.4 percent, and 2.4 percent, respectively.

Figure 2 shows plots of annual percentage changes in constant-dollar (1972 dollars) or real outputs of the farm and nonfarm sectors. Here it is not visually obvious whether the farm or nonfarm sector is the more variable. But, in fact, the farm sector is slightly more variable. Its standard deviations are 3.7 percent for 1948-81, 3.7 percent for 1948-64, and 3.8 percent for 1965-81. For the same time periods, the standard deviations of the nonfarm sector are 3.2 percent, 3.4 percent, and 3.0 percent, respectively.

From the data plotted in Figure 2, I also computed average annual rates of increase in the real outputs of the two sectors. For the farm sector, the average rate of increase in real output is 1.4 percent per year during 1948-81, 1.1 percent per year during 1948-64, and 1.7 percent per year during 1965-81. For these same time periods, the average annual increase in real nonfarm output is 3.7 percent, 3.9 percent, and 3.5 percent, respectively. That the real output of the farm sector has grown less rapidly than that of the nonfarm sector is not surprising. We know that the income elasticity of the demand for farm products is much less than unity. And the nonfarm business sector is so large relative to the entire economy that its average growth rate is a very good proxy for the rate of growth of the real

gross output (income) of the economy. The fact that the real output of the farm sector grew more rapidly relative to that of the nonfarm sector during 1965-81 than during 1948-64 is undoubtedly due to the rapid growth in the export market for U.S. farm products during the 1970s.

A visual comparison of Figures 1 and 2 reveals something very interesting. The profile of changes in real nonfarm output closely resembles the profile of changes in nominal nonfarm output. However, this is not true for the farm sector. These visual impressions can be quantified by regressing annual percentage changes in real nonfarm output (RBO) on annual percentage changes in nominal nonfarm output (BO) and also regressing annual percentage changes in real farm output (RFO) on annual percentage changes in nominal farm output (FO). The results are as follows (these regression results should not be interpreted in the classic statistical manner since the left-hand variables are components of the right-hand variables):

For the years 1948-81:

$$RBO = -0.72 + 0.56 BO; R^2 = .45$$

$$RFO = 1.28 + 0.03 FO; R^2 = .01$$

For the years 1948-81 with 1973 removed:

$$RFO = 1.17 + 0.11 FO; R^2 = .07$$

For the years 1948-64:

$$RBO = -0.54 + 0.70 BO; R^2 = .83$$

$$RFO = 1.13 + 0.13 FO; R^2 = .10$$

For the years 1965-81:

$$RBO = -2.70 + 0.66 BO; R^2 = .27$$

$$RFO = 1.81 - 0.01 FO; R^2 = .00$$

For the years 1965-81 with 1973 removed:

$$RFO = 1.42 + 0.07 FO; R^2 = .02$$

Figure 3 shows plots of annual percentage changes in the implicit price deflators (price levels) for farm output and nonfarm output.^{3/} The most casual comparison of Figures 1 and 3 gives one the impression that there is a very strong relationship between changes in the farm output price level and changes in nominal farm output. On the other hand, the relationship between changes in the nonfarm output price level and changes in nominal nonfarm output appears to be much weaker. These visual impressions can be quantified by regressing annual percentage changes in the nonfarm output price level (PBO) on annual percentage changes in nominal nonfarm output (BO) and also regressing annual percentage changes in the farm output price level (PFO) on annual percentage changes in nominal farm output (FO).^{4/} The results are as follows (these regressions should not be interpreted in the classic statistical manner since, once again, the left-hand variables are components of the right-hand variables):

