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SUPPLY-SIDE ECONOMIC POLICY EFFECTS ON AGRICULTURE

by

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Introduction

Supply-side theorists prescribe a set of policy mechanisms with the ultimate goal of the enhancement of national economic well-being by increasing industrial growth and lowering inflation. These policy mechanisms include reduced marginal tax rates, reduced growth in federal spending, restrained growth in the money supply, and reforms in the regulatory system (Barth). The various facets of these programs involve a wide-ranging series of effects that taken in concert are expected to lead the nation to renewed economic vigor.

Increasing productivity levels is a major goal of supply-side economic policy. In short, tax cuts are expected to lead to increased savings and increased willingness to work; which will lead to increased investment in capital goods; which will lead to increased productivity, increased supply of goods, and increased incomes with which to consume rising supplies and to save and invest (Canto, Joines, and Laffer). Productivity increases are fundamental to the success of the supply-side program. Increased output per unit input will result in inflation control, rising real incomes, and the inertia to prolong the economic recovery and propell the economy through a period of continued real growth.

Supply-side policy prescriptions are discussed in macroeconomic terms. The literature on supply-side economics most often focuses on issues that span all sectors of the economy to provide economic analysis of the general economy. In citing data to support or contest the validity of the supply-side program, figures aggregated across the entire economy are used (Laffer; Canto, Joines, and Laffer; Blinder).

Effects of supply-side policies on particular sectors may be quite different from the effects expected in the aggregate. The purpose of this paper is to empirically investigate the short-term implications of the supply-side program on the agricultural sector.

Literature on supply-side policy effects on agriculture is in short supply. Schuh has written a short paper outlining the major issues of supply-side economics as they compare to the Keynesian tradition and the Reagan administration's economic program. Schuh specifically addresses his expectations for supply-side policy effects on agriculture. He predicts that if supply-side policies are effective, the value of the dollar will be strengthened. A strengthened dollar will reduce agricultural exports by placing U.S. producers at a relative competitive disadvantage. Over the short and intermediate terms, the size of the agricultural sector will have to readjust to accommodate changing trade patterns. Over the long term, due to productivity increases fostered by supply-side policies, U.S. agriculture will regain its competitive position in international trade markets. Schuh does not provide empirical evidence to support his predictions, and thus the magnitudes of expected adjustments are not specified. Further, Schuh does not address the direct effects of supply-side policies on the agricultural sector.

To evaluate the supply-side effect on agriculture, and then agriculture's effect on the national economy, a sectoral general equilibrium macroeconomic model would be necessary. In particular, a macroeconomic model specified such that the variables of concern to supply-siders are allowed to explicitly demonstrate their influence would be highly desirable. Evans has constructed a supply-side

macroeconomic model which could be used as a starting place for the type of model desired for agriculture. However, Evans' model would have to be disaggregated to isolate the importance of the agricultural sector. Lamm has constructed a macro model that separates agriculture and manufacturing-services sectors; however, the behavioral relations are not specified in such a way as to provide explicit analysis of supply-side programs. This paper will present a tentative first step in the formulation of a sectoral supply-side macro model where agriculture and the direct effects of supply-side policies are among the primary focii.

The Model of Agricultural Investment and Productivity

The two equations presented in this paper are conceptually components of a sectoral macro model with a distinct agricultural sector. The theoretical structure of the model could conceivably follow the model constructed by Evans, with the agricultural sector separated to provide analysis of issues of particular concern to that sector while remaining within the context of the general economy. Effects on agriculture will be felt in other sectors as well, and effects outside of agriculture will have significant influence on economic variables pertinent the agricultural sector.

Two important structural components of Evan's model, from the supply-side perspective, are the investment and productivity functions. The model given here is a set of two simultaneous equations explaining investment in agriculture and agricultural productivity. It is felt that these two equations will provide a starting point for discussion of supply-side effects on agriculture and the eventual estimation of a full sectoral macro model for analysis of supply-side policies.

Specification of the investment relation follows the lead of Hessler and Schuh in their specification of demand for agricultural mortgage credit. Most of the same decision variables apply to agricultural producers considering investment in capital equipment, land, or both. Thus, investment was hypothesized to be a function of the price of credit, expected net returns from investment, the equity position of investors, the cost of alternative factors of production, and other factors affecting the investment decision. The investment equation obtained was:

$$INV_t = \underset{(1358.50)}{-\ 1752.24} \underset{(89.20)}{-\ 349.50\ IRATE_t} \underset{(20.28)}{+\ 77.74\ EXPNFI_t}$$

$$\underset{(5441.75)}{-\ 3039.73\ DBTETY_t} \underset{(292.72)}{+\ 1848.27\ WAGE_t} \underset{(39.46)}{+\ 49.44\ TIME_t}$$

Standard Error of Estimate = 1068 $\bar{R}^2 = .98$

Estimation technique: 2SLS Data: 1945-1979

where:

INV_t = value of shipments of farm machinery and equipment (million dollars), mean = 2444;

$IRATE_t$ = Federal Land Bank average interest rate on new loans, mean = 6.0;

$EXPNFI_t$ = expected net farm income (billion dollars), defined as simple three-year moving average of past years net farm ~~increases~~ incomes, mean = 14.9;

$DBTETY_t$ = debt-equity ratio defined as total liabilities in the farming sector divided by total proprietors' equities in the farming sector, mean = .15;

$WAGE_t$ = average farm wage paid per hour, without board or room (dollars), mean = 1.36;

$TIME_t$ = annual time trend; TIME(1945) = 45,..., TIME(1979) = 79.

