Suggested Citation: Long, D., Ahrendsen, B. L., Dixon, B. L., and Dodson, C. B. (2016) Modeling duration of FSA operating and farm ownership loan guarantees. Agricultural Finance Review, 76(4), 426-444. https://doi.org/10.1108/AFR-04-2016-0036

Modeling Duration of FSA Operating and Farm Ownership Loan Guarantees

Deng "Dede" Long[1]
Applied Economics, Oregon State University, Corvallis, Oregon, USA

Bruce L. Ahrendsen
Bruce L. Dixon
University of Arkansas Division of Agriculture, Fayetteville, Arkansas, USA, and

Charles B. Dodson
Farm Service Agency, US Department of Agriculture, Washington, District of Columbia, USA

ABSTRACT

Purpose – To identify determinants of feasible outcome events (expired with no loss, settled for loss, still performing) and time to event of Farm Service Agency (FSA) operating and farm ownership loan guarantees.

Design/methodology/approach – Data on 19,126 FSA guaranteed loans, which were made by various lenders to farmers who have limited ability to obtain loans from normal sources without the Federal guarantee, were collected. Cox proportional hazards models for operating loans and farm ownership loans are estimated to identify borrower characteristics, loan characteristics, lender types, and farm and macroeconomic environment factors that influence guarantee outcomes.

Findings – Loans with different characteristics (loan amount, loan term, lender type, region originated) and assistance programs (Beginning Farmer, Interest Assistance) have differing guarantee outcomes. Contemporaneous variables, in particular delinquency status, have a significant impact on guarantee outcomes.

[1] The author's current contact: Dede Long, Assistant Professor, Department of Economics, California State University Long Beach. Dede.Long@csulb.edu.

Research limitations/implications – All loans were originated in calendar years 2004 and 2005. Since farm ownership loans may have as long as 40 year terms, results are not as robust for farm ownership loans as for operating loans.

Practical implications – Different loan characteristics and macroeconomic conditions significantly influence the occurrence of possible guarantee outcomes and time to the outcomes.

Originality/value – Guaranteed loans are the primary method of government credit assistance to U.S. farm operators. Data on individual borrowers have been difficult to obtain for much of the life of the guaranteed program because loan applications are held privately. This study provides insight on how various factors drive guarantee performance which is useful to policy makers trying to increase guaranteed loan program efficiency.

Key words: Agricultural credit, Competing risks, Cox proportional hazards, Farm Service Agency, Guaranteed loan

Article Type: Research paper

Introduction

Federal credit programs represent one of the more noteworthy governmental assistance programs for U.S. farmers. As an agency of the U.S. Department of Agriculture (USDA), the Farm Service Agency (FSA) provides both direct and guaranteed non-governmental loans to farmers who cannot obtain credit from standard commercial sources at competitive rates and terms (Dodson and Koenig, 2006). In addition, FSA specifically targets loans to beginning farmers as well as members of socially-disadvantaged (SDA) groups, which include women and racial-ethnic minorities.

Direct and guaranteed loans function under different mechanisms. Direct loans are originated and serviced by FSA, whereas guaranteed loans are originated and serviced by private, commercial lenders but guaranteed against loss by FSA for up to 95 percent of loan principal and interest. Direct loans are available to farmers who cannot obtain credit at competitive rates even with the presence of an FSA guarantee. Guaranteed loans are intended for farmers who can acquire credit terms with a guarantee and are thereby expected to have lower risks and costs for the government than direct loans. FSA guarantees include both real estate or farm ownership (FO), and nonreal estate or farm operating (OL) loan programs.

The combination of relatively high direct loan default and loss rates with fewer federal budget resources led to a policy shift from direct loans to guaranteed loans (Ahrendsen *et al.*, 2005). A succession of farm bills has emphasized this shift. The 1996 Federal Agriculture Improvement and Reform Act enabled FSA guaranteed loans to take a more important role than previously. Under the 1996 farm bill, direct loan allocations were shifted to guaranteed loans, and the interest rate subsidy, or interest assistance (IA), on certain guaranteed loans was increased to 4 percentage points for qualifying borrowers. The Farm Security and Rural

Investment Act of 2002 maintained the lending authority of the guarantee increase from the 1996 farm bill. The 2002 farm bill made IA authority permanent for guaranteed operating loans. The Food, Conservation, and Energy Act of 2008 increased the maximum indebtedness per direct OL and FO loan program from $200,000 to $300,000 each, whereas the loan limit for total guaranteed OL and FO loan indebtedness has been adjusted annually since fiscal year 1999 and is $1,399,000 for fiscal year 2016 (USDA, FSA, 2015). The Agricultural Act of 2014 strengthens the emphasis toward guaranteed loans by removing the limitation on the number of years a borrower can receive loans guaranteed by FSA.

With this series of policy shifts, the share of FSA credit provided through guaranteed programs increased to 75 percent by 2004 (Dodson and Koenig, 2006). Even though the share of FSA credit provided through guaranteed programs has declined in more recent years, guaranteed programs remain the primary source of FSA credit, averaging 61 percent of the total for fiscal years 2010-2015 according to FSA data. Besides the obvious risk-reducing feature of using the FSA guaranteed loan program, lending institutions may further benefit by reselling the guaranteed loans in the secondary market through the Federal Agricultural Mortgage Corporation (Farmer Mac). This enhances a bank's ability to expand lending activities.

Since guaranteed loans are the major government tool for providing agricultural loans and the program is growing, identifying the factors affecting the probability of various guarantee outcomes—time-to-expiration or time-to-default—is useful information to both policy makers and private sector lenders. In particular, it helps evaluate loan program effectiveness, generate strategies to reduce program risk, and perform due diligence on rating loan applicants.

This study models possible loan guarantee outcomes and the time to outcome events. Cox competing risks regression models are estimated using quarterly data to predict loan guarantee

outcomes. The objectives are twofold: (1) identify demographic, macroeconomic variables, and farm financial characteristics together with loan characteristics and lender types that have impacts on the relative likelihood of guaranteed loan outcomes, *i.e.*, guarantee expiration or loss claim, which is a payment made by FSA to a lender to cover losses on the guaranteed portion of a loan; and (2) assess the likelihood of one loan outcome relative to another and the effects of these variables on the time to outcome events.

Results have implications for federal farm credit policy. First, knowing borrower, loan, and lender characteristics related to guaranteed loan outcomes and durations will help FSA better predict future loan durations and outcomes. Second, since the models include variables reflecting the business cycle, findings are useful for indicating the influence of broad economic changes on loan guarantee outcomes**.** Policy makers and lenders can use the findings to better forecast payment guarantee performance and enhance program efficiency.

Related studies

Previous studies on guaranteed loans have focused on examining factors influencing banks' decisions on participating in guaranteed loans programs (Settlage *et al.*, 2006; Ahrendsen *et al.*, 2011; Dodson, 2014), while others have focused on identifying factors affecting volume of loan guarantees, loss claims, and principal outstanding for both OL and FO loans (Dixon *et al.*, 1999; Settlage *et al.*, 2001a; Settlage *et al.*, 2001b). The latter are more relevant to this analysis and merit further discussion.

