Estimating Principal Outstanding Models for Farm Service Agency Guaranteed Loans

Latisha A. Settlage, Bruce L. Dixon, Bruce L. Ahrendsen, and Steven R. Koenig

Abstract

Financial, farm economy and bank factors are hypothesized to explain variation in FSA guaranteed loan principal outstanding. Regression models using state-level data (1990-1998) are estimated. Debt-to-asset ratios, percentage of agricultural revenues due to crops, interest rates, and off-farm income are significant variables for both farm ownership and operating loan principal.

Key words: Farm Service Agency, federal farm loan guarantees, principal outstanding models

Selected Paper
Annual Meetings of the American Agricultural Economics Association
Chicago, IL
August 5-8, 2001

Latisha A. Settlage is a Ph.D. student and graduate research assistant in the Department of Agricultural Economics at Purdue University. Bruce L. Dixon and Bruce L. Ahrendsen are professor and associate professor, both in the Department of Agricultural Economics and Agribusiness at the University of Arkansas. Dixon and Ahrendsen are associates in the Center for Farm and Rural Business Finance. Steven R. Koenig is an economist in the Food and Rural Economics Division at USDA’s Economic Research Service. This paper was partially supported by cooperative agreement number 43-3AEM-9-80128 between the Economic Research Service and the University of Arkansas at Fayetteville, by USDA-CSREES agreements numbers 99-34275-7556 and 00-52101-9630, and by the Center for Farm and Rural Business Finance. Copyright by L.A. Settlage, B. L. Dixon, B. L. Ahrendsen and S.R. Koenig. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that his copyright notice appears on all such copies.
Estimating Principal Outstanding Models for Farm Service Agency Guaranteed Loans

The Farm Service Agency (FSA) is the USDA agency responsible for administering government lending programs providing capital to borrowers who do not meet commercial credit standards but still possess the potential to establish financially viable farming operations. Funds for administering the guaranteed loan programs are appropriated by Congress, but the source of the loan principal comes from private lending institutions, primarily commercial banks and the Farm Credit System. FSA guarantees the lender repayment of up to 95 percent of the loan if the borrower defaults. This payment by FSA to the lender is termed a loss claim.

The FSA guaranteed loan program is an important source of funds for production agriculture. In particular, FSA guarantees enable farm borrowers who are unable to obtain credit from commercial sources on their own to do so with a guarantee at reasonable terms and interest rates. Until the mid-1980s, the majority of farm loan assistance provided by FSA was direct loans funded entirely from Congressional appropriations. Over the past fifteen years, federal legislation has been successful in shifting FSA’s lending emphasis from direct to guaranteed loans. In fiscal 1982, only one percent of total FSA loan obligations were guaranteed compared with 72 percent in fiscal 2000 (USDA/ERS, 2001). FSA is no longer able to provide the higher volume of direct loans as in past years because Congress does not appropriate the funds to do so. In addition, the Omnibus Consolidated and Emergency Supplemental Appropriations Act of 1998 increased the caps on borrower indebtedness for both guaranteed farm ownership loans and operating loans from $300,000 and $400,000, respectively, to $700,000 (total indebtedness in the program) making the program more accessible to family sized farm operations (USDA/ERS, 1999).¹

¹ The cap is now adjusted for inflation. For fiscal 2001 the cap on the sum of guaranteed FO and OL loans for a given borrower is $731,000.
The increased emphasis on guaranteed lending and higher guaranteed loan limits combined with reduced farmer deficiency payments stemming from the 1996 Federal Agriculture Improvement and Reform Act have likely placed more demand on the guaranteed loan programs. However, despite its increased utilization in recent years, scant attention has been given to the program in the literature. Three previous studies directly assess the aspects of the program. Koenig and Sullivan profiled the lenders and borrowers who participated in guaranteed farm loan programs in fiscal 1988, while Dixon, Ahrendsen and McCollum examined which characteristics of commercial banks affected the use of guaranteed loans in Arkansas in the early 1990s. A third study by Fultz focused on determining which factors influenced the variation in loss claim rates for the U.S. from 1990 through 1997. Loss claim rates were defined as dollar amount of loss claims divided by loan principal outstanding. While the results shown in Fultz are important in determining variation in the overall loss rates for the program, a more useful prediction (from a policymaking perspective) would be actual loss claim levels.

This study extends Fultz’s research and moves toward a framework to predict loss claim levels several years into the future. The study by Fultz defined loss rates as the level of loss claims during a fiscal year divided by the principal outstanding at the beginning of that fiscal year. Thus, without a forecast of principal outstanding, the Fultz model can only be used for forecasting loss levels for the current year. One way to predict losses is to multiply predicted loss claims rates by the amounts of predicted loan principal outstanding. The estimation of principal outstanding equations is the focus of this paper.