Values in parentheses are standard errors. The interest rate was considered as an endogenous explanatory variable. All other explanatory variables were treated as exogenous.

The productivity equation was specified to include factors having direct effects on the level of agricultural productivity. These factors include capital investment, the amount of land in farms from which agricultural products can be produced, the current level of variable costs of production, and past investment in agricultural research. The productivity equation obtained was:

$$PDTY_t = \underset{(59.70)}{357.07} + \underset{(.0022)}{.0027}\ INV_t + \underset{(.0276)}{.1209}\ RSNVST_{t-10} - \underset{(.0524)}{.2260}\ LAND_t - \underset{(.0283)}{.0796}\ VARCST_t$$

Standard Error of Estimate = 11.1 $\bar{R}^2$ = .94

Estimation technique: 2SLS Data: 1945-1979

where:

$PDTY_t$ = index of agricultural productivity, 1967 = 100, mean = 101;

INV_t = value of shipments of farm machinery and equipment (million dollars), mean = 2687;

$RSNVST_t$ = federal obligations for R&D by agency, for agriculture (million dollars), mean (t-10) = 114.5;

$LAND_t$ = land in farms, less Alaska and Hawaii (million acres), mean = 1105.6;

$VARCST_t$ = index of prices paid by farmers for production inputs, all commodities, 1910-14 = 100, mean = 344.6.

Values in parentheses are standard errors. Investment is considered an endogenous explanatory variable, and all other explanatory variables are treated as exogenous.

Both equations were considered as parts of a much larger simultaneous system, and therefore 2SLS was used to derive parameter estimates. To better represent the set of influences operating in the theoretical system, exogenous variables affecting supply of investment credit and opportunity costs of agricultural investment supplemented the set of exogenous variables in the investment and productivity equations. Thus, first stage estimates were based on exogenous factors including government and corporate bond interest rates, Federal Reserve Bank reserve requirements, commercial bank assets, and the producer price index.

Results of the two equations presented here conformed to a priori expectations in the sense that all signs were plausible. All parameter estimates were greater than their associated standard errors with the single exception of the debt-equity variable in the investment equation. However, since the sign was correct and theory and practice strongly imply the importance of farmers' equity positions to the investment decision, the variable was retained. In all other cases, standard errors were sufficiently small to imply statistical significance of parameter estimates at acceptable significance levels.

Implications of the Model

The results of the two equations can be used to evaluate direct effects of some supply-side policies, as well as other factors, on

agricultural investment and agricultural productivity. Elasticities derived from the two equations provide focal points for analysis. In the investment equation, investment elasticities with respect to the interest rate, expected net farm income, the debt-equity ratio, and farm wage rates were -.86, .47, -.19, and 1.03, respectively. None of these elasticity values is particularly surprising. All are in the inelastic range, except for the wage rate which is nearly unitary elastic.

The elasticities of primary concern to supply-side policy evaluation are those with respect to the interest rate and expected net farm income. The interest rate in agriculture is determined in large part by factors in the non-agricultural sectors of the economy (Lamm). However, supply-side policies address the problem of inflation, and presumably, once set in motion, general price inflation will be decreased and interest rates will eventually fall as part of the same economic program. The effect of falling interest rates as given in the investment equation is significant. Though the effect is inelastic, the elasticity is sufficiently high to indicate substantial changes when put in the context of absolute numbers. A 10 percent reduction in the interest rate (about one point in current terms) would lead to an increase in investment of .86 percent, or about $200 million measured at the means. When the elasticity is measured at 1979 values, rather than at the mean, the elasticity of -.55 would imply investment increases of a little more than $300 million given the same 10 percent reduction in the interest rate.

The immediate direct effect of supply-side policies on agriculture will come through income enhancement. Reduced marginal tax rates will stimulate increased net incomes. Other tax incentives, such as

accelerated depreciation, will also stimulate investment; however, these effects will not be measured with this model. The investment elasticity with respect to expected net farm income was .47. Thus, a 10 percent increase in expected net farm income will lead to a $115 million increase in investment measured at the means. At 1979 levels, the elasticity of .27 would imply an investment increase of about $160 million if expected income were to rise 10 percent.

Other influences given in the model are more difficult to associate with supply-side policies. The effect of supply-side policies on the debt-equity ratio is ambiguous. There is no persuasive evidence that would suggest a major shift of the balance between debt and equity in agriculture. Similarly, the nominal wage rate is not necessarily affected by the supply side program. Disposable wages are increased through reduced taxes and real wages are increased through rising productivity levels; however, the supply-side design does not require a change in nominal wages paid by employers.