For the years 1948-81:

$$PBO = 0.81 + 0.41 BO; R^2 = .29$$

$$PFO = -1.26 + 0.97 FO; R^2 = .92$$

For the years 1948-81 with 1973 removed:

$$PFO = -1.13 + 0.89 FO; R^2 = .83$$

For the years 1948-64:

$$PBO = 0.59 + 0.27 BO; R^2 = .45$$

$$PFO = -1.12 + 0.86 FO; R^2 = .82$$

For the years 1965-81:

$$PBO = 2.99 + 0.29 BO; R^2 = .06$$

$$PFO = -1.78 + 1.02 FO; R^2 = .94$$

For the years 1965-81 with 1973 removed:

$$PFO = -1.31 + 0.92 FO; R^2 = .80$$

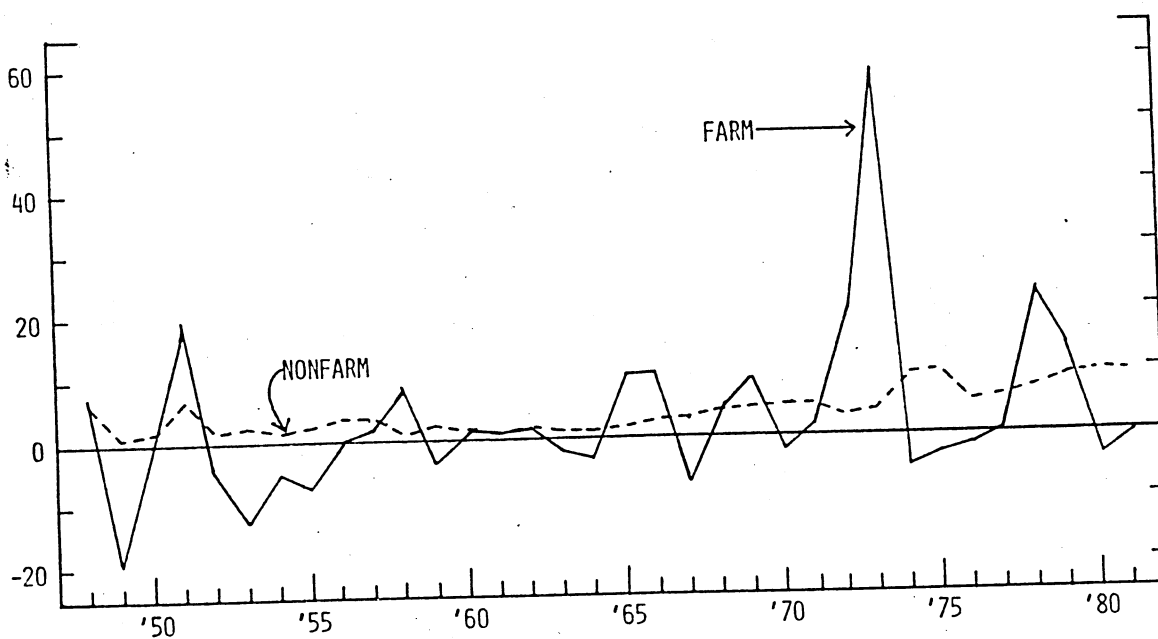


FIGURE 3. ANNUAL PERCENTAGE CHANGES IN THE OUTPUT PRICE LEVEL

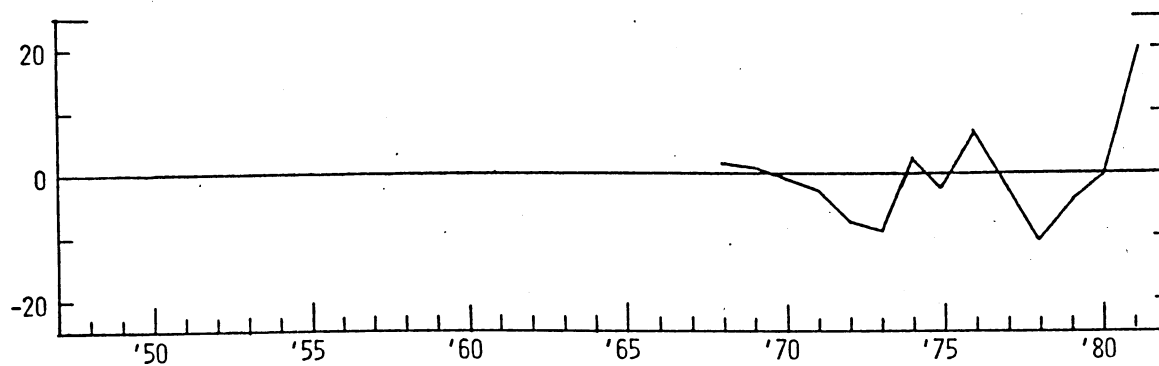


FIGURE 4. ANNUAL PERCENTAGE CHANGES IN EXCHANGE VALUE OF U.S. DOLLAR

What conclusions should we draw from these observations of the performances of the farm and nonfarm sectors of the U.S. economy during most of the post-WWII period? I think there are three which are particularly pertinent to this investigation:

- The nominal output of the farm sector has been much more variable than the nominal output of the nonfarm sector.
- Almost all of the year-to-year variability in nominal farm output has been due to changes in the farm output price level, rather than changes in real farm output.
- Much more than half of the year-to-year variability in nominal nonfarm output has been due (on the average) to changes in real nonfarm output, as opposed to changes in the nonfarm output price level.

These observational conclusions are consistent with what we know about the economics of production and marketing in the two sectors.

The production decision for most farm products is substantially made far in advance of the time the product is marketed. For any given farm product, there are many producers and many potential buyers. The output of different producers is homogeneous or easily gradable. Consequently, most farm products are sold on markets which closely approximate the competitive markets of microeconomic theory, and their prices often diverge significantly from their costs of production. A sudden and unforeseen increase (decrease) in the demand for farm products sharply increases (decreases) their prices. Of course, speculative activity, involving storage, on the part of farmers and nonfarmers tends to smooth out what would otherwise be extreme fluctuations in farm prices. Then, too, public policy limits down-side movements in farm prices through such devices as marketing orders and loan rates. But still, given the way the farm economy works, it

