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SOME EVIDENCE ON THE RELATIONSHIP BETWEEN LOAN INSURANCE AND THE SUPPLY OF AGRICULTURAL CREDIT FROM COMMERCIAL BANKS

L. Upton Hatch and Wesley N. Musser

Insured farm loans have evolved to be an important component of the federal role in the agricultural credit subsector. Currently, agricultural credit is supplied by three sets of institutions: (1) private firms and individuals, (2) the quasiprivate cooperative Farm Credit System, and (3) the federal public programs of the Farmers Home Administration (FmHA) and Small Business Administration. Statutory authority currently limits federal programs to a residual role of lending to borrowers who cannot receive credit from the other segments. Though a large component of public programs consists of emergency loans in areas of economic disaster, the FmHA also makes farm operating and real estate loans to farmers who meet the statutory requirements. The source of funds for some FmHA loans is federal appropriations and money market certificates. However, guaranteed loans have become an important component of FmHA programs. These loans are made in cooperation with other agricultural finance agencies. The public agency insures or guarantees repayment of the loan. The cooperating firm negotiates the loan and provides the funds. Usually the interest payment is below the current market interest rate structure.¹

An important issue concerning the guaranteed loan program is whether it effectively increases the aggregate supply of agricultural credit or only redistributes loanable funds from regular farm borrowers to marginal farm borrowers. Redistribution of loanable funds can be justified by public objectives related to income redistribution and facilitation of entry into farming. Our investigation does not pursue the desirability of these objectives; instead it focuses on the extent to which the insured loan program increases agricultural credit. Increasing the aggregate supply would contribute to these objectives without transferring capital away from farmers who can obtain loans from other sources. Research on this issue would help to determine whether the

public program is creating indirect costs to regular agricultural borrowers.

The Georgia Development Authority (GDA) provides a unique opportunity to explore empirically the policy issues related to publicly insured farm loan programs. The GDA was created by the State of Georgia in 1954 as a public nonprofit corporation. Its original capitalization was provided by the assets of the Georgia Rural Rehabilitation Corporation. The function of the GDA is to insure and service long-term loans secured by farm real estate for commercial banks and other credit institutions. Total insured loans are limited to 15 percent of the GDA's capitalized assets, and public appropriations or money market instruments cannot be a source of operating or loan funds. Unlike the Farmers Home Administration, the GDA makes its program available to all owners of farm real estate.² The GDA enables us to analyze the impact of insured loans on the aggregate supply of farm credit without considering the limited eligibility for loans associated with federal programs.

The purpose of our article is to present some empirical research on the impact of insured credit on the aggregate supply of agricultural credit. Specifically, the alternative hypotheses concerning redistribution of or increase in the supply of agricultural credit by agricultural banks are tested with reference to the GDA program. A cross-sectional econometric model of agricultural credit supply by banks in Georgia is developed and estimated. This model provides evidence on the policy hypotheses as well as other hypotheses pertaining to agricultural credit.

CONCEPTUAL FRAMEWORK

Recently, Robison and Barry conceptualized the portfolio decision of a bank in an expected utility framework. Their model was an application of modern portfolio theory that explains the asset composition of portfolios on the basis

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The research reported was supported in part by a grant from the Georgia Development Authority, Atlanta, Georgia. Terry Roe made some helpful suggestions on the theory used and three anonymous reviewers made helpful comments on a draft of the article.

¹For a more thorough description of the U.S. agricultural credit system, see Barry, Hopkins, and Baker, Chapter 2.

²Carlan and Wise have more completely described the GDA program.

of the expected value and variance of returns (Markowitz; Sharpe). In this model, the bank is assumed to maximize the following formulation of expected utility (EU).

$$(1) \quad] EU = \sum_j c_j x_j - \frac{\alpha}{2} \sum_j \sum_k x_j x_k \sigma_{jk}^2 [$$

where x_j = investment in asset j , c_j = expected return on assets, α = the risk aversion coefficient for the bank, and σ_{jk}^2 = variance of return on asset j if $j = k$ and covariance between returns on assets j and k is $j \neq k$. This framework is consistent with both hypotheses concerning the impact of insured loans on the supply of agricultural credit. A simple rationalization would be that a bank would substitute GDA loans for other assets if the expected value and variance of returns on GDA loans were consistent with the maximization of its utility function. Covariance of returns from insured loans with returns from other assets may also provide a reason for substitution for other assets. The more risk averse the bank, i.e., the larger its value of α , the more likely the occurrence of such substitution. The redistribution hypothesis would suggest the substitution of insured loans for regular farm loans whereas the increased supply hypothesis would indicate substitution for nonfarm assets.

