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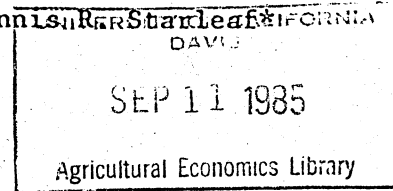
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THE IMPACTS OF U.S. MONETARY POLICIES

ON THE FARM SECTOR

by

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Presented to the

American Agricultural Economics Association Meetings
August 6, 1985

1985

Agricultural Economics aspects

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ABSTRACT

Much of the literature on the macroeconomics of agriculture investigated only the exchange rate linkage between the general economy and agriculture. This study examines the effects of U.S. monetary policies on agriculture in a general equilibrium framework through exchange rates, interest rates, inflation, and income linkages. Empirical results indicate that the U.S. monetary policy has significant impacts on farm incomes, prices, exports, demand, and supply.

The Impacts of U.S. Monetary Policies on the Farm Sector

I. Introduction

Since Schuh's 1974 article on the relationship between exchange rates and U.S. agriculture, there have been several attempts to investigate the effect of monetary factors on U.S. agriculture. Much of the literature in the area of macroeconomics of agriculture mainly focused on the linkage between exchange rates and agricultural commodity trade; relatively little attention has been given to other macro-connections such as interest rate, inflation, and income linkages. There are two objectives of this paper. First, the interrelationships between the macrosector and agriculture are investigated through exchange rates, interest rates, inflation and income linkages. Secondly, the effect of changes in the U.S. monetary policies on the U.S. farm sector (particularly on crop prices, livestock product prices, crop production and demand, exports, inventories, livestock production and demand, and farm incomes) are examined through these four linkages.

The remainder of the paper is organized as follows: Section II presents a brief review of earlier studies on the macroeconomics of agriculture. Section III explains the transmission mechanism between the macroeconomy and agriculture. Section IV illustrates the macroeconometric model with the aid of a flow chart. Section V presents the results of dynamic simulation and multiplier analysis of the effect an expansionary monetary policy on the farm sector. Section VI sets forth the conclusions.

II. Review of Literature

Following Schuh's article, numerous theoretical and empirical studies examined the relationship between monetary factors and the agricultural sector. Given the number and nature of these studies, it is impossible to do

them justice within the confines of this paper. However, a few studies are quite relevant to this article and are reviewed here.

Shei constructed a compact general equilibrium model to analyze the effect of exchange rate devaluation on the agricultural sector. Since the exchange rate was treated as exogenous (fixed), the important causal linkage between the money supply and the exchange rate was ignored. Lamm (1980) used a small macroeconomic model to determine the relationships between agriculture and the macroeconomy. Since his model is a closed economy model, the rest of the world import and export demands are assumed to be predetermined. Furthermore, his model did not explicitly consider the linkages between agriculture and the macroeconomy. Chambers and Just developed an empirical model to analyze the effect of the money supply on corn, soybean and wheat market. A similar study on coarse grains was examined by Denbaly. Even though these two studies endogenized the exchange rate, as the authors admittedly recognized, their analysis is incomplete in the sense they include only the exchange rate linkage. Their results could be magnified if a more complete set of linkages such as interest rate and inflation linkages were specified.

Freebairn, Rausser and de Gorter constructed a larger empirical model to investigate the interfaces between agriculture and general economies. Starleaf, by examining the macroeconomic policies and their impact upon the farm sector, summarized that activist macroeconomic policy actions have had a short-run effect upon the farm economy, particularly on the farm output price level. Along the same line, Chambers (1984), in his recent study, found that a contractionary monetary policy depresses the agricultural sector in the short run leading to lower farm prices and incomes.

Even though the above mentioned studies underline the fact that monetary policies have significant influence on the farm sector, they are incomplete in two aspects. Either they fail to incorporate all the possible interconnections between U.S. monetary policies and agriculture (see Chambers, 1981, 1984) or narrowly concentrate only on the exchange rate linkage.

The present study is different from the other studies, in that it attempts to systematically capture the important interfaces between the macroeconomy and agriculture. To this analysis, we will turn in the next section.

III. Transmission Mechanism Between the Macroeconomy and Agriculture

Suppose the government conducts an easy monetary policy to stimulate the growth of the economy. From macroeconomic theory, we know this policy action will put downward pressure on the interest rate and the exchange rate, upward pressure on the general price level and the overall output of the economy. These are the basic four channels through which, we expect, changes in the monetary policy to influence the decision variables in the agricultural sector.