---

2 Principal outstanding on guaranteed loans is not the contingent liability of the loans. Unfortunately, FSA does not record the contingent liability by state. However, as discussed in Fultz, aggregate data at the national level show that principal outstanding and the contingent liability are strongly correlated.
History of the Guaranteed Loan Program

Beginning in the mid-1980s, the FSA guarantee program became a significant part of FSA’s credit programs. Between fiscal 1983 and 1995, loan guarantees rose from 2.3 percent of total FSA annual obligations to a high of 77.5 percent of total annual obligations (USDA/ERS, 2001). Table 1 shows the upward trend in obligation levels throughout the early and mid-1990s. Obligation levels decreased somewhat in fiscal 1997 and 1998, but $1.3 billion in direct loans and $2.6 billion in guaranteed loans were obligated in fiscal 1999 (USDA/ERS, 2001). This was the highest level of lending during the 1990s, as Congress boosted lending authority to assist an ailing farm economy. Total principal outstanding has consistently increased throughout the time period examined in the study with the rate of increase slowing in 1997 and 1998.

The use of loan guarantees is centered in the middle portion of the U.S. with limited use in the western and eastern parts of the country (Figures 2 and 33). Loan guarantee obligations represent additions to principal outstanding in the form of new loans made. In terms of farm ownership (FO) loan principal outstanding among states, Wisconsin ($173.2 million), Iowa ($166.1 million), Minnesota ($111.2 million), Illinois ($105.5 million), and Nebraska ($105.2 million) have the five highest average levels for the 1989-1998 period. Arizona, Nevada, and Rhode Island have the smallest average levels of FO principal outstanding for the study period. Four of the five states with the highest FO principal outstanding averages also have the highest operating loan (OL) principal outstanding averages. The five states with the highest averages are Iowa ($316 million), Texas ($283 million), Nebraska ($213 million), Minnesota ($193 million), and Wisconsin ($189 million). Three states in the Northeast region of the U.S. have the lowest average OL principal outstanding: Delaware, New Hampshire, and Rhode Island.

3 Due to a technical problem, there is not Figure 1.
Conceptual Model

There are two types of guaranteed loans, farm ownership and operating loans. They have different repayment terms and are made for different purposes. FO loans have longer repayment terms and are made for the purchase or improvement of farmland. OL loans are shorter term and provide credit for annual operating expenses or capital purchases. A principal outstanding equation is estimated for each type of loan. Since it is hypothesized that many of the variables that affect the variation in loss claims rates also influence the variation in loan principal outstanding, a set of explanatory variables similar to those considered in Settlage et al. are used in the regression procedure. These variables include characteristics of farm operators, the farm economy, and commercial banks.

The dependent variables in the study are the first difference of FO principal outstanding per farm (FOPRIN) and the first difference of OL principal outstanding per farm (OLPRIN).

Changes in the levels of FO and OL principal outstanding occur by increases or decreases in the amount of loans made or by the amount of principal repaid in a year. Thus variables are needed that predict the level of new loans made as well as variables that explain repayment rates.

The explanatory variables include variables describing farm financial status and characteristics of farm operations. These are debt-to-asset ratio (DAR), net farm income per farmer (NFI), debt coverage ratio (DEBTOV), percentage of state agricultural revenue coming from crops (CREV), average farm size (SIZE), and proportion of farm operators working more than 200 days off-farm (WORK). Variables describing costs of borrowing, government support and the banking characteristics include short- and long-term interest rates (STINT and LTINT), government payments per farm operation in a state (GOV), loan-to-asset ratio of commercial

---

4 Since several of the independent variables considered are ratios, we divide FO and OL principal outstanding by farm numbers in order to normalize them before differencing. The normalizations are required because the sizes of the agricultural economies vary greatly across states. Without normalization, any variables that vary as a function of
banks (LAR) and number of agricultural banks\(^5\) per farm (AGBNK). The data were constructed from various sources including FSA, Economic Research Service (ERS), National Agricultural Statistics Service (NASS), Census Bureau and the Report of Bank Condition and Income Database from the Chicago Federal Reserve Bank. The definitions of the dependent and independent variables are listed in Table 2. A fuller description of the variable construction and sources is given in Fultz.

The observations on the principal levels are generally increasing throughout the time period of the study because annual obligations exceed repayment of principal on existing loans. The differencing of the dependent variables account for most of this increase and forces the model to explain the crucial aspects of predicting loan principal--namely the changes in level from one year to the next. The variables DAR, NFI, and DEBTCOV are included to represent the importance of the financial situation of farm borrowers in explaining variation in principal outstanding. DAR quantifies the solvency position of the typical farm borrower, which is also an indicator of the capacity of the borrower to take on additional debt. The variable NFI measures the profitability of the average farm borrower, another indicator of loan demand, and DEBTCOV measures the ability of the borrower to meet debt payments (liquidity).