Dixon *et al.* (1999) examine factors that indicate whether a bank has a loss claim given that they have originated guaranteed loans. They estimate a "double hurdle" model with a selection equation to model if the bank had a loss claim(s) and a regression equation to model the

factors affecting loss claim volume. They find interest rates and level of involvement in guaranteed lending to affect the likelihood of a loss claim and changes in farm income and age of the guaranteed OL loan outstanding balance to affect guaranteed OL loan loss claim volume.

Settlage *et al.* (2001a) model bank ratios of loss claims paid to principal outstanding aggregated at the state level for forty states for OL loans and thirty states for FO loans as the dependent variable for both OL and FO loans. State-level farm financial characteristics, state of the farm economy and interest rates have a significant impact on loss claim ratios.

Settlage *et al.* (2001b) estimate principal outstanding regression models for guaranteed FO loans and OL loans, respectively, using state level data. Results show farm operator financial characteristics and farm economy indicators have major impacts on the principal outstanding for both FO and OL guaranteed loans. Enterprise type and interest rates have significant effects on principal outstanding loan volume.

The Dixon *et al.* and Settlage *et al.* studies aggregate data at the bank or state level and, therefore, do not address individual loans. Nor do they shed any light on the probability of possible outcomes and time to outcomes. Dressler and Stokes (2010) applied Cox proportional hazards models to a sample of Farm Credit System mortgage loans to dairy farmers in Pennsylvania and West Virginia. They found initial interest rates, and time-varying debt-to-asset ratios and FICO scores are significant indictors of default risk. Like Dressler and Stokes (2010), Dixon *et al.* (2011) estimate a competing risks, Cox proportional hazards model on a sample of FSA direct, farm operating loans. Proportional hazards models estimate the relative probability of possible outcomes. The results in their study indicate that loan characteristics, borrower attributes, and macroeconomic variables have significant impacts on loan outcome types and time to outcome.

Methods

The Cox proportional hazards regression model with competing risks is employed to estimate the determinants of possible loan guarantee outcomes. The method is presented in more detail in Kalbfleisch and Prentice (2002), Dressler and Stokers (2010), and Dixon *et al.* (2011). As opposed to conventional regression methods, duration models accommodate censored observations and time varying variables routinely, which is relevant for this study.

In the analysis presented here, censoring occurs when the outcome of a particular loan guarantee is not observed as of the end of the study period. The statuses of guaranteed loans originated in calendar years 2004 and 2005 were tracked on a quarterly basis through the second quarter in calendar year 2012 (June 30, 2012). Loan guarantees which were still in effect at that time, but had neither expired nor had a loss claim, are right censored since expiration or loss claim had not occurred. Using Cox proportional hazards models requires the censoring to be uninformative, which means no information about the censored observations can be revealed from the occurrence of censoring (Allison, 2010). Given that all loan guarantees are censored at the same date and have approximately the same duration if they are still performing, *i.e.*, if the guarantees are still in effect, there is no particular reason to suspect that censoring is informative.

A competing risks approach is required because a loan guarantee can terminate in one of two, mutually exclusive ways: termination without a loss claim or termination with a loss claim. The occurrence of one of these events prevents the other competing event from happening. Therefore, a competing risks, Cox proportional hazard model becomes appropriate and is estimated as a specific hazard for each potential outcome.

A semi-parametric hazard function in exponential form may be written as

$$h(t) = \lambda_0(t)\exp(\alpha+\beta_1 x_1+\beta_2 x_2+\cdots+\beta_k x_k),$$

where $\lambda_0(t)$ is arbitrary and not estimated. If the outcome event is expired with loss, a positive β indicates that an increase in x increases the probability of loan default and decreases loan survival time**.** Different from the parametric model, the Cox proportional hazards model does not require making any assumptions about the shape of the base line hazard function ($\lambda_0(t)$) or the distribution of the time of occurrence for some event, T.

Following Dixon *et al.* (2011), the partial likelihood of an observation ending (J) by ending event j out of m ending events is:

$$P(J = j|x_t) = \frac{\exp(\alpha_j + \beta_j' x_t)}{\exp(\alpha_1 + \beta_1' x_t)+\ldots+\exp(\alpha_m + \beta_m' x_t)}$$

The Cox competing risks model parameters can be estimated by partial maximum likelihood method (Kalbfleisch and Prentice, 2002). For the purposes of parameter identification, the constant term of one of the event outcomes, the loss claim outcome in this instance, is restricted to be zero.

Model specification

The dependent variable is duration of the loan guarantee until an outcome is realized, *i.e.*, the guarantee expires with or without a loss claim. Guarantee duration is hypothesized to be a function of farmer repayment ability, loan and lender characteristics, and overall economic conditions. Time is measured in number of quarters from the date of loan obligation until the guarantee either expired-with-no-loss-claim (EXP) or expired-with-loss-claim (LOSS). Since OL and FO loans have different expected loan durations, separate models are estimated for each.

Two individual hazard functions for expired-with-no-loss and expired-with-loss-claim are estimated for each of the two loan models. Each hazard function measures the risk of ending

from a particular cause—EXP or LOSS—given the loan is still performing at a given point in time. If a guarantee is still in effect as of June 30, 2012, it is considered as still performing, *i.e.*, the observation is censored. Two types of independent variables are included: (1) variables measured at the time of loan origination and (2) economic environment variables that vary over time and the delinquency status of the loan over time. There are three subgroups of variables measured at loan origination: (1) borrower characteristics, (2) loan characteristics, and (3) lender characteristics. Previous duration and agricultural finance studies suggest contemporaneous variables could indicate economic conditions that influence borrower payment ability and should be included as indicators that affect loan outcomes (Dixon *et al.*, 2007; McFadden, 2009; Dixon *et al.*, 2011). Table I provides descriptions of variables used in the model specification.

Variables chosen to reflect borrower characteristics include: age (Age), marital status (Married), borrower gender (Female), borrower race (NonWhite), borrower region, and prior involvement with FSA loans (BrwHist). The borrower region was defined as the 10 USDA Farm Production regions (USDA, Economic Research Service (ERS), 2010). Distinct regional differences in FSA loan programs, as shown in previous studies, would suggest regional differences in loan duration (Dodson and Koenig, 2003; Ahrendsen *et al.*, 2011).