is not surprising that farm prices exhibit substantial year-to-year variability.

The economics of the nonfarm economy is, for the most part, quite different. The time lag between when production is begun and when the product is ready to be sold is typically much shorter than is the case in the farm sector. The products of different producers are usually neither homogeneous nor easily gradable. Consequently, most nonfarm products are sold on what Arthur Okun has described as "customer markets" — markets in which quantities demanded and quantities supplied are rarely equal to one another and prices move sluggishly. A sudden increase (decrease) in demand usually has relatively little effect upon the course of the nonfarm price level, but it does bring about a quick response in the form of a larger (smaller) real output.^{5/}

Farm Prices, Nonfarm Output, and Macroeconomic Policies

If you look very closely at Figures 1 and 3 and/or Figures 2 and 3, you can see something of a relationship between what is going on in the nonfarm sector and what is going on in the farm sector. Often (but not always) when nonfarm output is rising unusually rapidly (slowly), the farm output price level is rising unusually rapidly (slowly). Most notably, the annual change in the farm price level was negative in the immediate proximity of all but two (1957-58 and 1960-61) of the seven business cycle contractions (1948-49, 1953-54, 1957-58, 1960-61, 1969-70, 1973-75, and 1980) experienced between 1947 and 1980.

In order to test whether the relationship is statistically significant, I regressed annual percentage changes in the farm output price level (PFO) on annual percentage changes in nominal nonfarm output (BO) and also on annual percentage changes in real nonfarm output (RBO). In order to control

for changes in real farm output, the annual change in real farm output (RFO) was included as an additional independent variable.^{6/} The results are as follows:

For the years 1948-81:

$$\text{PFO} = -6.77 + 1.36 \text{ BO} - 0.56 \text{ RFO} \\ (1.37) (2.46) (0.97)$$

$$R^2 = .19 \quad d = 2.02$$

$$\text{PFO} = -1.14 + 1.29 \text{ RBO} - 0.35 \text{ RFO} \\ (0.31) (1.80) (0.56)$$

$$R^2 = .13 \quad d = 1.78$$

For the years 1948-81 with 1973 removed:

$$\text{PFO} = -6.27 + 1.06 \text{ BO} - 0.31 \text{ RFO} \\ (1.91) (2.85) (0.81)$$