Three structural variables (CREV, SIZE, WORK) are included to measure the diversity of farm operators across states in terms of enterprise type, farm size, and off-farm employment. The CREV variable reflects the fact that crop and livestock operations experience different levels of risk and have different credit demands. Moreover, farms of different sizes and the degree of reliance on off-farm income also affect loan demand and ability to repay loans. Two interest rate variables (long and short term interest rates) are included to represent the cost of borrowing, and the size of a state’s agricultural economy would likely explain a majority of the variation in the levels of principal outstanding across states.
government payments are utilized to account for the variation in guaranteed loan principal outstanding due to government financial support. Finally, LAR and AGBNK measure the variation in the change in principal caused by varying propensities of banks lending to agriculture.  

Sign Expectations for Independent Variables

In their study of participants in the guaranteed loan program, Koenig and Sullivan found that guaranteed borrowers had a weighted debt-to-asset ratio of 0.66 compared with a USDA Farm Costs and Return Survey estimate of the weighted debt-to-asset ratio of all farm operators of only 0.15. Not surprisingly, it appears that guaranteed borrowers carry much higher debt-to-asset ratios than the average farm borrower. As the solvency position of farmers weakens, it is expected that less solvent farmers would experience difficulties in obtaining credit from conventional sources. Those farmers would likely turn to FSA guarantees--translating into increased demand for guaranteed principal and less ability to pay back loans early.

While a deterioration of solvency would be expected to vary directly with principal outstanding per farm, profitability and liquidity are expected to exhibit negative relationships. Higher levels of farm income should allow farmers to obtain loans from conventional sources without a guarantee and to pay back existing guaranteed loans, thus reducing the net demand for FSA guarantees. Increased liquidity positions should also bode well for farm borrowers seeking traditional credit and graduating early from using guaranteed loans.

Structural factors in the farm economy may play a role in the levels of guaranteed principal outstanding for the FSA program. Crop farms have more borrowed capital for

---

5 An agricultural bank is defined as a bank having loans made for production agriculture and loans secured by farm real estate that comprise at least 17 percent of total loans made by a bank (in dollar amount).

6 Commercial banks are responsible for making the majority of FSA guarantees (80 percent) (Koenig and Dodson).
operating expenses, and as such their credits are less secure which would lead to a greater
demand for guaranteed loans. Moreover, crop operations are more sensitive to bad weather so
that they can be viewed as higher risks. Thus our prior belief is that as CREV increases,
principal outstanding will also increase. Shepard and Collins hypothesize that increased farm
size results in a need for greater financing needs. However, FSA credit programs are targeted
specifically for family-sized farming operations that are typically in the small to medium size
ranges, so there may be an upper limit on the impact of SIZE. Also, very small farms are not
usually considered as family farming operations either because they receive substantial amounts
of off-farm income and such farms may be used by the farm operator more for recreational or tax
deduction purposes. Koenig and Dodson found that guaranteed loans do not typically go to small
"hobby" farms. We expect SIZE to be positively related to principal outstanding.

The same theoretical justification on the directional relationship between net farm income
and principal outstanding may be applied to the relationship between off-farm income and
principal outstanding. More off-farm income should result in less need for FSA guarantees by
farm borrowers in general and an opportunity for graduation from FSA programs to conventional
credit sources for existing FSA borrowers. Increases in off-farm income could also result in
faster retirement of existing debt. As with net farm income, we expect a negative sign for the
proxy for off-farm income, WORK.

Interest rates are clearly major determinants of loan levels because they represent the
price that borrowers pay to obtain and hold credit. We expect higher interest rates to translate
into lower net demand for FSA loans and thus, a decrease in principal outstanding. While we
expect negative signs, there is also the possibility that increasing interest rates make loans riskier
so that borrowers must secure the protection of a guarantee to obtain a loan. Higher rates can
also be an inducement to pay back existing debt, particularly for variable rate loans as many
guaranteed loans are. So the expected direction of the relationship between interest rates and principal outstanding is indeterminant.

Government payments are an inverse measure of the financial health of the agricultural sector. As the financial health of farms deteriorates, government transfers to farmers rise. In times of high financial stress government payments certainly allow farmers at the financial margin to make debt payments and thus lower principal outstanding. However, the government payments may not be sufficient to overcome the problems associated with the financial stress. If farmers are in a heightened state of financial stress, creditors may require loan guarantees to limit their exposure to risk. Because government payments may assist farmers in making loan payments or indicate general financial problems, the relationship with principal outstanding is indeterminant.