Variables chosen to reflect loan characteristics include: loan obligation request amount (LoanAmnt), whether the loan was delinquent or not in a given quarter during the 34 reported quarters (DEL). DEL is included in the models as a time varying variable since the delinquency status changes over time. Dummy variables are created for the loan assistance type to indicate if a loan is made to a beginning farmer (BF), both a beginning farmer and a socially-disadvantaged farmer (BFS),[2] if the loan receives interest assistance (IA), or if the loan is a line-of-credit (LOC)

[2] Socially-disadvantaged farmer (SDA) is not included to avoid potential collinearity problems since both NonWhite and Female variables are included in the models.

loan. Interest assistance (IA) and line of credit (LOC) are only included in the OL loan model since they are only relevant for OL loans. Interest type (IntrType) indicates if the loan has a fixed or variable interest rate and interest rate (IntrRate) is the interest rate at loan origination.[3] Loan term (LoanTerm) is computed by subtracting the quarter number of loan closing date from the quarter number of maturity date. By including the loan term (LoanTerm) variable, the hypothesis of whether the guarantee length influences guarantee outcome may be tested.

In the initial model estimation, 16 percent of the observations did not report marital status, while nearly one-third of the observations were missing values for birth date used to compute age variable (Age). For models estimated with and without the dummy variable for marital status (Married), the parameter estimates of the other independent variables differed negligibly. Excluding marital status (Married) enables estimation with a larger sample. Since age (Age) and beginning farmer (BF) variables were found to be collinear, beginning farmer (BF) captured much of the variability arising from borrower age permitting age (Age) to be excluded from the final model and allowing a much larger sample.

Following Dixon *et al.* (2011), a variable was maintained in estimating the final models if it was significant at the 0.10 level or better in one or more hazard functions in a given competing risks model as estimated. For the OL model, interest type (IntrType), line-of-credit (LOC), and dummy variables for Northeast (NE) and Northern Plains (NPL) regions did not meet the 0.10 level of significance criterion and were excluded from the final model. For the FO model, gender (Female), race (Nonwhite), interest type (IntrType), large commercial banks (LrgComm), other lenders (Other), Northeast region (NE), Lake States region (LKS), and time varying interest rate

[3] A quarterly time-varying interest rate that is unique for each loan is not used because there is no reliable record for quarterly interest rates in the loan status reports.

on non-real estate loans (INTR) and real estate value per acre (REV) variables were excluded from the final model.

Data

Data on individual borrower, loan and lender characteristics come from guaranteed loan records provided by FSA. Data measuring contemporaneous factors are from various sources including the U.S. Department of Agriculture, Bureau of Labor Statistics, Federal Financial Institutions Examination Council (FFIEC), and Federal Reserve Bank of Kansas City.

FSA provided loan-level data covering the period from January 1, 2004 through June 30, 2012. The loan data are from three different FSA databases: loan obligations, lender loan status reports, and loan losses. The sample selected includes all loans obligated in calendar years 2004 and 2005 and coincides with the availability of loan status report data. While lenders have always been required to update FSA on the status of any guaranteed loans with respect to balance owed, terms, and payment status, these data have only been available electronically since 2004. The two years also provide a sufficiently long time period to fully analyze OL loans since most OL loans should terminate within seven years.

The loan obligation data collected by FSA include borrower history with FSA, borrower demographics (e.g., gender, birth date, marital status) and other information related to loan characteristics (loan amount, loan term, interest type, interest rate) and lender characteristics (commercial bank, Farm Credit System (FCS), other lender). Data on guaranteed loan balance outstanding and payment status (delinquent or current) were obtained from quarterly loan status reports collected by FSA for calendar year 2004 through the second quarter of 2012. Loan loss data for the same time period were matched to the loan status data to determine loan outcomes.

Loan outcomes are defined based on whether a loan guarantee expires and no loss claim was paid (EXP) or a loss claim was paid (LOSS). Loan guarantees are considered expired (EXP) when they no longer appear in a loan status report as long as they do not have a loss claim over the study period. The particular reason a given guarantee expired is unknown. A loan guarantee may expire because the loan was paid in full, refinanced with or without a new guarantee, or at the discretion of the lender, because the lender no longer considered it was necessary, or at the discretion of FSA because the lender did not report to FSA as required, for example. Loss claims (LOSS) are defined as payments made by FSA to a lender who has incurred a loss on a guaranteed loan. While losses must be associated with loans becoming delinquent before the guarantee expires, loss claim payments can be made after the guarantee has expired. A still performing (SP) loan is defined as a loan whose guarantee neither expired nor had a loss claim as of the final quarterly status report, *i.e.*, June 30, 2012. Such guarantees are considered censored in the Cox model.

Lender characteristics include lender type, whether a lender is a commercial bank, FCS or other, such as a credit union, mortgage bank, savings bank, insurance company, *etc*. (Other). Commercial banks are divided into two categories: top ten largest banks (LrgComm) and smaller commercial banks (SmlComm), which are those commercial banks that are not top ten banks. The top ten banks are defined from the FFIEC Consolidated Reports of Condition and Income (Call Reports) data available at the Federal Reserve Bank of Chicago (FFIEC, 2004).[4] Top ten banks are those banks with the highest total deposits at the end of the second quarter of 2004 that are also in the FSA dataset.[5] The large commercial banks (LrgComm) and small commercial

[4] The FSA data contained bank names that were used to match them to the top banks in the FFIEC data. The matching was based on name only making it problematic to include more than 10 banks.
[5] The top ten banks are Bank of America, Charlotte, NC; Wachovia Bank, Charlotte, NC; Wells Fargo, San Francisco, CA; Bank One, Chicago, IL; Fleet National Bank, Boston, MA; Bankcorp (U.S Bank N.A.), Minneapolis,

banks (SmlComm) binary variables are included because it was found in earlier agricultural loan studies that large banks behave differently from small banks (Dixon *et al.*, 1999; Dodson, 2014). The lender characteristic PreCrtif indicates if a lender is a preferred or certified lender by FSA.

Data on variables that vary over time were collected to capture the impact of changing farm economy and macroeconomic conditions. Operating profit margin (OPM) was gathered from annual, state-level ERS data (USDA, ERS, 2012).[6] OPM is computed by dividing net farm income by the value of farm production.[7] It is a measurement of farm efficiency by state and year. Farm real estate value per acre (REV) is considered an indicator of farm asset values since farmland comprises a large part of farm assets. REV is annual, state-level National Agricultural Statistics Service data (USDA, NASS, 2012).[8] Since farm economic data were annual, the data are repeated for each quarter within that particular calendar year. The time-varying interest rate (INTR) is the average effective interest rate on all non-real estate bank loans collected quarterly through surveys of agricultural bankers by the Federal Reserve Bank of Kansas City (2013).[9]

MN; HSBC Bank USA, N.A, New York, NY; Sun Trust Bank, Atlanta, GA; Key Bank, Cleveland, OH; Branch Banking and Trust, Winston-Salem, NC.

[6] Models initially included state-level net farm income per farm (NFIF) and operating profit margin (OPM). However, an anonymous referee pointed out NFIF and OPM are both a function of net farm income. The correlation test of these two variables showed they are collinear (0.811, $p < 0.0001$). Since they are both measures of profitability, NFIF was dropped from the estimation. Changes in the estimation results were minimal.