This reasoning abstracts from an important theoretical issue concerning insured loans—the insurer's ability to bear the risk of the loan is superior to that of the cooperating firm. Federal insured loan programs derive this superiority from the spreading of risk over the whole nation and the potential use of public subsidies. However, GDA operates only in Georgia and has no access to public appropriations. Though GDA undoubtedly has more risk-spreading ability than a commercial bank serving a local area, its superior access to information on farm real estate loans is an important component of its comparative advantage in risk bearing. Akerlof and Lipton both argue that differential access to information can affect agricultural credit institutions. The operation of GDA requires specialized knowledge about agriculture and security values of farm real estate which must be constantly revised in the dynamic environment of modern agriculture. Insurance companies and Federal Land Banks have sufficient volume to justify employment of specialized personnel, but many small banks and even large banks with a low volume of agricultural loans could not justify such a division of labor. The superior information of specialized personnel relates to the existence of economies of size in finance. The existence of such economies of size from specialized personnel is a central

proposition of Adam Smith (p. 3). The existence of economies of size in banking has been well documented empirically; Mullineaux discusses the issue and also reviews the pertinent literature. Thus, specialized information can serve as the basis for the assumption that GDA insured loans have lower risk than similar uninsured loans by banks.³

In examining the substitution of GDA loans for assets with similar risks, such as government securities, one must consider the indirect effects of such action in addition to direct risk and returns of the two classes of assets. Recipients of the GDA loans are more likely to retain the proceeds in the local area. As Barry has noted, such deposits can serve as the basis for increased bank investments. GDA loans can therefore indirectly affect returns through the borrower's increased level of deposits prior to spending the loan proceeds, from growth arising from the financing, and from accumulation of funds to repay the loan. The loan and its direct stimulation of deposits may also have further indirect effects, by increasing the level of business activity in the community.

Portfolio theory is helpful in providing some hypotheses concerning the willingness of banks to hold insured loans, but it does not provide a specific empirical model for testing the hypotheses of interest to us. If the objective in equation 1 is maximized subject to production constraints, asset supply functions can be derived from the first-order conditions as in the static theory of the firm. These functions would be reduced-form equations in that asset demand would be a function of exogenous variables. However, the hypothesis of interest to us concerns the relationships between levels of GDA loans and other assets. Thus, economic theory could be used in an indirect manner to suggest variables to include in a simultaneous econometric model for various assets.

The specific model consists of three equations with three endogenous variables—total loans for an individual bank (TLOAN), total loans secured by agricultural assets for an individual bank (FLOAN), and total GDA insured loans for an individual bank (GLOAN). Note that FLOAN is a component of TLOAN, and GLOAN is a component of FLOAN. As cross-sectional data are used in the estimation, each equation can be considered a reduced form of a supply and demand system for the particular dependent variable in the equation. The variables included in this model would also appear in the supply and demand equations of the structural model.

The particular model specification for an individual bank is

$$(2) \quad TLOAN = f_1(FLOAN, DEP, URBAN)$$

³Roe and Nygaard present a theoretical demonstration that improved information can reduce the variance of profits of agricultural producers. A similar formula could be used to derive rigorously the assumption that increased information would reduce variance for agricultural lenders.

$$(3) \quad \text{FLOAN} = f_2(\text{TLOAN}, \text{GLOAN}, \text{SALE}, \text{URBAN})$$

$$(4) \quad \text{GLOAN} = f_3(\text{FLOAN}, \text{SALE}, \text{LOAN/DEP})$$

where DEP = total deposits of the bank, URBAN = banks located in urban areas, SALE = gross farm sales in the bank's trading area, and LOAN/DEP = the ratio of total loans to total deposits for the bank.

Our primary concern is the coefficient on GLOAN in equation 3. If this coefficient is greater than one, the hypothesis of increased agricultural credit is supported; if it is less than or equal to zero, the alternative hypothesis is supported; an intermediate value suggests some redistribution and some increase in supply.⁴ A positive coefficient on FLOAN is expected in equation 2 because of likely portfolio effects arising from the covariance relationships between farm and other loans. If the returns on FLOAN are less than perfectly correlated with other loans, increasing FLOAN will reduce the risk of TLOAN and therefore allow substitution of TLOAN for other less risky assets. DEP is expected to be positively related to TLOAN because it is the major source of loanable funds for banks (Barry); a nonlinear specification of DEP would be appropriate because of the previously discussed economies of size in banking. The inclusion of URBAN in equation 2 reflects the empirical fact that farm banks can loan a smaller proportion of their deposits because their deposits are more variable throughout the year (Barry, Hopkins, and Baker). SALE in equation 3 reflects the demand for farm loans as related to agricultural activity in the bank's trading area, and a positive coefficient is anticipated. The existence of economies of size in agriculture arising from more efficient use of machinery and equipment (Krause and Kyle; Musser and Marable) would suggest a nonlinear relationship between SALE and FLOAN. TLOAN would be expected to have a positive coefficient in equation 3 in reflection of the effect of total portfolio size on amount of farm loans. A negative coefficient on URBAN in equation 3 would reflect greater demand for nonagricultural loans in urban areas.