The number of agricultural banks (AGBNK) measures the availability of credit from banks making a significant proportion of their loans to production agriculture. Such banks are likely more aware of agricultural conditions and have probably used FSA guarantees more frequently than non-agricultural banks. However, non-agricultural banks may be more familiar with SBA and other guaranteed loan programs than are agricultural banks. The ratio of total loans made by commercial banks in the state to total assets of commercial banks in the state (LAR) measures lenders’ propensities to invest available funds in loans as opposed to other investments. Dixon, Ahrendsen and McCollum reported that agricultural banks were likely to make more guaranteed loans than non-agricultural banks and found banks with higher loan-to-asset ratios were more likely to have made at least one FSA guaranteed loan over a six-year period. This increased use of guarantees was thought to shield lenders with aggressive lending policies from an otherwise expanded exposure to agricultural loan losses. Since increases in
both of these variables would imply a larger number of guaranteed loans being made, they are hypothesized to have positive relationships with principal outstanding.

Data and Estimation

For each of the variables included in the regression models, the data are observed for each of the 48 contiguous states for each year, 1989 through 1998. Observations for eight of the 48 states in the sample were deleted due to their relatively low level of guaranteed loan activity. The eight states deleted from the sample were Rhode Island, New Hampshire, Delaware, Connecticut, Nevada, New Jersey, Maine and Arizona as was also done in Settlage et al. As argued in Fultz, their inclusion might lead to spurious results since the loan activity in these states was so low. The reduced sample contains 360 observations (40 states across nine years).

The years of the dependent variables in this study are fiscal years ending on September 30. Several of the independent variables\(^7\) are computed on a calendar year basis. Since the calendar year includes one quarter (the fourth) that is not included in the current fiscal year, all calendar year variables are lagged one year in order to avoid having the future explain the present. All dollar figures were deflated using chain type price indexes for gross domestic product reported in *The Economic Report of the President* with 1992 as the base year.\(^8\) Although the FSA data are reported on a fiscal year basis, they are deflated using the calendar year gross domestic product deflator.

As discussed previously, a separate regression model is estimated for both types of guaranteed loans: FO and OL. The same explanatory variables are contained in each model with the exception of interest rates. Short-term interest rates are included in the OL model,

---

\(^7\) Variables reported by calendar year include DAR, NFI, DEBTCOV, CREV, WORK, SIZE, GOV, and AGBNK.

\(^8\) LTINT and STINT are nominal rates.
while long-term interest rates are included in the FO model. The difference in interest rate variables is due to the differences in the repayment terms for the two different types of loans.

Given the differences in the term structures and purposes of the two types of loans being made and the volumes of the loans made, it is to be expected that the coefficients of the two models will differ in magnitude and significance level. Pooling the observations into one model would likely result in a specification error. It is unlikely that the two dependent variables will respond identically to a given variable so that coefficients would not be homogeneous across the two samples.

The data are a time series of cross sections (panel in nature). A substantial literature exists on the appropriate estimation of panel data models. Under very restrictive assumptions the components of the coefficient vector could be estimated by ordinary least squares (OLS). However, this would not be appropriate for the application at hand because of the heterogeneity across states in the principal outstanding data. Such heterogeneity clearly calls for a shifting intercept for each state, and a fixed effects model can accommodate this (Greene). In addition, there is likely to be heteroscedasticity across states so this is allowed for in the model. Even though the time series are relatively short for each state—nine for each state—autocorrelation is a possibility. However, the pooled first order autocorrelation coefficients were less than 0.15 for both models so the time series were assumed to be non-autocorrelated. Hence estimation is by feasible generalized least squares.9

An alternative specification, if the coefficient vector is thought to be heterogeneous across states, would be seemingly unrelated regression (SUR) model. However, for the particular application in this study, a SUR model is not estimated because the number of cross-sectional

---

9 The fixed effects essentially model the long-term mean variations in differences in principal per farm from state-to-state. An alternative method of modeling would be to include a lagged dependent variable which might preclude the
units (40) greatly exceeds the number of years of annual observations (9). Thus, the empirical estimate of the SUR error term covariance matrix would be singular.

Results and Analysis

FO Model

The estimated coefficients of the FO principal outstanding model are displayed in Table 3. The coefficient of determination for the estimated FO model is 0.42, reasonable for a cross-sectional, time series-model, particularly considering the dependent variable is in first differences. Of the ten continuous explanatory variables in the FO model, coefficients of four variables (DAR, CREV, WORK and LTINT) were statistically significant the 0.01 level. Only GOV was nearly significant at the .05 level (p-value = .06) and the remaining variables were not significant at any of the conventional levels of statistical significance.

The positive sign on DAR shows that as farmers in the state have a greater debt relative to assets, FO principal outstanding increases. As farm operators face solvency problems, they are likely to be less able to obtain conventional loans and may turn to FSA guarantees. This behavior translates into increases in guaranteed principal outstanding, so the positive relationship agrees with expectations.