[7] An anonymous referee suggested including debt service coverage ratio in the model. However, debt repayment measures may not reflect the repayment capacity of the FSA borrowers in the study. FSA borrowers have relatively more debt and less repayment capacity than the operators of most farms. Moreover, many debt repayment capacity measures, such as debt service coverage ratio, include principal payments and these data are not available at the state level. As an alternative, times interest earned was considered in the model, where times interest earned equals the sum of net farm income, interest, and taxes divided by interest. Times interest earned was only found to be significant in the expire-with-loss-claim hazard function for OL loans and it had the expected sign. Since times interest earned and operating profit margin (OPM) both include net farm income, a correlation test was performed. OPM and times interest earned are highly correlated (0.870, $p < 0.0001$). Considering the collinearity and negligible changes in the other coefficient estimates when times interest earned was included, it was not included in the final estimation.

[8] A variable to indicate the relative security position at time of loan origination, such as loan-to-value, was considered. Unfortunately, the data were unavailable.

[9] The spread between the current market interest rate and the current loan rate would be an alternative to measure changes in the interest rate environment for agriculture. However, the spread as of every quarter is unknown, since loan interest rate is only available at loan origination. Non-real estate loan interest rate (INTR) is used in both the

Monthly state-level unemployment rates are obtained from the Bureau of Labor Statistics (2013) and averaged to provide the quarterly unemployment rate (UNEMP). UNEMP provides an indication of the general economic wellbeing by quarter and by state. All the contemporaneous variables, with the exception of delinquency (DEL), are lagged one quarter to allow borrower adjustments to changes in economic conditions.

Descriptive statistics

There were 19,126 observations of loans that were in both the obligation and quarterly loan status report datasets. Out of the 19,126 loans, 12,372 (65 percent) were OL loans and 6,754 (35 percent) were FO loans, an almost two-to-one ratio. The average loan term at origination for OL loans was 21 quarters while it was 74 quarters for FO loans. Twenty percent of loans were made to beginning farmers (BF), four percent went to socially-disadvantaged farmers (SDA), and four percent of loans went to farmers that were both beginning and socially-disadvantaged (BFS). Summary statistics for all loans are displayed in Table II.

Loan guarantee outcomes are the focus of this study. Table III shows the loan guarantee outcome statistics for all loans, OL loans, and FO loans. Out of the 19,126 loans, 76.6 percent (14,643) had expired without a loss by the end of second quarter of 2012, 2.8 percent (532) settled for a loss, and 20.7 percent (3,951) were still performing. The average loan terms at origination for all the expired loan guarantees and loan guarantees with loss claim were 32 and 34 quarters, respectively. For OL loans, the expired loans and loss claim loans had the same

OL and FO models because it was assumed agricultural non-real estate loan interest rates and real estate loan interest rates are correlated. Correlation test results for the sample period show that the non-real estate loan interest rate is highly correlated with both 3-month treasury yield (0.793, $p < 0.0001$) and 10-year treasury yield (0.983, $p < 0.0001$).

average loan terms, which were 21 quarters. For FO loans, expired loan guarantees had a longer average loan term (71 quarters) than loss claim loans had (63 quarters).

FO loans and OL loans have different purposes and are structured differently with respect to terms and collateralization. FO loans are long term real estate loans with maturities of up to forty years. Whereas OL loans have much shorter maturities of seven years or less, although they may be rescheduled for up to 15 years, and OL loans are used to finance working capital, livestock, and/or machinery/equipment. As displayed in Table III, FO loans and OL loans have different patterns in loan outcomes. In the sample, almost half (3,259) of FO loans were still performing as of June 30, 2012, while only 5.6 percent (692) of OL loans were still performing as of the same date. Also, 91.4 percent (11,313) of OL loan guarantees had expired while only 49.3 percent (3,330) of FO loan guarantees had expired by June 30, 2012. Both OL and FO loan guarantees had low loss claim experiences, with 3.0 percent (367) and 2.4 percent (165), respectively.

A loan being in delinquency (DEL) turns out to be very important in the estimated competing risks models. Of the 19,126 loans, 10 percent of the loans were delinquent at least once in the quarterly status reports. Out of the 1,984 loans that had been delinquent at least once, 76 percent (1,512) had no loss claim while 24 percent (472) reported a loss claim. Of the 17,142 loans that had not experienced a delinquency, 99.6 percent (17,082) did not have a loss claim, whereas 60 had a loss claim. This demonstrates on a bivariate basis, delinquency is a strong but not perfect predictor of a loss claim.

As would be expected, loss claims occurred mostly on loans which had been delinquent at least once. For 11 percent of the loans reporting loss claims, however, there had never been a delinquency. Typically, this would occur when a borrower is current on a guaranteed loan but

delinquent on other debts. The lenders to whom the borrower is in default may initiate adverse action which could force a full or partial liquidation of the security for the guaranteed loan. Delinquency (DEL) was included as a time varying variable to determine the importance of diminishing borrower financial strength and of other lenders in initiating default.

Model estimation results

The estimated coefficients for the OL and FO competing risks models are displayed in Tables IV and V, respectively. A positive coefficient indicates an increase in the independent variable increases the likelihood the loan outcome happens at a given point in time and decreases the expected time to the outcome.

Operating Loan model

A variety of borrower, loan and lender characteristics, along with general economic conditions, have significant impacts on time to OL loan guarantee outcomes and the eventual terminating event. Gender is minimally related to Loss indicating females are less likely to experience a loss claim. Non-white indicates a longer time to expiration.

Loans made to borrowers who have previous involvement with FSA (BrwHist) are more likely to have the guarantee expire with no loss and have it occur earlier. Increasing loan amount (LoanAmnt) decreases the likelihood of expiration-with-no-loss and increases the probability of a loss claim. Ceteris paribus, the larger the loan amount, the longer it takes to pay back the loan and the greater the financial risk, which is consistent with the positive sign for the loss claim hazard function. Likewise, an increase in loan term (LoanTerm) decreases the possibility of expiration-with-no-loss, but has no significant effect on possibility of loss claim. The positive

and significant sign on interest rate (IntrRate) in both hazard functions is consistent with higher interest rates at loan origination increasing financial risk and decreasing the time for the loan to expire, either because of a loss or, perhaps, to refinance the loan.

Beginning farmer (BF) is highly significant and positive in both hazard functions, indicating loans made to borrowers who qualify as beginning farmers have higher likelihoods to both expire with no loss and result in a loss claim. Relatively though, guaranteed loans to beginning farmers are more likely to have a loss claim than expire with no loss. Additionally, farmers who are both beginning and socially-disadvantaged (BFS) are more likely to have a loss claim and take a shorter time to file the claim.