The other half of the model deals with the desired end of the supply-side program. It is through increased productivity that the economy will be stimulated to grow on a sustained basis and problems of inflation and unemployment will be brought into line. In agriculture, productivity will be stimulated by capital investment and investment in technological innovation through research. Productivity increases will be dampened by bringing more, presumably marginal, lands into production and rising variable cost levels. The results of the productivity equation imply mean level elasticities with respect to capital investment, research investment lagged 10 years, land, and variable costs of .07, .14, -2.48, and -.27, respectively.

The primary thrust of the supply-side program is to stimulate productivity through stimulated investment. Results given here suggest that agricultural productivity cannot be significantly affected, at least in the very near term, by programs that stimulate investment. At the means, a 10 percent increase in investment, about $240 million, would lead to only a .7 percent rise in productivity. The same elasticity at 1979 levels would imply that a 10 percent increase in investment, about $590 million, would result in a 1.35 percent rise in productivity. Though the elasticity is higher at the end point of the data, the response remains very inelastic.

Each of the other factors specified in the equation provide more important stimulus to productivity than current investment. Increases in investment in research generally do not significantly affect productivity levels until a rather long lag period has passed (Nielson). However, the importance of research investment should not be disregarded. Rates of return to agricultural research are generally quite high (Evenson, et al.). Rising variable cost levels also affect productivity. As variable costs increase, fewer variable factors will be used in combination with fixed factors and productivity will fall. On the basis of the results presented here, the most important influence on productivity is land. Decreasing the amounts of marginal lands used in agricultural production would provide more than proportional returns in terms of rising productivity. However, research investment, land, and variable cost levels are elements of concern more to policy specifically directed at the agricultural sector than to policies developed as part of an economy-wide package.

Observations and Conclusions

The effects of supply-side policies on agriculture cannot be fully examined by concentrating only on the agricultural sector. General economic programs affect all sectors of the economy and inter-sectoral relationships will be important in determining ultimate success or failure of an economic policy.

From a slightly different perspective, particular facets of economic programs focused on the general economy may vary significantly in their effects on individual sectors. A considerable amount of literature has emerged recently that addresses issues of supply-side economics and the expected effects of supply-side policies on the general economy. It is hypothesized that supply-side policies would lead to economic recovery by raising productivity levels in the economy. However, response to supply-side policies may vary considerably across sectors.

The model presented in this paper was developed to examine some of the direct effects of supply-side policy on agriculture. It was shown that increases in productivity will come relatively slowly if the primary policy instrument used to induce rising productivity is tax policy to raise net farm incomes. Of more importance is the result which indicates that stimulated investment in capital equipment may not be as important for increasing productivity levels as policies affecting investment in research, lands used in agriculture, and costs of variable inputs used in agriculture.

Results of the model show that to increase agricultural productivity by one percent, investment would have to increase by more than seven percent--about $400 million. Investment increases in this

range are a little under the average for the past 10 years. Investment stimulation through increasing expected net farm incomes as an economic policy will not contribute substantially to rising productivity. Income expectations would have to rise by nearly 30 percent before sufficient investment would be stimulated to increase productivity by one point.

The model presented here gives some guidance for understanding the effects of supply-side policies. However, the missing structural components of the complete model would also have much to contribute. Based solely on results presented here, it is apparent that supply-side policies will act in the hoped-for directions, but the magnitudes of the impacts may be disappointingly small.

References

Barth, J. R. "The Reagan Program for Economic Recovery: Economic Rationale," Economic Review, Federal Reserve Bank of Atlanta, September 1981.

Blinder, A. S. "Thoughts on the Laffer Curve," in The Supply-Side Effects of Economic Policy, L. H. Meyer ed., Federal Reserve Bank of St. Louis, May 1981.

Canto, V. A., D. H. Joines, and A. B. Laffer. "Tax Rates, Factor Employment, and Market Production," in The Supply-Side Effects of Economic Policy, L. H. Meyer ed., Federal Reserve Bank of St. Louis, May 1981.

Evans, M. "An Econometric Model Incorporating the Supply-Side Effects of Economic Policy," in The Supply-Side Effects of Economic Policy, L. H. Meyer ed., Federal Reserve Bank of St. Louis, May 1981.

Evenson, R. E., P. E. Waggoner, and V. W. Ruttan. "Economic Benefits from Research: An Example of Agriculture," Science, September 1979.

Hessler, L. F. and G. E. Schuh. "The Demand for Agricultural Mortgage Credit," AJAE, December 1962.

Laffer, A. B. "Supply-Side Economics," Financial Analysts Journal, September-October 1981.

Lamm, R. M., Jr. "The Role of Agriculture in the Macroeconomy: A Sectorial Analysis," Applied Economics, March 1980.

Nielson, J. "Issues and Priorities in Public Funding of Agricultural Research and Extension Education," in Public Support for Agricultural Research and Extension--Investing in the Future, B. R. Eddleman ed., Mississippi Ag and Forestry Exp. Sta., December 1978.

Schuh, G. E. "Supply-Side Economic Policy and the Implications for Agriculture," paper presented at the 1981 Southern Regional Outlook Conference, Atlanta, GA, September 1981.

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