The coefficient on CREV is positively signed. This indicates that as a higher proportion of revenues are obtained from the sale of crops within a state, FO principal outstanding increases. This reflects that crop farmers appear to have a greater need for FO loans than livestock producers. As hypothesized earlier, crop farms have less secure capital and are more susceptible to weather events so that creditors are more likely to demand the security of guaranteed loans.

need for normalizing and first differencing the dependent variable. This presents a different set of estimation problems, see Blundell and Bond.
The negative WORK coefficient indicates that as the proportion of farm operators working off the farm more than 200 days per year increases, FO principal outstanding decreases. A priori, we hypothesized a negative sign for this variable. As a higher percentage of farm operators are employed off the farm, the extra income received from those off-farm sources may have a stabilizing effect on overall farm household income. Thus, those farm operators are better able to support conventional sources of credit and to pay back existing debt. Traditional lenders observing potential borrowers with a source of supplemental income possibly are more likely to extend credit without a guarantee, since lenders perceive the borrower’s repayment potential more favorably than without an off-farm source of income. This increase in debt repayment capacity results in a decrease in guaranteed loan principal outstanding as borrowers graduate to conventional credit sources or credit needs decline.

Long-term interest rates have a positive sign, contrary to our earlier expectations. It should be noted that long-term rates were generally declining during the sample period, so they also fill the role of a trend variable. As the data in Table 1 show, FO principal outstanding increased sharply, in percentage terms, in the early part of the sample period. It is likely that lenders perceived making higher interest rate loans as being more risky, and they required guarantees as further assurance. Thus the normal effect of lower interest rates stimulating loan demand is not present, or at least overshadowed by the risk effect.

The government payments coefficient is positive and significant at the 0.03 level on a one-sided test. Government payments to farmers often occur when it is anticipated that lower net farm income from farm marketings will happen. This result seems to suggest that government payments may soften the blow to farmers from decreases in net farm income from less farm marketings, but government payments do not fully offset the reduction in net farm income from farm marketings. Loans may be needed to make up the difference, and loan guarantees may be
required by lenders to limit their exposure to risk. It should also be pointed out that while
government payments affect other variables like DAR and NFI, the correlation coefficient
between GOV and the other independent variables is less than 0.5 for every independent variable
except AGBNK.

In order to compare the effects of the explanatory variables on FOPRIN without
encountering differences in units among the variables, elasticities were computed (Table 3). Of
the statistically significant variables in the FO model, it appears that WORK is the most
important variable in explaining variation in changes in FO loan principal outstanding. For a one
percent increase in the proportion of farm operators working off the farm greater than 200 days
per year, the change in FO loan principal outstanding decreases by almost 14 percent. The other
three statistically significant variables are all elastic though less than 3.0. Government payments,
which were marginally significant, are inelastic. It should be noted that these are elasticities for
changes in the loan principal and would be considerably less in absolute value if applied to
principal overall.

OL Model

Results for the OL principal outstanding model are shown in Table 4. The coefficient of
determination of 0.24 indicates that the estimated model has a good fit but not as strong as for
FO loans. This is not surprising since OL loans are more volatile as can be seen in the aggregate
annual data in Table 1. Eight of the ten continuous explanatory variables are significantly
different from zero at the 0.02 level. Only the variables DEBTCOV and GOV are insignificant.
The lack of significance of GOV cannot be attributed to its correlation with AGBNK. Even
when AGBNK is omitted, GOV is insignificant. All variables significant at 0.02 and higher in
the FO model are also significant in the OL model (DAR, CREV, WORK and interest rates as
represented by STINT).
Similarly to the FO model, DAR has a significant impact on OL principal outstanding. As discussed previously, Koenig and Sullivan examined the profiles of guaranteed loan borrowers in the late 1980s and found that guaranteed borrowers tended to have significantly higher debt-to-asset ratios than the average farm borrower. The results of this study show that as debt-to-asset ratios rise, guaranteed OL principal outstanding increases as well. Obviously banks and the FCS will not make loans in situations where the borrower is not sufficiently solvent, so they may require borrowers with higher debt-to-asset ratios obtain FSA guarantees before making loans.

The negative and significant sign on the NFI coefficient implies an inverse relationship between net farm income and OL guaranteed principal outstanding as expected. Higher net farm income enables existing FSA guaranteed borrowers repay their debt. Given their successful guarantee experience, they may graduate to traditional sources of credit without guarantees to finance their operations. At least for the time period in the study, it seems that increases in income were sufficient to make graduation feasible for a large enough group of FSA borrowers to result in decreases in OL guaranteed principal outstanding. Also, fewer borrowers would need to have their loans guaranteed in the first place given their increased profitability.

Surprisingly, CREV has a negative sign. It is positive in the FO model. It could be that for short term loans lenders react to the credit needs of crop-based borrowers by not making as many guaranteed loans because even with the guarantee, crops are perceived as too risky or lenders in regions with a high proportion of crop operations do not want to be over-weighted in crop loans for the short term. Nonetheless, the negative sign is perplexing.

As in the FO model, the coefficient for WORK is significant and negative. This result implies that off-farm work has a significant impact on FSA principal outstanding. As the proportion of farmers spending more time working off the farm increases, it is likely that more
FSA borrowers are able to successfully repay guarantees and graduate to conventional credit sources. This results in a decrease in OL principal outstanding.