These results at first appear to be somewhat different than those in Dixon *et al.* (2011) whose results were for direct OL loans. Dixon *et al.* found beginning farmer (BF) loans to be insignificant, while direct loans that were both beginning and socially-disadvantaged (BFS) were less likely to be paid in full and, after loan restructuring, were more likely go into default. However, the results presented here may be similar to those in Dixon *et al*. BF farmers with limited financial resources may more likely need to restructure their loan, which may result in guarantee termination and perhaps a new guarantee. Later, the guarantee for the restructured loan may end in a loss claim. The signs and relative magnitudes of the BF coefficients indicate that while a borrower being a beginning farmer increases the likelihood of expiration without a loss claim, this effect is more than offset by the stronger impact of BF on filing a loss claim.

The significant, negative signs of interest assistance (IA) in both OL hazard functions indicate loans with interest assistance take longer to expire and they are even less likely to end with a loss claim, since the coefficient in the expire function is much lower than the coefficient in the loss claim function. This is unsurprising since the IA program assists farmers by making

the interest the borrower pays lower. IA borrowers have an incentive to keep the loan longer since their interest payments are subsidized. Although borrowers were limited to receive IA for a maximum of 10 years and lenders were required to file annual reviews with FSA documenting the borrower's continued need of IA, it is expected that most borrowers continued to receive IA. It was reported in the Federal Register (2007) that 93 percent of FSA borrowers continued to receive IA each year. The finding of guaranteed IA loans having a lower possibility of loss claim suggests a beneficial policy impact. Although the borrowers who obtained IA are supposed to have less repayment capacity without IA than other FSA borrowers, the benefit afforded by IA is sufficient to make loss claims less likely. This finding is consistent with the finding in Ahrendsen *et al.* (2004). In addition to finding lower percentages of IA loans expired than non-IA loans, they found lower percentages of IA loans had loss claims than did non-IA loans, indicating IA users are more successful in repaying loans.

Compared with loans made by small commercial banks (SmlComm), loans made by FCS and other lenders (Other) are less likely to have losses. The positive and significant signs on large commercial banks (LrgComm) and other lenders (Other) in the expiration function indicate loans made by large commercial banks and other lenders are more likely to expire and have shorter time to expiration relative to small commercial banks.

These results are intuitive if FCS, large commercial banks and other lenders have stricter standards selecting loan borrowers. Dodson (2014) found FSA guaranteed loans to farms considered to be less creditworthy were more likely to be originated by small banks than large banks. The FCS, large commercial banks and other lenders may also have more experience in making and servicing guaranteed loans. For the 2004 and 2005 sample, FCS, large commercial banks, and other lenders averaged 37, 42, and 17 guaranteed loans per bank/association, whereas

small commercial banks averaged seven guaranteed loans per bank. The negative sign on preferred or certified lenders (PreCrtif) in the loss claim hazard function is expected. Loans made by lenders recognized as preferred or certified by FSA have a lower likelihood to receive a loss claim. Apparently larger and more experienced lenders of guaranteed loans are better at selecting borrowers.

Among the contemporaneous variables, delinquency (DEL) is highly significant and has a positive sign in the loss claim hazard function. While delinquency would be expected to precede a loss, this may not always be the case. For example, an adverse action by a third party lender could result in a loss claim without a delinquency. Compared with the other categorical variables, the impact of delinquency is large for the loss claim hazard function indicating weakening financial strength. Delinquency (DEL) is not significant in the expiration hazard which is expected since 76 percent of loans delinquent at some point in time did not have a loss claim as of June 30, 2012.

The positive sign on operating profit margin (OPM) in the expire-with-no-loss hazard function is expected and indicates that generally prosperous conditions increase the likelihood of expiration and shortens the time to expiration. However, the positive sign on OPM in the loss hazard function is surprising and indicates that increasing operating profit margin increases the likelihood of loss claims. This result could reflect that average operating profit margin for all farms within a state is probably a poor indicator for individual farms. Also, operating profit margin might reflect differences in the structure of agriculture between states. When calculating operating profit margin, the denominator is the value of farm production and the way USDA calculates aggregated value of production at the state level does not differentiate between farms and contractors or landlords. So, in states where a larger share of production goes to contractors,

the value of production would be high even though farmers may receive little of this total value. For example, state-level value of production tends to be highest in states where there is a large concentration of broiler farms. Also, lenders like to obtain an FSA guarantee before lending on a poultry facility. Therefore, operating profit margin may be reflecting the structure of agriculture in a state.

Real estate value per acre (REV) is significantly positive in the expire-with-no-loss hazard function, which indicates that higher real estate value increases the probability of loan expiration with no loss. An increase in real estate values is indicative of a positive farm economy and, perhaps, increasing collateral values, such that the loan is repaid or the lender no longer believes the guarantee is needed. Interest rate (INTR) is positive and significant in the loss claim hazard function. Increasing variable interest rates over time increase the debt-service cost. A large portion of loans (83 percent) had a variable interest rate at the time of loan origination. An increasing interest rate increases the required payment for farmers which increases the likelihood and shortens the time to a loss claim.

Unemployment rate is significant in the expired-with-no-loss hazard function. Increasing unemployment rate decreases the likelihood of expiration with no loss. This result is intuitive since unemployment is an indicator of weak economic conditions in a region, making it more difficult to repay a loan and probably reflects overall lower income for loan repayment and an environment where lenders are less likely to allow a guarantee to expire.

Farm Ownership model

The estimated coefficients for the FO loan model are presented in Table V. Coefficient signs are generally consistent with expectations and have similarities to those in the OL hazard functions.

The respective coefficients of borrower history (BrwHist), loan amount (LoanAmnt) and loan term (LoanTerm) in the FO model are identical in sign and significance to those in the OL model and have essentially the same interpretation.

The beginning farmer (BF) and beginning and socially-disadvantaged farmer (BFS) results for FO loans are similar to those for OL loans. Beginning farmers have relatively less experience and likely have constrained financial resources. Although it is unknown if the loan expired because it was paid in full, refinanced with or without a guarantee, or the lender simply allowed the guarantee to expire, beginning farmers may be more likely to leave farming voluntarily, thereby hastening the expiration of their loans. This is consistent with the finding of Dixon *et al.* (2007) for FSA direct loan borrowers with beginning farmer loans. Also, with limited experience and financial resources, it is expected that beginning farmer loans have an increased loss claim hazard. The impact of beginning farmer (BF) on the hazard rate is much higher for loss claim than expiration.

As was found for OL loans, the beginning and socially-disadvantaged farmer (BFS) coefficient has a positive and highly significant coefficient in the loss hazard function for FO loans, indicating loans made to farmers who are both beginning and socially-disadvantaged are more likely to have a loss claim and have shorter time to the loss claim. However, it should be noted that 96.4 percent of all beginning farmer (BF) loans and 90.4 percent of all BFS loans did not have a loss. Such loans are only more likely to have a loss relative to non-BF and non-BFS loans. Guarantees originated by the FCS are less likely to expire.

The contemporaneous variable loan delinquency status (DEL) is positive and highly significant for both expiration and loss hazards. It could be that delinquent loans are more likely to be refinanced and expire sooner due to repayment difficulties although the data are not

available to test this hypothesis. As would be expected, the presence of repayment problems, as indicated by delinquency, shortens the time to the loss claim outcome and increases the likelihood of a loss claim. The occurrence of delinquency has a much larger impact on loss claim than on expiration-without-loss.