The Exchange Rate Effect: According to monetary approach to exchange rate determination, an increase in the money supply reduces the exchange value of the dollar. This reduction in the value of the dollar is further exacerbated by capital outflow, as the domestic interest rate decreases because of the easy monetary policy. The consequences of dollar depreciation is to provide stimulus to dollar exports, leading to an increase in the export demand for farm products (trade effect). As mentioned in previous sections, a number of studies examined this exchange rate linkage. Since the change in monetary policy influences farm exports through the exchange rate,

the exchange rate can no longer be considered as an exogenous variable (see Schuh, 1981). Therefore, in this study, the exchange rate is endogenized by using the monetary approach to exchange rate determination.

The Interest Rate Effects: The downward pressure on the interest rate can affect the farm sector in two ways. First, a lower interest rate will reduce the cost of production loans which in turn helps to lower the cost of production and thereby increases the farm supply (cost effect). At the same time, a decline in the interest rate will lower the storage cost of commodity reserves and will induce farmers to accumulate inventories and thereby increase the demand for stocks (stock effect). The interest rate linkage is very important in the light of recent farm financial crisis. Economists believe that the current farm financial problem is mainly due to the higher interest rates caused by the budget deficits and tight monetary policy (see Harl, 1984). The importance of the changes in the interest rate and its implications on the farm sector was emphasized by Schuh, Hodges, and Orden; Chambers (1984); and Freebairn, Rausser, and de Gorter.

Inflation Effect: The growing dependence of U.S. agriculture on other sectors for inputs has resulted in the general economy price directly influencing returns to agriculture. A monetary-policy induced higher general price level will increase the cost of nonfarm inputs such as machinery, fertilizer, fuel, etc., leading to a reduction in the supply of farm products (cost effect). Even though the effect of inflation on the farm sector has been analyzed by Tweeten, Starleaf, Meyers, and Womack, and others, the linkage of the monetary policy to the farm sector through inflation is yet to be examined.

Income Effect: One of the goals of monetary policy activism is to achieve a higher real output of the economy; which means increased total

spending for the output of the economy. The effect of this increased spending on the farm sector is captured as a higher domestic demand for the farm products (income effect).

The effects of the easy monetary policy on the farm commodity market are illustrated in Figure 1. Aggregate demand for farm products increases, i.e., shifts right because of the income, stock, and trade effects, as explained above. The aggregate supply of farm products decreases, i.e., shifts left because the cost effect of higher inflation on the supply offsets the cost effect of interest rate decrease, as the empirical results suggested. At the new equilibrium, E_1 , price level increases, however, the change in quantities depends on demand and supply elasticities.

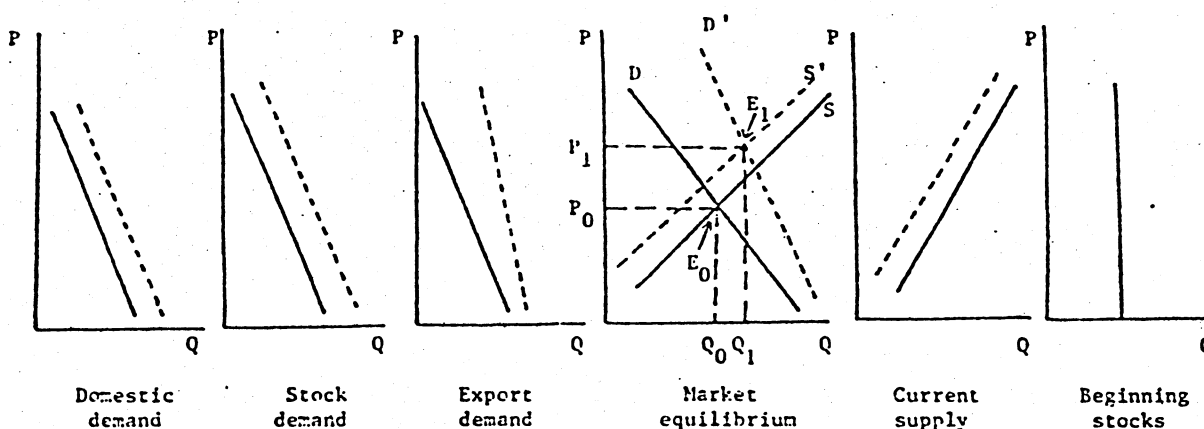


Figure 1. The effect of money supply increase on the farm sector

IV. The Model

This section describes the general equilibrium nature of the macroeconomic model that was developed to empirically analyze the effect of the changes in the monetary policies on the farm sector (see Figure 2). The model is divided into a farm block and a macro block. The farm block of