$$R^2 = .23 \quad d = 2.14$$

$$\text{PFO} = -1.33 + 0.85 \text{ RBO} - 0.18 \text{ RFO} \\ (0.53) (1.72) (0.42)$$

$$R^2 = .11 \quad d = 1.93$$

For the years 1948-64:

$$\text{PFO} = -5.75 + 0.78 \text{ BO} - 0.20 \text{ RFO} \\ (1.57) (1.66) (0.35)$$

$$R^2 = .17 \quad d = 2.28$$

$$\text{PFO} = -2.71 + 0.49 \text{ RBO} - 0.22 \text{ RFO} \\ (0.79) (0.75) (0.36)$$

$$R^2 = .05 \quad d = 2.24$$

For the years 1965-81:

$$\text{PFO} = -9.93 + 2.02 \text{ BO} - 0.92 \text{ RFO} \\ (0.62) (1.25) (0.88)$$

$$R^2 = .18 \quad d = 1.88$$

$$\text{PFO} = -2.06 + 2.73 \text{ RBO} - 0.06 \text{ RFO} \\ (0.30) (2.01) (0.05)$$

$$R^2 = .30 \quad d = 1.71$$

For the years 1965-81 with 1973 removed:

$$\text{PFO} = -7.84 + 1.39 \text{ BO} - 0.45 \text{ RFO}$$

$$(0.89) (1.55) (0.78)$$

$$R^2 = .23 \quad d = 1.66$$

$$\text{PFO} = -1.61 + 1.73 \text{ RBO} + 0.05 \text{ RFO}$$

$$(0.43) (2.29) (0.08)$$

$$R^2 = .35 \quad d = 1.81$$

where the figures in parentheses under the regression coefficients are t-statistics and d is the Durbin-Watson coefficient. The regression coefficients for BO and RBO all have the hypothesized signs (positive) and have magnitudes which are roughly consistent with economic theory and empirical estimates of the income and price elasticities of the demand for farm products.^{7/} All but one of the coefficients for RBO are significantly greater than zero at the .05 level (one-tail test). The R^2 s are very low, but the variables used in these regressions are percentage first differences, and I have made no attempt to allow for other factors which affect U.S. farm prices (such as domestic farm policy actions and shifts in the foreign demand for U.S. farm products).

It is also noteworthy that the statistical significance of the coefficients for RFO is very low in all the regressions. I interpret this result, together with the generally high statistical significance of the coefficients for BO and RBO, to mean that short-run farm price movements are more closely associated with movements in domestic demand than domestic supply.

What has this got to do with the impact of macroeconomic policy actions on the farm sector? In conducting activist macroeconomic demand-management policies, the policy authorities have attempted to affect the short-run performance of the macro economy. But the nonfarm business sector is so massive that for all practical purposes it is the macro economy. Thus, if

activist macroeconomic policy actions have had at least a short-run impact upon the real output of the macro (nonfarm business) economy, it appears that they have also had a short-run effect upon the farm economy, particularly the farm output price level.

Most macro economists appear to believe that macroeconomic policy actions have played a major role in the determination of the short-run movements in the real output of the macro economy in the recent past, particularly the last 15-20 years.

I do not have the space here to report a detailed analysis of macroeconomic policy actions and their impacts upon the macro economy. (Good ones by other authors are not hard to find, e.g., Dornbusch and Fischer, Chapters 10 and 16.) But let me call your attention to several instances when macro policy actions appear to have had a strong impact upon the macro economy and the farm economy:

- When Richard Nixon became president in January 1969, the unemployment rate was less than 4.0 percent, and the rate of price inflation was about 5.0 percent per year. In an effort to reduce the rate of inflation, the money stock (M1) growth rate was about cut in half between early 1969 and early 1970, and the high employment fiscal deficit was sharply reduced. The recession of 1969-70 was the result; the real output of the nonfarm economy declined as did the farm output price level in 1970.
- A system of price and wage controls was in effect in 1972, the rate of increase in the Consumer Price Index averaged only 3.4 percent, and the unemployment rate (in a state of decline) averaged 5.6 percent. Yet, the M1 money stock was increased 9.3 percent from December 1971 to December 1972 (the largest one-year percentage

increase of modern times), and the high-employment fiscal deficit was increased in 1972. No wonder real nonfarm business output rose 6.8 percent in both 1972 and 1973, and the farm output price level (where price controls were generally not effective) began to explode in 1972.