As was found for OL loans, a strengthening in the overall economy, as indicated by a decrease in the unemployment rate (UNEMP), is more likely to result in loan expiration with no loss and for expiration to occur sooner.

Hazard function ratios

In competing risks models, independent variables common to the two hazard functions (expiration and loss claim) affect both hazards of events, raising the issue of which event is affected more strongly. Computing a hazard function ratio (loss claim divided by expired) and examining the change in the ratio as a function of such independent variables measures the net impact of the independent variable over its relevant range. The hazard function ratio shows the relative change in the likelihood of different outcomes with the change of the independent variable.

Figure 1 shows the ratios of the loss claim hazard function to the expired-with-no-loss hazard function as a function of loan amount (LoanAmnt), for both the OL and FO models. Loan amount is the obligation loan request amount when loans were originated. Both curves in Figure 1 show that the probability of loss claim increases sharply relative to expiration with no loss as loan amount increases. It is not surprising since the larger the loan amount, the more difficult it is to repay. Larger loans are more likely to have a loss claim and less likely to expire

with no loss. There is little difference between the ratios for OL loans and the ratios for FO loans.

Figure 2 shows the OL and FO loan hazard function ratios as a function of loan term (LoanTerm)—the projected length of the loan at origination. For OL loans, the likelihood of loss claim increases sharply relative to the likelihood of expiration as loan term increases. Much of the sharp increase in the ratio occurs for loan terms beyond 40 quarters, which is an unusually long term for operating loans and is nearly double the average term of 21 quarters for OL loans in the sample. All of the typical loan term range of 28 quarters or less still has an increasing ratio, but not nearly as much as is depicted for the longer term OL loans. Unlike OL loans, the likelihood of loss claim for FO loans decreases relative to the likelihood of expiration as loan term increases, although the rate of the decline is quite low. Moreover, the sample data only cover, at a maximum, loans lasting thirty-four quarters.

The OL and FO hazard function ratios as a function of the initial interest rate on the loan (IntrRate) are plotted in Figure 3. The curves indicate the probability of a loss claim increases at an increasing rate relative to likelihood of expiration-with-no-loss as the initial interest rate increases for OL loans. FO loans have a similar curvature, although the increase in the hazard function ratio is relatively sharper for OL loans than for FO loans. Also, the hazard function ratio is lower for OL loans than for FO loans for interest rates within most of the sample range.

Conclusion

FSA's loan guarantee program is the primary government vehicle for providing credit to production agriculture. A large majority of guarantees expire without a loss claim, reflecting the efficiency of the guarantee program. Results show loss claims increase with loan amount for

both OL and FO loans, suggesting that larger loans should perhaps be subject to stronger scrutiny. Loans targeted to beginning farmers are more likely to experience a loss claim than other loans. This is not to say that the additional loss claim activity is not justified in meeting the greater social objective of assisting beginning farmers. In fact, only 3.6 percent of beginning farmer loans resulted in loss claims, while 75.9 percent expired without any loss, with the remaining loans being censored. FSA may consider increasing its training and financial support of beginning farmers if FSA wants to bring beginning farmer loan loss claim activity more in line with non-beginning farmer loan loss activity.

The interest assistance (IA) program appears to confer an advantage on IA recipients because IA loans are less likely to have a loss claim or expire, i.e., IA loans are held longer. Although FSA stopped accepting applications for IA loans in fiscal year 2012 because of a lack of program funding, the results found here have implications for the IA program if it is reinstated. If the intent of the IA program is to simply equalize chances of borrower success, then the findings suggest that IA eligibility requirements—if the IA program is reinstated—be revised to restrict IA to only the neediest farmers.

The results showed that lender type is significant. The top ten largest commercial banks and other lenders were more likely to have OL loans expire than did small commercial banks. In contrast, FO loans originated by the Farm Credit System (FCS) had a lower probability of expiration compared with small banks. This finding is consistent with the liquidity issues of banks, such that compared to FCS, banks are less likely to hold loans for extended periods. Moreover, FCS and other lenders (Other) had a lower loss hazard rate than did small commercial banks for OL loans. These results may be useful in computing risk of the overall program as a function of lender type. Preferred or certified lenders have a lower loss hazard rate for OL loans,

indicating that lenders in FSA's Preferred and Certified Lender programs are more experienced with guaranteed loans and better able to identify successful borrowers.

The strong significance of some of the contemporaneous variables provides evidence that the overall economic environment affects guaranteed loan performance. Changes in farm and general economies influence loan performance. In particular, increasing unemployment extends the length of both OL and FO loan guarantees. Loan delinquency status is significant and clearly a harbinger of loss claims to follow for both loan types.

Table I. Variable definitions

Dependent variable	
Dur	Quarters from obligation to observed loan outcome of either: EXP, where loan expired with no loss, or LOSS, where loan expired with a loss
Independent variables	
Time invariant (values are at time of loan obligation)	
Age	Borrower Age in years
Married	Equals 1 if borrower is married at the time of loan origination, 0 otherwise
Female	Equals 1 if borrower gender is female or organization owned by female, 0 otherwise
NonWhite	Equals 1 if borrower is racial or ethnic minority, 0 otherwise
BrwHist	Equals 1 if borrower had previous loan involvement with FSA, 0 otherwise
LoanAmnt	Loan obligation amount in thousand dollars
LoanTerm	Loan term measured as subtracting quarter of loan closing from quarter of maturity
IntrType	Equals 1 if interest type is fixed, 0 otherwise
IntrRate	Lender guarantee interest rate in percent
BF	Equals 1 if loan has beginning farmer assistance code, 0 otherwise
SDA	Equals 1 if loan has socially-disadvantaged assistance code, 0 otherwise
BFS	Equals 1 if loan has beginning farmer and socially-disadvantaged assistance code, 0 otherwise
IA	Equals 1 if loan has interest assistance code, 0 otherwise
LOC	Equals 1 if loan was line of credit, 0 otherwise
FCS	Equals 1 if lender is Farm Credit System, 0 otherwise
LrgComm	Equals 1 if lender is a top ten commercial bank, 0 otherwise
SmlComm	Equals 1 if lender is a commercial bank that is not a top ten commercial bank, 0 otherwise
Other	Equals 1 if lender is not FCS, LrgComm, and SmlComm, 0 otherwise
PreCrtif	Equals 1 if lender is preferred or certified by FSA, 0 otherwise
NE	Equals 1 if borrower is in Northeast region, 0 otherwise
CRN	Equals 1 if borrower is in Corn Belt region, 0 otherwise
LKS	Equals 1 if borrower is in Lake States region, 0 otherwise
NPL	Equals 1 if borrower is in Northern Plains region, 0 otherwise
APP	Equals 1 if borrower is in Appalachian region, 0 otherwise
SE	Equals 1 if borrower is in Southeast region, 0 otherwise
DLT	Equals 1 if borrower is in Delta States region, 0 otherwise
SPL	Equals 1 if borrower is in Southern Plains region, 0 otherwise
MTN	Equals 1 if borrower is in Mountain region, 0 otherwise
PAC	Equals 1 if borrower is in Pacific region, 0 otherwise