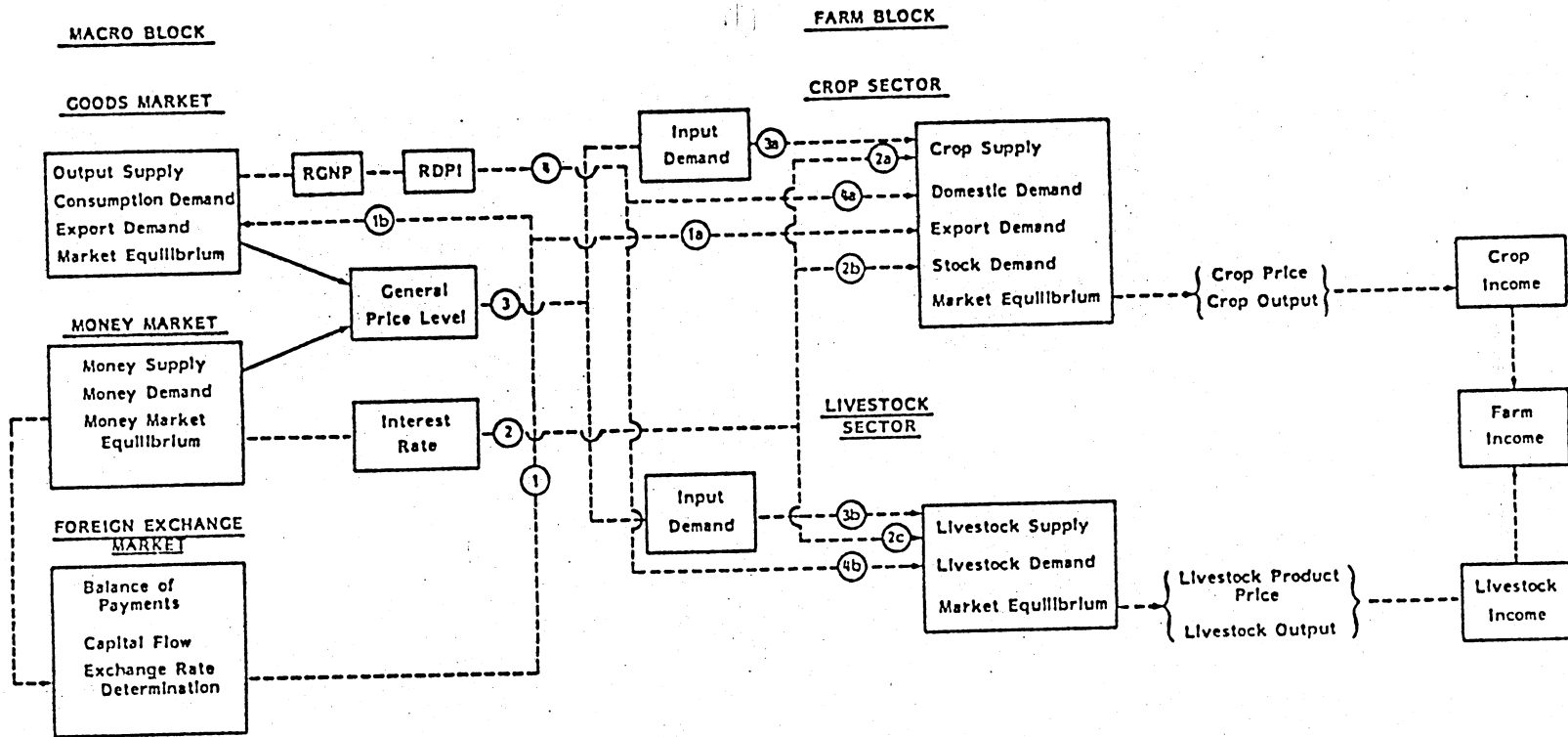


Figure 2. General equilibrium structure of the econometric model.