As in the FO models, interest rates (STINT) are significant and of the same sign as in the FO model. While somewhat unexpected, the positive sign on STINT can be justified for the same reasons as in the FO model. Higher borrowing costs result in lenders wanting to lower the risk of their loans. Also, as interest rates rise, lenders could help offset the impact of higher interest costs by using interest rate assistance which can lower the rate to the borrower by 400 basis points. However, the data on interest rate assistance indicate rising levels of assistance vouchered per loan over time when interest rates were declining. This option is not available for FO loans.

Farm size appears to be a negative factor in growth of OL loans. While not anticipated, it could be explained by the greater efficiency of larger farms or the fact that as farms get bigger, they do not find the guaranteed loans useful, especially since the old caps of $300,000 for FO loans and $400,000 OL loans were in place for the sample period. These caps might explain most of the reason for the negative sign. With the larger caps, it will be interesting to see how size might affect use although for truly large farms, the caps still make the guarantees a minor consideration. Also, very large farms may not be eligible for FSA guaranteed loans since they may not be considered family-sized farms.

The significant, positive coefficient for LAR is in accordance with expectations. As banks increase their exposure to loss, they desire greater protection. As noted earlier, Dixon, Ahrendsen and McCollum found that banks with higher LAR in Arkansas were more likely to make guaranteed loans. The negative sign on AGBNK is unexpected. Agricultural banks most likely make more use of agricultural loans than non-agricultural banks but when there are fewer agricultural banks per farmer, this might force more operators to do business with non-
agricultural banks. These banks are probably less familiar with agricultural loans and could therefore be more likely to use loan guarantees.

As with the FO model, elasticities were computed for the explanatory variables included in the estimated model (Table 4). Like the FO model, the elasticities seem inordinately large, even more so than in the FO model. The explanation is that these elasticities are in relation to the changes in principal levels and not the levels themselves. As in the FO model, WORK is the most important variable in explaining variation in changes in principal outstanding with an elasticity of –39. All of the other significant variables are highly elastic with respect to changes in the change in principal. The obvious impact of off-farm sources of income points to the larger issue of how farm families are so strongly dependent on non-farm income sources and that this fact is also affecting the financing of production agriculture.

Summary

The purpose of this study was to identify which characteristics of farm operators, the farm economy and commercial banks are most important in determining the variation in the levels of FSA guaranteed farm ownership (FO) and operating loans (OL) principal outstanding in the U.S. for 1990-1998. A feasible generalized least squares estimator with fixed effects was used to estimate two change-in-principal outstanding equations, one for FO loans and one for OL loans. The estimator corrects for heteroscedasticity among the states.

Financial characteristics of farm operators and various factors of the farm economy are important in predicting FSA guaranteed loan principal outstanding for both FO and OL loans. Results indicate that increases in debt-to-asset ratios lead to greater levels of FO loan principal outstanding. Also, an off-farm income proxy, enterprise type variable and long-term interest rates are significant. Results of the model indicate that for a one percent increase in the proportion of farm operators working off the farm more than 200 days per year, changes in
guaranteed FO principal decrease by about 14 percent. This elasticity is for the first difference of principal outstanding and not for total loan principal outstanding.

The off-farm income proxy also is the most important financial factor in determining OL principal outstanding. In addition, debt-to-asset ratios, enterprise type, and short-term interest rates are significantly related to OL principal as well as other characteristics of the farm economy and commercial bank characteristics. While only four of ten variables in the FO model were highly significant, eight of ten were significant for the OL. This might be due to OL’s shorter length of loans. A one percent increase in the off-farm income proxy was found to lead to a 39 percent decrease in changes in OL principal outstanding.

The results of this study have implications for policy decisions. Given that FSA must submit annual budget proposals to Congress, the results of the models would be helpful in determining the budget needed for new loans in the coming fiscal year. The significance of debt-to-asset ratio in both the FO and OL models indicates that there is a strong correlation between the debt position of farm operators and the amount of guaranteed loans outstanding. In general, changing government payments were not highly important in either model. Fiscal 1999 was a financially stressing year for many farmers, particularly in the Southeast, and the Southern and Northern Plains regions of the U.S. As a result, guaranteed loan activity increased dramatically from $1.4 billion in fiscal 1998 to $2.7 billion in fiscal 2000 (USDA/ERS, 2001). This strong correlation is likely to continue to be important for FSA guaranteed loan programs in the future.