Table I. Variable definitions (continued)

Time varying	
DEL	Equals 1 if loan delinquent in a given quarter, 0 otherwise
OPM	State-level quarterly operating profit margin measured as net farm income divided by value of farm production
REV	State-level quarterly average real estate value per acre in thousand dollars
INTR	National-level average effective interest rate on non-real estate bank loans, all non-real estate loans (%)
UNEMP	State-level quarterly, seasonally adjusted unemployment rate (%)

Table II. All loan summary statistics

	All loans (Expire with no loss, Loss claim, Still performing)				
Origination Variables	n	Mean	Std. Dev.	Min	Max
Age	12,749	42.78	12.00	18.00	83.00
Married	16,067	0.81	0.39	0	1
Female	19,126	0.32	0.47	0	1
NonWhite	19,126	0.07	0.25	0	1
BrwHist	19,126	0.65	0.48	0	1
LoanAmnt ($1000)	19,126	215.547	186.647	1.898	852.000
LoanTerm	19,126	39.65	30.55	1.00	160.00
IntrType	19,126	0.24	0.43	0	1
IntrRate (%)	19,126	7.18	1.20	0.05	12.25
BF	19,126	0.20	0.40	0	1
SDA	19,126	0.04	0.19	0	1
BFS	19,126	0.04	0.20	0	1
IA	19,126	0.15	0.35	0	1
LOC	19,126	0.33	0.47	0	1
FCS	19,126	0.27	0.44	0	1
LrgComm	19,126	0.02	0.16	0	1
SmlComm	19,126	0.65	0.48	0	1
Other	19,126	0.06	0.24	0	1
PreCrtif	19,126	0.52	0.50	0	1
NE	19,126	0.06	0.19	0	1
CRN	19,126	0.21	0.41	0	1
LKS	19,126	0.15	0.35	0	1
NPL	19,126	0.16	0.37	0	1
APP	19,126	0.07	0.26	0	1
SE	19,126	0.06	0.23	0	1
DLT	19,126	0.09	0.28	0	1
SPL	19,126	0.08	0.27	0	1
MTN	19,126	0.07	0.25	0	1
PAC	19,126	0.06	0.23	0	1
Contemporaneous Variables					
DEL	352,320	0.02	0.14	0	1
OPM	352,320	0.24	0.07	-0.06	0.44
REV ($1000)	352,320	2.383	1.549	0.260	16.800
INTR (%)	352,320	6.52	1.50	4.25	8.60
UNEMP (%)	352,320	5.58	2.03	2.40	14.13

Table III. Loan outcome summary statistics

	All loan		OL loan		FO loan	
Loan outcome	n	Percent	n	Percent	n	Percent
Expired with no loss	14,643	76.56	11,313	91.44	3,330	49.30
Loss claim	532	2.78	367	2.97	165	2.44
Still performing	3,951	20.66	692	5.59	3,259	48.25
Total	19,126	100.00	12,372	100.00	6,754	100.00

Source: USDA, Farm Service Agency, Guaranteed Loans, calendar years 2004 and 2005

Table IV. Competing risk model estimates of hazard function coefficients and elasticities for OL loans

	Expire with No Loss (EXP)			Loss Claim (LOSS)		
Variables	Coefficient Estimate		Elasticity[b]	Coefficient Estimate		Elasticity
Time Invariant						
CON[a]	9.8659	***		NA		
Female	-0.0263			-0.2137	*	
NonWhite	-0.2043	***		-0.034		
BrwHist	0.1691	***		0.0582		
LoanAmnt	-0.0005	***	-0.0857	0.0009	***	0.2165
LoanTerm	-0.0723	***	-1.5059	-0.0081		-0.1687
IntrRate	0.0146	*	0.1062	0.1809	***	1.4216
BF	0.0808	***		0.3435	***	
BFS	0.1161			0.9862	***	
IA	-0.241	***		-0.5647	***	
FCS	0.0389			-0.3406	**	
LrgComm	0.2447	***		-0.174		
Other	0.1299	***		-0.6081	*	
PreCertif	0.0155			-0.4668	***	
LKS	0.0869	***		0.3605	*	
APP	-0.1174	***		0.4543		
SE	-0.3911	***		0.5416	**	
DLT	0.3009	***		0.7928	***	
SPL	0.0155			1.3962	***	
MTN	0.2079	***		-0.2706		
PAC	0.5494	***		0.6547	**	
Time variant						
DEL	0.0418			3.0798	***	
OPM	0.9834	***	0.2406	3.9135	***	1.0749
REV	0.0315	***	0.0669	-0.0081		-0.0172
INTR	-0.0103		-0.0697	0.3033	***	2.0594
UNEMP	-0.0509	***	-0.2575	-0.0063		-0.0349

Notes: N= 12,372; Significance at *p<0.10, **p<0.05 and ***p<0.01; [a] CON indicates a constant term for the EXP function; [b] Elasticities evaluated at the independent variable sample means

Table V. Competing risk model estimates of hazard function coefficients and elasticities for FO loans

	Expire with No Loss (EXP)			Loss Claim (LOSS)		
Variables	Coefficient			Coefficient		
Time invariant	Estimate		Elasticity[b]	Estimate		Elasticity
CON[a]	5.4755	***		NA		
BrwHist	0.1525	***		0.0071		
LoanAmnt	-0.0004	***	-0.1229	0.0010	**	0.4009
LoanTerm	-0.0066	***	-0.4648	-0.0103	***	-0.6472
IntrRate	0.0179		0.1246	0.1032		0.7433
BF	0.0830	*		0.4682	**	
BFS	-0.0534			1.0939	***	
FCS	-0.4293	***		-0.3599		
PreCertif	-0.0826	**		-0.1264		
NPL	-0.2924	***		-0.4431		
APP	0.0829			0.5799	**	
SE	0.1441	*		-0.1723		
DLT	0.1097			0.7644	**	
SPL	-0.0182			1.0011	***	
MTN	-0.2033	***		-0.2697		
PAC	0.2265	***		0.3411		
Time variant						
DEL	0.7091	***		3.6219	***	0.9715
OPM	0.4565		0.1116	-1.6898		-0.4205
UNEMP	-0.0663	***	-0.3620	0.0600		0.3407

Notes: N = 6,754; Significance at *p<0.10, **p<0.05 and ***p<0.01; [a] CON indicates a constant term for the EXP function; [b] Elasticities evaluated at the independent variable sample means

REFERENCES

Ahrendsen, B.L., Dixon, B.L., Settlage, L.A., Koenig, S.R. and Dodson, C.B., (2011), "A triple hurdle model of US commercial bank use of guaranteed operating loans and interest assistance", *Agricultural Finance Review*, Vol. 71 No. 3, pp. 310-328.