RGNP = Real gross national product
 RDPI = Real disposable income

the model consists of the crop sector and livestock sector. The crop sector is described by crop supply, demand, inventory, export, input demand relationships, and an equilibrium condition. The crop price, output, and income are endogenously determined in the crop sector part of the model. The livestock sector includes supply, demand for livestock products, feed demand, and market clearing conditions. The net imports of livestock products, because of the restrictive U.S. trade policies to the importation of livestock products (usually through import quotas), are assumed to be exogenously determined. The livestock price, output, and income are endogenously determined in the livestock sector. Total farm income is derived from the crop and livestock incomes.

The macro block is divided into the goods market, money market, and foreign exchange market. The goods market contains output supply, consumption demand, export demand, and an equilibrium condition. The money market, from which all the macroeconomic linkages originate, is the catalyst section of the entire model. The monetary sector consists of the money demand and supply functions and a money market equilibrium equation. The foreign exchange market includes the balance of payments identity, international capital flow, and exchange rate equation to determine the exchange rate endogenously.

The transmission mechanism explained in Section III can be better understood with the help of Figure 2, in which the four channels - exchange rates, interest rates, inflation, and income--that link the macroeconomy and the agriculture are schematically summarized. For example, the trade effect of the exchange rate decline on the crop export, caused by the higher money supply, is linked through dotted lines 1 and 1a. Similarly, other interfaces can be traced by following the dotted lines from the macro sector to the farm sector. To keep Figure 2 simple, only the forward linkages from the general

economy to the farm sector are depicted. However, the theoretical model is a simultaneous model and involves an integrated treatment of the agricultural sector with the general economy. In addition, the interrelationships between the farm and nonfarm sectors establish a dynamic pattern of forward and backward linkages among the endogenous variables in both the sector. Furthermore, it is possible to analyze the effect of farm policies, such as acreage diversion, on the overall economy.

The sample period of the study is from 1951 to 1982. The model contains 33 equations and 26 exogenous variables. Considering the nonlinearity and simultaneous nature of the model, nonlinear three-stage least square was used to estimate the model. Since the exchange rate was fixed prior to 1973 and flexible after 1973, a grafted polynomial technique, developed by Fuller, was incorporated in the model in estimating the exchange rate equation. The grafted polynomial technique allows the explanatory variables such as money supply to determine the exchange rate only under flexible exchange rate system (see Devadoss for further details on the grafted polynomial approach of estimating the exchange rate equation). The estimated coefficients have good statistical properties. In particular, all the coefficients related to the macrolinkages are consistent with a priori expectations. The dynamic historical simulation has satisfactory Theil statistics, and tracked the turning points of the endogenous variables very well.

V. Dynamic Analysis of the Money Supply Increase

To analyze the effect of U.S. monetary policy on the farm economy, it is assumed that the monetary authority increases the money supply growth rate by an additional 3 percent in every year from 1972 to 1982. This sustained increase in the money supply growth rate will have compounding effect, i.e., the consequent changes in the endogenous variables in any period will include

the dynamic effects of the increase in the money supply of all previous periods. Table 1 reports the dynamic multipliers associated with the U.S. money supply increase in percentage terms.

The simulation results support the hypothesis that an expansionary monetary policy will lower the exchange value of dollar and domestic interest rate and increase the general price level and disposable income. The impact of these changes on the crop sector can be examined with the help of Figure 3. As explained earlier, the depreciation of dollar causes a higher demand for U.S. crop products by the rest of the world. Similarly, increase in the income and decline in the interest rate causes domestic demand and inventory demand curves, respectively, to shift up. Therefore, the aggregate demand curve shifts from D to D' . The empirical results indicated that the aggregate supply curve shifts from S to S' because the cost effect of increase in the inflation dominates the cost effect of decline in the interest rate. Furthermore, the results show that the rise in the crop price at the new equilibrium (E_1) led to a decline in the equilibrium quantities of crop inventories and domestic demand. This suggests that the increased foreign demand for U.S. crop products tend to crowd out the domestic usages.