Economic theory is not very helpful in specifying equation 4 because of the nonmarket allocation of GLOAN arising from the limited size of the GDA program. FLOAN is included to reflect the impact of the volume of agricultural credit on possible awareness of GDA and existence of customers with needs for the program; a positive coefficient would conform to

this logic. LOAN/DEP is included as a proxy of risk preferences of bank managers or owners and a negative relationship is expected. SALE is included as a measure of the importance of farming in the market areas of the bank. If banks wish to include farm loans in their loan portfolio but agriculture is an unimportant business activity in their area, GDA loans may be attractive. The SALE coefficient is therefore expected to be negative.

In summary, the hypothesis that the GDA program increases agricultural credit in Georgia is tested. Other hypotheses concerning economic relationships in rural banking include: (1) agricultural loans reflect economies of size in farming, (2) the banking sector exhibits economies of size in loans, (3) seasonality associated with agriculture decreases the proportion of loans to deposits for farm banks, and (4) the covariance relationship between farm loans and other loans allows total loans to be higher for banks that include farm loans in their loan portfolio. The results of the econometric analysis provide some evidence on these hypotheses.

METHODS AND PROCEDURES

Data to estimate the econometric model were drawn from several sources. Call data from the Federal Reserve Bank of Atlanta for June 1975 were used for TLOAN, DEP, and FLOAN. We recognized that these variables would be subject to considerable seasonal variation. The quarter ending in June would be expected to reflect the highest seasonal level of FLOAN as harvest of major crops is completed in the subsequent quarter. Consequently, the data in June would represent the highest agricultural loan activity. Data on GLOAN were obtained from GDA for the same period. For the remainder of the variables secondary data were used. As these variables reflected characteristics of the market area of the bank, no secondary data corresponded to the exact theoretical specifications. Therefore, we assumed that the county in which the bank was located represented the market area of the bank (Boehlje, Harris, and Hoskins). The large number of banks in Georgia increased the plausibility of this assumption; the few banks with statewide activity were deleted from the analysis. Two dummy variables were constructed to represent URBAN. URBAN 1 had a value of one for banks located in a county in a Standard Metropolitan Statistical Area with a city of population at least 15,000 and a value of zero otherwise. URBAN 2 had a value of one for banks in a county in a Standard Metropoli-

⁴One referee suggested that insured loans other than GDA loans may be a component of FLOAN. This point is valid but unfortunately it was not possible to include such data in the model. A more complete analysis of insured loans would have to include data on these other loans. In the current analysis, it is not possible to examine the issue of substitution of GLOAN for other insured loans and/or this joint interaction on FLOAN. However, this weakness does not mean that the overall analysis of the relationship between GLOAN and FLOAN is necessarily biased.

tan Statistical Area which did not have a city of at least 15,000 or in a county with a city of at least 15,000 and outside a Standard Metropolitan Statistical Area, and a value of zero otherwise (U.S. Department of Commerce 1974, 1975). SALE was gross farm sales per county in 1974 (U.S. Department of Commerce 1976).

The model in equations 2, 3, and 4 was estimated with two-stage least squares. Sample size was 440. The equations were specified in linear form. Both a linear and a quadratic form of DEP were included to allow for economies of size in loan departments. SALE was also specified in linear and quadratic forms to allow for economies of size in use of capital by farmers. Finally, both URBAN 1 and URBAN 2 were multiplied by DEP and included in some specifications of the model.