Ahrendsen, B.L., Dodson, C.B., Dixon, B.L. and Koenig, S.R. (2005), "Research on USDA farm credit programs: past, present, and future", *Agricultural Finance Review*, Vol. 65 No. 2, pp.165-181.

Ahrendsen, B.L., Koenig, S.R., Dixon, B.L, Dodson, C.B. and Settlage, L.A. (2004), "Analysis of borrower and lender use of interest assistance on FSA guaranteed farm loans", *Staff Paper SP 02 2004*, Department of Agricultural Economics and Agribusiness, University of Arkansas, Fayetteville, available at: purl.umn.edu/15778 (accessed 15 March 2016).

Allison, P.D. (2010), *Survival analysis using SAS: a practical guide, second edition*, SAS Institute Inc., Cary, NC.

Bureau of Labor Statistics (2013), "Local area unemployment statistics: civilian labor force and unemployment by state and selected area, seasonally adjusted (monthly)", available at: http://www.bls.gov/lau/ (accessed 1 August 2013).

Dixon, B.L., Ahrendsen, B.L. and McCollum, S.M. (1999), *Models of FSA guaranteed loan use volume and loss claims among Arkansas commercial banks*, Research Bulletin, Vol. 962, Arkansas Agricultural Experiment Station, Agricultural Experiment Station, University of Arkansas, Fayetteville, available at: arkansasagnews.uark.edu/962.pdf (accessed 8 August 2015).

Dixon, B.L., Ahrendsen, B.L., McFadden, B.R., Danforth, D.M., Foianini, M. and Hamm, S.J. (2011), "Competing risks models of Farm Service Agency seven-year direct operating loans", *Agricultural Finance Review*, Vol. 71 No. 1, pp. 5-24.

Dixon, B.L., Ahrendsen, B.L., Nwoha, O.J., Hamm, S.J. and Danforth, D.M. (2007), "FSA direct farm loan program graduation rates and reasons for exiting", *Journal of Agricultural and Applied Economics*, Vol. 39 No. 3, pp. 471-487.

Dodson, C.B. (2014), "Bank size, lending paradigms, and usage of Farm Service Agency's guaranteed loan programs", *Agricultural Finance Review*, Vol. 74 No. 1, pp. 133-152.

Dodson, C.B. and Koenig, S.R. (2003), "Explaining county-level variability in Farm Service Agency farm loan programs", *Agricultural Finance Review*, Vol. 63 No. 2, pp. 193-212.

Dodson, C.B. and Koenig, S.R. (2006), *Report to Congress: evaluating the relative cost effectiveness of the Farm Service Agency's farm loan programs*, USDA, FSA, Economic Policy Analysis Staff, Washington, DC, August, available at: www.fsa.usda.gov/Internet/FSA_File/farm_loan_study_august_06.pdf (accessed 6 March 2016).

Dressler, J.B. and Stokes, J.R. (2010), "Survival analysis and mortgage termination at AgChoice ACA", *Agricultural Finance Review*, Vol. 70 No. 1, pp. 21-36.

Federal Financial Institutions Examination Council (2004), "Consolidated reports of condition and income", 30 June, available from the Federal Reserve Bank of Chicago at: http://www.chicagofed.org/webpAges/banking/financial_institution_reports/commercial_bank_data_complete_2001_2010.cfm (accessed 1 August 2013).

Federal Register (2007), "Rules and regulations", Vol. 72 No. 67, 9 April 2007, available at: http://www.fsa.usda.gov/Internet/FSA_File/interest_assist_final_040907.pdf (accessed 14 March 2016).

Federal Reserve Bank of Kansas City (2013), "Agricultural finance databook, section A.5: Average effective interest rate on non-real estate bank loans made to farmers, all loans, quarterly", available at: https://www.kansascityfed.org/research/indicatorsdata/agfinancedatabook (accessed 15 March 2016).

Kalbfleisch, J.D. and Prentice, R.L. (2002), *The Statistical Analysis of Failure Time Data*, 2nd ed., Wiley-Interscience, Hoboken, NJ.

McFadden, B.R. (2009), *Impact of time to default and contemporaneous events on FSA direct loan losses*, MS thesis, University of Arkansas, Fayetteville, AR, ProQuest Dissertations Publishing, No. 1478496.

Settlage, L.A., Dixon, B.L., Ahrendsen, B.L and Koenig S.R (2001a), *Models of Farm Service Agency guaranteed loan loss claim rates in the U.S. for 1990-1998*, Research Bulletin, Vol. 966, Arkansas Agricultural Experiment Station, Division of Agriculture, University of Arkansas, Fayetteville, available at: arkansasagnews.uark.edu/966.pdf (accessed 8 August 2015).

Settlage, L.A., Dixon, B.L., Ahrendsen, B.L. and Koenig, S.R. (2001b), "Estimating principal outstanding models for Farm Service Agency guaranteed loans", AgEcon Search, Research in Agricultural and Applied Economics, Selected Paper, American Agricultural Economics Association, 2001 annual meeting, Chicago, IL, August 5-8, pp. 1-23, available at: http://21474/20738 (accessed March 15, 2016).

Settlage, L.A., Dixon, B.L., Ahrendsen, B.L. and Koenig, S.R. (2006), "Factors determining the use of guaranteed loans by US commercial banks", AgEcon Search, Research in Agricultural and Applied Economics, Selected paper 157050, American Agricultural Economics Association, 2006 annual meeting, Long Beach, CA, July 23-36, pp. 1-31, available at: http://purl.umn.edu/21474 (accessed March 15, 2016).

U.S. Department of Agriculture, Economic Research Service (2010), "Agricultural resource management survey (ARMS): resource regions - ERS U.S. farm resource regions, farm production regions", available at https://wayback.archive-

it.org/5923/20110913212900/http://www.ers.usda.gov/Briefing/ARMS/resourceregions/resourceregions.htm (accessed 15 March 2016).

U.S. Department of Agriculture, Economic Research Service (2012), "U.S. farm income and wealth statistics", US Department of Agriculture, Economic Research Service, Washington, DC, available at: http://www.ers.usda.gov/data-products/farm-income-and-wealth-statistics.aspx#.UfAtaY3vt8E, (accessed 14 March 2012).

U.S. Department of Agriculture, Farm Service Agency, (2015), "Farm loans: 2014 farm bill fact sheet." November, US Department of Agriculture, Farm Service Agency, Washington, DC, available online: http://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/2015/farmlnchart_current_nov2015.pdf (accessed 6 March 2016).

U.S. Department of Agriculture, National Agricultural Statistics Service (2012), "Land values 2012 summary (August 2012)", August, various years, US Department of Agriculture, National Agricultural Statistics Service, Washington, DC, available at: http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1446 (accessed 1 August 2013).