One final point of interest is the significance of off-farm income in both models. Increases in the off-farm variable were found to lead to decreases in both FO and OL guaranteed loan principal outstanding. As expected, supplemental income to farm operators from off-farm sources not only allows existing FSA borrowers to successfully repay guarantees and graduate to
traditional credit sources such as commercial banks and the Farm Credit System, but it also likely decreases annual demand for FSA guarantees.
Figure 2. Guaranteed FO Principal Outstanding in the U.S.
Fiscal 1989-1998, Average

Figure 3. Guaranteed OL Principal Outstanding in the U.S.
Fiscal 1989-1998, Average
<table>
<thead>
<tr>
<th>Variable</th>
<th>FO obligations</th>
<th>OL obligations</th>
<th>Total obligations</th>
<th>FO principal</th>
<th>OL principal</th>
<th>Total principal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>297.2</td>
<td>877.5</td>
<td>1,174.7</td>
<td>769.0</td>
<td>2,367.0</td>
<td>3,136.0</td>
</tr>
<tr>
<td>1990</td>
<td>348.1</td>
<td>907.6</td>
<td>1,255.7</td>
<td>1,283.1</td>
<td>2,770.0</td>
<td>4,053.1</td>
</tr>
<tr>
<td>1991</td>
<td>359.9</td>
<td>1,027.3</td>
<td>1,387.2</td>
<td>1,516.1</td>
<td>2,936.7</td>
<td>4,452.8</td>
</tr>
<tr>
<td>1992</td>
<td>451.1</td>
<td>1,107.6</td>
<td>1,558.7</td>
<td>1,813.9</td>
<td>3,055.2</td>
<td>4,869.1</td>
</tr>
<tr>
<td>1993</td>
<td>444.4</td>
<td>1,001.0</td>
<td>1,445.4</td>
<td>2,089.2</td>
<td>2,910.6</td>
<td>4,999.8</td>
</tr>
<tr>
<td>1994</td>
<td>540.2</td>
<td>1,298.7</td>
<td>1,838.9</td>
<td>2,322.9</td>
<td>3,057.8</td>
<td>5,380.8</td>
</tr>
<tr>
<td>1995</td>
<td>558.2</td>
<td>1,377.0</td>
<td>1,935.2</td>
<td>2,584.0</td>
<td>3,318.6</td>
<td>5,902.6</td>
</tr>
<tr>
<td>1996</td>
<td>534.0</td>
<td>1,314.6</td>
<td>1,848.6</td>
<td>2,794.8</td>
<td>3,538.9</td>
<td>6,333.6</td>
</tr>
<tr>
<td>1997</td>
<td>521.5</td>
<td>1,036.0</td>
<td>1,557.5</td>
<td>2,971.4</td>
<td>3,502.2</td>
<td>6,473.6</td>
</tr>
<tr>
<td>1998</td>
<td>419.8</td>
<td>1,004.2</td>
<td>1,424.0</td>
<td>3,023.6</td>
<td>3,475.1</td>
<td>6,498.7</td>
</tr>
</tbody>
</table>

* Obligations and principal outstanding are reported in millions of dollars. Both are nominal.

Table 2. Definitions of Dependent and Independent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variables:</td>
<td></td>
</tr>
<tr>
<td>FOPRIN</td>
<td>FO principal outstanding divided by number of farm operations first differenced ($1,000/operation).</td>
</tr>
<tr>
<td>OLPRIN</td>
<td>OL principal outstanding divided by number of farm operations first differenced ($1,000/operation).</td>
</tr>
<tr>
<td>Independent Variables:</td>
<td></td>
</tr>
<tr>
<td>DAR</td>
<td>Debt-to-asset ratio.</td>
</tr>
<tr>
<td>NFI</td>
<td>Net farm income divided by number of farm operations ($1,000/operation).</td>
</tr>
<tr>
<td>DEBTCOV</td>
<td>Debt coverage ratio ((net cash income + interest) / (interest + principal)).</td>
</tr>
<tr>
<td>CREV</td>
<td>Proportion of state farm revenues generated by crop sales.</td>
</tr>
<tr>
<td>SIZE</td>
<td>Land in farms with annual sales greater than $10,000 divided by number of farm operations with annual sales greater than $10,000 (Acres).</td>
</tr>
<tr>
<td>WORK</td>
<td>Proportion of farm operators in the state working more than 200 days off the farm.</td>
</tr>
<tr>
<td>LTINT</td>
<td>Interest rate charged by commercial banks on long-term farm real estate loans (% / 100).</td>
</tr>
<tr>
<td>STINT</td>
<td>Interest rate charged by commercial banks on short-term non-real estate farm loans (% / 100).</td>
</tr>
<tr>
<td>GOV</td>
<td>Direct government payments per farm operation ($1,000/operation).</td>
</tr>
<tr>
<td>LAR</td>
<td>Ratio of total loans made by commercial banks to total assets of commercial banks.</td>
</tr>
<tr>
<td>AGBNK</td>
<td>Number of agricultural banks per farm operation.</td>
</tr>
</tbody>
</table>

The subscripts “it” are suppressed for clarity, but each variable is defined for state i and year t.