RESULTS

The final results of the estimation follow, with asymptotic Student t-ratios in parentheses.

$$(5) \quad \begin{aligned} \text{TLOAN} = & 457.86 + 0.99\text{FLOAN} + \\ & (1.23) \quad (2.81) \\ & .50\text{DEP} + 0.00000019\text{DEP}^2 + \\ & (11.0) \quad (46.98) \\ & 0.055\text{DEPURBAN1} + \\ & (1.20) \\ & 0.12\text{DEPURBAN2} \\ & (2.97) \end{aligned}$$

$$(6) \quad \begin{aligned} \text{FLOAN} = & 246.49 + .00029\text{TLOAN} + \\ & (1.64) \quad (3.22) \\ & 2.85\text{GLOAN} + 0.092\text{SALE} - \\ & (1.87) \quad (5.02) \\ & 0.00000086\text{SALE}^2 - \\ & (-1.95) \\ & 371.49\text{DEPURBAN1} \\ & (1.83) \end{aligned}$$

$$(7) \quad \begin{aligned} \text{GLOAN} = & 122.66 + 0.047\text{FLOAN} - \\ & (3.42) \quad (4.99) \\ & 177.68\text{LOAN/DEP} - \\ & (-3.15) \\ & 0.00000006\text{SALE}^2 \\ & (-2.78) \end{aligned}$$

DEPURBAN2 in equation 6 and SALE in equation 7 were deleted in the final specification because of statistically insignificant coefficients.

All coefficients in the final specification except for DEPURBAN1 are significant at least at the 10 percent level and have the expected sign.

The coefficients in the model are consistent with most of the hypotheses used to specify the model. Most important, the coefficient for GLOAN in equation 6 is statistically significantly different from zero and positive. Therefore, the analysis supports the hypothesis that GDA increases the aggregate supply of agricultural credit. The magnitude of the coefficient suggests that GLOAN has a portfolio effect and/or indirect effect on FLOAN—each \$1.00 increase in GLOAN increases FLOAN \$2.85. However, this relationship cannot be supported statistically. The t-statistic for the hypothesis that the GLOAN coefficient is less than one is 1.214, which cannot be rejected at standard levels of significance. Consequently, GDA does increase the aggregate supply of agricultural credit but some substitution for other agricultural loans may occur.

The economies of size hypotheses are also supported. The positive signs on DEP and DEP² in equation 5 imply that loans increase at proportionately greater rates than deposits; this result is consistent with the existence of economies of size in banking. The positive sign on SALE and the negative sign on SALE² in equation 6 indicate that loans increase at a decreasing rate as sales in the county increase. This relationship reflects several dimensions of economies of size in the agricultural sector. Economies of size in the marketing and farm supply subsectors could account for decreasing farm capital requirements per unit of sales. In addition, economies of size in farm firms could contribute to decreasing capital requirements per unit of sales if larger sales reflect larger farm units.

The model also provides support for the hypothesized relationships between various assets. Positive signs on TLOAN in equation 6, FLOAN in equation 7, and DEPURBAN1 and DEPURBAN2 in equation 5 and the negative sign on DEPURBAN1 in equation 6 were all anticipated. The larger magnitude of the coefficient for DEPURBAN1 than for DEPURBAN2 in equation 5 is consistent with the greater stability of deposits in larger urban areas arising from greater diversification of industry. The positive coefficient on FLOAN in equation 5 supports the proposition that the correlation between returns on farm and other loans is sufficiently small that diversified portfolios have reduced variance which encourages substitution of loans for other assets. The particular magnitude of the coefficient suggests that farm loans are substituted for non-farm assets with nonfarm loans being constant. As with the coefficient in GLOAN in equation

6, this relationship cannot be supported statistically—the hypothesis that the coefficient of FLOAN is less than one cannot be rejected.

As noted heretofore, equation 7 has the least support from economic theory. The coefficients have the anticipated signs; however, more theoretical and empirical research is necessary to verify this equation.

CONCLUSIONS

Our econometric model of Georgia banks supports the view that insured GDA loans increase the aggregate supply of credit to the agricultural sector from commercial banks, but may also result in some redistribution of credit within the agricultural sector. This finding does imply that a national program such as that provided by GDA would be effective in increasing the participation of banks in the agricultural credit sector. The results also pro-

vide tentative support for the proposition that the current guaranteed federal loan program increases the supply of agricultural credit. However, differences in operating practices and in eligibility for loan insurance between GDA and the FmHA require estimation of a similar model for federally insured loans to verify this implication, particularly because FmHA loans were not implicitly considered in our research.

Several weaknesses of our analysis suggest directions for future research in this area. Most important, more theoretical development of the model should be considered; finance literature on the banking sector may be helpful in this regard. Disaggregating the equation for TLOANS into more specific categories and including more equations would also be useful in analyzing the tradeoffs among alternative bank assets. Finally, collection of a time series of cross-sectional data would allow estimation of the model in structural form.

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