- Between 1972 and 1974, the December-to-December M1 money stock growth rate was cut from 9.3 to 4.4 percent per year, and the high-employment fiscal deficit was cut from 1.0 percent to 0.0 percent of high-employment GNP. This accompanied the longest and most severe economic contraction of the post-war period.
- In late 1975, President Ford recommended and the Congress passed a tax cut. Although Federal expenditures continued to increase, the high-employment fiscal deficit dropped as the economy expanded from 1975 through 1979. In the meantime, however, monetary policy eased greatly, and the December-to-December money stock growth rate increased from 5.0 percent in 1975 to 8.3 percent in 1978. The real output of the nonfarm economy rose rapidly during 1976, 1977, and 1978. In 1977, the farm output price level rose modestly, but then it rose very sharply in 1978 and 1979.
- Sometime in late 1978 or early 1979, the Federal Reserve authorities adopted a tight money policy in an attempt to reduce the inflation rate. This policy is still in effect. Under it, the December-to-December M1 money stock growth rate was reduced from 8.3 percent in 1978 to 5.6 percent in 1981. This, in my opinion, is the major causal factor for the business cycle contraction of 1980 and for the cyclical contraction which began in July 1981.

Macroeconomic Policies, Exchange Rates, and Farm Prices

Thus far, I have been concerned with the effects of macroeconomic policy actions upon the farm sector via domestic channels. This is obviously inadequate, since a large portion of U.S. farm products are sold abroad. Furthermore, the U.S. farm sector is the major supplier of several of the most important internationally traded agricultural products. Hence, it makes sense that movements in the exchange rate between the U.S. dollar and foreign currencies affect the U.S. farm output price level.

Modern macroeconomic theory indicates that an easing of fiscal policy (e.g., a tax cut and/or expenditure increase) tends to raise the value of the U.S. dollar in terms of foreign currencies (Dornbusch and Fischer, Chapter 19). A tightening of fiscal policy obviously does just the opposite. On the other hand, an easing (tightening) of monetary policy tends to lower (raise) the value of the dollar in the international exchange market. Thus, if fiscal and monetary policies are both eased (tightened), the net impact upon the exchange rate is theoretically indeterminate. In addition, foreign economic developments, including foreign macroeconomic policy actions, have an impact upon the exchange rate between the U.S. dollar and foreign currencies.

Figure 4 shows a plot of annual percentage changes in the Federal Reserve's index of the value of the U.S. dollar in terms of a trade-weighted market basket of foreign currencies from 1968 through 1981.^{8/} Negative (positive) changes in the value of the U.S. dollar should result in increases (decreases) in the farm output price level.

In order to statistically test whether exchange rate movements have an effect upon the farm sector which is over and above effects captured by movements in nonfarm output, annual percentage changes in the farm output

price level (PFO) were regressed on annual percentage changes in the trade-weighted value of the U.S. dollar (EX) and annual percentage changes in nominal nonfarm output (BO) and also annual percentage changes in real nonfarm output (RBO). Once again, in order to control for changes in real farm output, annual percentage changes in real farm output (RFO) were included as an additional independent variable. The results were as follows:

For the years 1968-81:

$$\text{PFO} = -13.63 - 1.33 \text{ EX} + 2.20 \text{ BO} - 0.41 \text{ RFO}$$

$$(0.77) (2.33) \quad (1.29) \quad (0.35)$$

$$R^2 = .45 \quad d = 1.97$$

$$\text{PFO} = -2.50 - 1.12 \text{ EX} + 2.74 \text{ RBO} + 0.50 \text{ RFO}$$

$$(0.36) (2.12) \quad (1.92) \quad (0.40)$$

$$R^2 = .53 \quad d = 1.75$$

For the years 1968-81 with 1973 removed:

$$\text{PFO} = -11.51 - 0.80 \text{ EX} + 1.62 \text{ BO} - 0.01 \text{ RFO}$$

$$(1.33) (2.72) \quad (1.92) \quad (.01)$$

$$R^2 = .54 \quad d = 2.03$$

$$\text{PFO} = -2.15 - 0.68 \text{ EX} + 1.78 \text{ RBO} + 0.52 \text{ RFO}$$

$$(0.64) (2.57) \quad (2.50) \quad (0.86)$$

$$R^2 = .62 \quad d = 2.16$$

where the figures in parentheses under the regression coefficients are t-statistics, and d is the Durbin-Watson coefficient. The coefficients for EX are all significantly less than zero (as hypothesized) at the .05 level, and the coefficients for RBO are both significantly greater than zero at the .05 level. Once again, the coefficients for RFO are of very low statistical significance; and here their signs change depending upon whether BO or RBO is included in the regression. These regression results are obviously consistent with the argument that macroeconomic policy actions have had an effect upon the farm output price level via both their effect upon domestic

demand and their effect upon the exchange rate between the U.S. dollar and foreign currencies.

Final Remarks

In recent years, there has been considerable controversy among economists as to whether domestic macroeconomic developments and exchange-rate changes have had a substantive influence upon the farm sector (see Gardner for a review of much of this literature). The research results presented above suggest that this has been the case, at least so far as the short run is concerned.

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Footnotes

The author is Professor of Economics, Iowa State University. He is indebted to Suchada V. Langley for help in carrying out the statistical computations.

1. This measure of farm output includes changes (positive or negative) in farm inventories of farm products. In the case of nominal (or current-dollar) farm output, the physical change in inventories is measured at current market prices. In the case of real farm output, the physical change in inventories is measured at 1972 market prices. Hence, returns to farmers (positive or negative) which result from mere changes in the market prices of the inventories that they hold are not included in the measure of farm output employed in this research. Similarly, capital gains (losses) on farm land, buildings, and machinery are not included in farm output.

Much the same comments can be made regarding the nonfarm business sector's contribution to GNP.

2. The data reported in Figures 1, 2, and 3 are from the 1982 Economic Report of the President, pp. 242-3.
3. The implicit price deflators are derived by dividing nominal outputs by real outputs.
4. Actually, these regressions are not really necessary, since nearly all the information they provide is contained in the previous set of regressions. For example, if you take the two regressions (one from each set) for the years 1948-81 in which B_0 is the left-hand variable, you notice that the sum of the intercepts is approximately equal to zero, while the

sum of the slope coefficients is approximately unity. This is because $BO = PBO + RBO + PBO \cdot RBO$, and $PBO \cdot RBO$ is nearly equal to zero.

5. Of course, a sustained increase (decrease) in the growth rate of nominal demand for the output of the nonfarm sector will in the long run cause the growth rate of the nonfarm price level to increase (decrease) by essentially the same amount.
6. Lagged values of RFO were not included in these regressions as additional independent variables because the dependent variable is the annual percentage change in the farm output price level and (presumably) real-farm-output changes that occurred in the past have already had their full impact upon the farm price level in the past. The inclusion of lagged values of RFO in these regressions would be tantamount to an assumption that the markets for farm products are extremely inefficient.
7. According to ordinary demand theory, the percentage rise in the market clearing price in response to a one-percent rise in income, when the quantity is held constant, is equal to the income elasticity of demand divided by the price elasticity of demand.
8. The data for Figure 4 are taken from the 1982 Economic Report of the President, p. 345. The Federal Reserve's index has not been run backward further than 1967. The basket of foreign currencies consists of the currencies of the "Group of Ten" countries (other than the United States) plus Switzerland. The weights used in constructing the index are based upon the 1972-76 global trade of each of the ten countries.