Note: All variables measured in dollars are deflated by price indexes for gross domestic product (1992 = 100).
Table 3. Regression Statistics of Farm Ownership Loan Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std error</th>
<th>t-ratio</th>
<th>p-value</th>
<th>Elasticity$^+$</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAR$^*$</td>
<td>1.77</td>
<td>0.40</td>
<td>4.40</td>
<td>0.00</td>
<td>2.52</td>
</tr>
<tr>
<td>NFI</td>
<td>-3.63E-04</td>
<td>9.84E-04</td>
<td>-0.37</td>
<td>0.71</td>
<td>-0.07</td>
</tr>
<tr>
<td>DEBTOCV</td>
<td>-5.87E-03</td>
<td>1.56E-02</td>
<td>-0.38</td>
<td>0.71</td>
<td>-0.13</td>
</tr>
<tr>
<td>CREV$^*$</td>
<td>0.58</td>
<td>0.14</td>
<td>4.29</td>
<td>0.00</td>
<td>2.45</td>
</tr>
<tr>
<td>WORK$^*$</td>
<td>-4.52</td>
<td>0.62</td>
<td>-7.28</td>
<td>0.00</td>
<td>-14.18</td>
</tr>
<tr>
<td>SIZE</td>
<td>-5.68E-05</td>
<td>5.36E-05</td>
<td>-1.06</td>
<td>0.29</td>
<td>-0.52</td>
</tr>
<tr>
<td>LTINT$^*$</td>
<td>1.81</td>
<td>0.47</td>
<td>3.83</td>
<td>0.00</td>
<td>1.60</td>
</tr>
<tr>
<td>GOV$^{**}$</td>
<td>7.87E-03</td>
<td>4.14E-03</td>
<td>1.90</td>
<td>0.06</td>
<td>0.29</td>
</tr>
<tr>
<td>LAR</td>
<td>0.18</td>
<td>0.13</td>
<td>1.36</td>
<td>0.17</td>
<td>1.00</td>
</tr>
<tr>
<td>AGBNK</td>
<td>-12.88</td>
<td>30.81</td>
<td>-0.42</td>
<td>0.68</td>
<td>-0.17</td>
</tr>
</tbody>
</table>

Coefficient is statistically significant at the 0.01 level.
** Coefficient is statistically significant at the 0.05 level.
*** Coefficient is statistically significant at the 0.10 level.
† Elasticity at the means.
Coefficient of determination is 0.42. State fixed effects are omitted due to space considerations.

Table 4. Regression Statistics of Operating Loan Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std error</th>
<th>t-ratio</th>
<th>p-value</th>
<th>Elasticity$^+$</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAR$^*$</td>
<td>1.75</td>
<td>0.55</td>
<td>3.20</td>
<td>0.00</td>
<td>8.36</td>
</tr>
<tr>
<td>NFI$^{**}$</td>
<td>-3.59E-03</td>
<td>1.58E-03</td>
<td>-2.28</td>
<td>0.02</td>
<td>-2.34</td>
</tr>
<tr>
<td>DEBTOCV</td>
<td>-1.94E-02</td>
<td>2.29E-02</td>
<td>-0.85</td>
<td>0.40</td>
<td>-1.41</td>
</tr>
<tr>
<td>CREV$^{**}$</td>
<td>-0.46</td>
<td>0.20</td>
<td>-2.36</td>
<td>0.02</td>
<td>-6.56</td>
</tr>
<tr>
<td>WORK$^*$</td>
<td>-3.71</td>
<td>0.93</td>
<td>-4.01</td>
<td>0.00</td>
<td>-39.07</td>
</tr>
<tr>
<td>SIZE$^*$</td>
<td>-2.53E-04</td>
<td>9.78E-05</td>
<td>-2.59</td>
<td>0.01</td>
<td>-7.74</td>
</tr>
<tr>
<td>STINT$^*$</td>
<td>2.59</td>
<td>0.53</td>
<td>4.84</td>
<td>0.00</td>
<td>7.12</td>
</tr>
<tr>
<td>GOV</td>
<td>-1.61E-03</td>
<td>6.37E-03</td>
<td>-0.25</td>
<td>0.80</td>
<td>-0.20</td>
</tr>
<tr>
<td>LAR$^*$</td>
<td>0.56</td>
<td>0.22</td>
<td>2.56</td>
<td>0.01</td>
<td>10.34</td>
</tr>
<tr>
<td>AGBNK$^{**}$</td>
<td>-112.10</td>
<td>46.84</td>
<td>-2.39</td>
<td>0.02</td>
<td>-5.02</td>
</tr>
</tbody>
</table>

Coefficient is statistically significant at the 0.01 level.
** Coefficient is statistically significant at the 0.05 level.
*** Coefficient is statistically significant at the 0.10 level.
† Elasticity at the means.
Coefficient of determination is 0.24. State fixed effects are omitted due to space considerations.
References