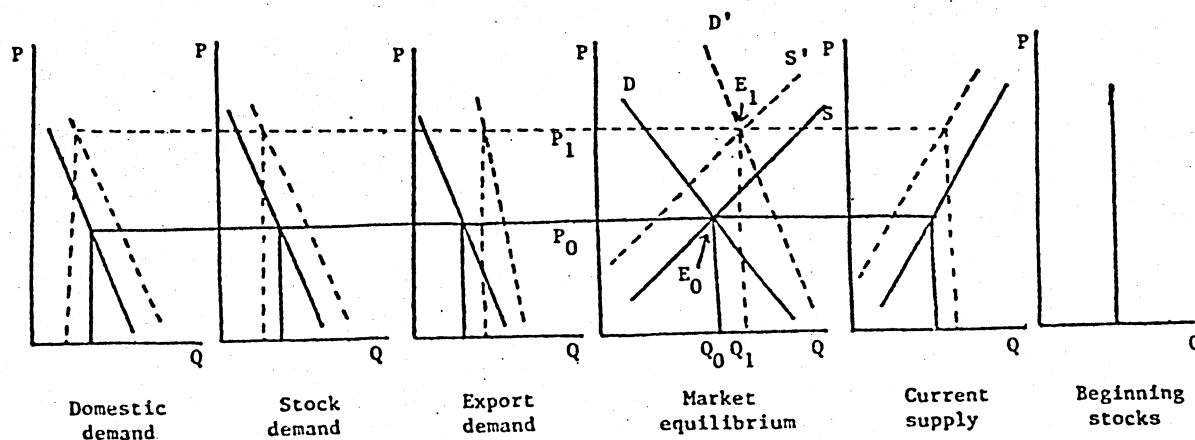


Figure 3. The effect of money supply increase on the crop sector

Table 1. Dynamic Effect of Sustained Increase in the Money Supply Growth Rate by 3 Percent

	Average impact ^a of money supply increase for the period 1978-1982	Long-run ^b elasticity
Exchange rate (SDR/U.S.\$)	-9.60	-3.25
Domestic interest rate	-3.17	-1.12
Consumer price index (1967=100)	1.32	0.48
Real crop supply (mil. dol. in 1967 prices)	0.63	0.23
Real domestic demand for crop output (mil. dol. in 1967 prices)	-5.23	-1.87
Real crop inventories (mil. dol. in 1967 prices)	-1.43	-0.90
Real crop net exports (mil. dol. in 1967 prices)	22.85	6.69
Crop price index (1967=100)	3.72	1.28
Real livestock product supply (mil. dol. in 1967 prices)	0.20	0.07
Real domestic demand for livestock products (mil. dol. in 1967 prices)	0.20	0.07
Livestock product price (1967=100)	1.59	0.59
Real farm income (mil. dol. in 1967 prices)	3.05	1.08

^aCalculated as average percentage changes of simulated values compared with the base values. The period 1978-1982 is considered for the purpose of long-run analysis.

^bCalculated as average changes of the variable in interest divided by average changes of the money supply, and evaluated at the means over the period 1978-1982.

The long-run elasticities of crop price, exports, and domestic demand associated with one percent increase in the money supply are elastic. The elasticities for crop exports (6.69) and crop price (1.28) are interesting because they provide evidence to Chambers and Just's argument that the effect of money supply changes on agricultural trade and prices would be magnified if a more complete set of linkages are specified, as has been done in this study.

Turning to the livestock sector, the long-run elasticity of livestock product price of money supply increase is inelastic at 0.59. This inelastic response is anticipated because the livestock commodity trade is exogenous and, therefore, there is no trade effect. Hence, the increase in the livestock product price is only due to changes in the domestic market. Furthermore, the equilibrium quantity of domestic demand for livestock product increases because the income effect dominates the effect of the price increase and also there is no crowding out of domestic demand since the livestock product trade is predetermined.

Another interesting result is that both crop and livestock price elasticities are greater than that of the overall consumer price index, supporting the evidence of Starleaf et al. that farmers are net beneficiaries of unexpected increase in the inflation rate. The net impact on farmers is seen in the long-run elasticity of farm income at 1.08, which implies that expansionary monetary policies are beneficial to agriculture.

VI. Conclusion

A general equilibrium macroeconomic model was used to capture the interrelationships between the general economy and agriculture through the exchange rate, the interest rate, inflation and income linkages. The model was used to empirically measure the effect of expansionary monetary policies

on the farm sector through these linkages. The results indicate that such an expansionary monetary policy favors the agricultural sector leading to an increase in the farm exports, prices and incomes.

These results are particularly interesting in the light of recent policies to tighten the U.S. money supply. According to our analysis, such a contractionary monetary policy has a substantial adverse effect on the farm economy. This conclusion has been hypothesized by many economists, and our analysis provides quantitative evidence to support such a conclusion.

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